INTERDISCIPLINARITY AND ACADEMIC WRITING: A CORPUS-BASED CASE STUDY OF THREE INTERDISCIPLINES

by

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ABSTRACT

This corpus-based study is aimed at exploring interdisciplinarity in academic writing in the light of two different linguistic aspects: citation practices and adjectives of importance. More specifically, these features have been compared across a corpus of Research Articles from the interdisciplines of Educational Neuroscience, Economic History, and Science & Technology Studies. In addition, comparisons between the interdisciplinary fields and their related single-domain disciplines have been carried out. The methodology applied for the study of the linguistic features combines the analysis of the quantitative data with their qualitative interpretation by means of close reading. It has been concluded that both citations and adjectives of importance are viable tools to explore typical features of interdisciplinary writing in the fields explored. Furthermore, it has been suggested that the findings reported are useful to the description of different types of relationships between disciplines when interacting in the matrix of interdisciplinary fields.

DEDICATION

To the memory of my father, who continuously inspires me to fight for my dreams.

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Chapter 1: INTRODUCTION

1.1 Background to the study

Interdisciplinarity is a ubiquitous term in current academic and educational settings. Furthermore, interdisciplinarity is rapidly becoming a dominant form of scholarly work (Graff, 2015) as well as a pervasive form of knowledge production (Boix Mansilla & Gardner, 2003). As Barry and Born (2103) state, it is commonly accepted that research needs to be more interdisciplinary. This scenario, however, has generated a heated debate about how interdisciplinarity should be understood considering the interplay of several dichotomies and contradictions. In order to shed some light on this issue, I will start by clarifying what is understood by interdisciplinarity in this work.

According to Graff (2015, p. 5), interdisciplinarity "is part of the historical making and ongoing reshaping of modern disciplines." In other words, this means that it is "inseparable" from them, not "oppositional" to them. Interdisciplinarity, as Graff (2015) adds, is defined and constructed by several problems and questions as well as by the means to answer those questions in different and also new ways. Thus, interdisciplinarity derives from the selection of appropriate ideas, relevant approaches, theories, concepts and methods from different fields or disciplines. At the same time, the selected choices influence those problems and questions, as Graff (2015, p. 5) concludes. These ideas are in line with the suggestion introduced by Barry and Born (2013, p. 15) that interdisciplinarity should aim at "the solution of current problems, in particular the relations between science and society." Furthermore, this emphasis on problems is often linked to contemporary concerns and to "pressures and threats in the real world" (Graff, 2015, p. 6), which is another typical feature of interdisciplinary approaches.

Another important point of agreement is the fact that there is "no single path to interdisciplinarity, no single model, no single standard for successful development" (Graff, 2015, p. 5). In other words, there is not only one form of interdisciplinarity; rather, distinct approaches to interdisciplinarity are to be adopted according to different fields or disciplinary clusters. In these terms, interdisciplinarity must be understood "less as a unity and more as a field of differences," as argued by Barry and Born (2013, p. 15). A final consideration acknowledges that interdisciplinarity not only consists of the integration of various kinds of disciplinary knowledge but also comprises "the challenges surrounding effective communication to different audiences" (Frodeman, Klein, & Pacheco, 2017, p. 38). In sum, this work is underpinned by an idea of interdisciplinarity understood as a historical construct

aimed at addressing questions and problems that have consequences in the real world. In addition, the idea of *difference* is a central one: there are different types of interdisciplinarity, and there are also different kinds of audiences.

In spite of the efforts to explain interdisciplinarity, several conflicts and contradictions are still present. Most of them are rooted in and reinforced by what Graff (2015, p. 10) has defined as "myths of interdisciplinarity." One of these myths is usefully countered in this thesis: more frequently than not, studies of interdisciplinarity are based on the myth that interdisciplines are similar to each other. Those assumptions, according to Graff (2015, p. 11), tend to interfere with a "much-needed comparison of interdisciplines from different disciplinary clusters, institutions, times, and places." Consequently, they also lead to incomplete examinations which lack sufficient evidence. Similarly, Fuchsman (2012) argues that interdisciplines are still understudied despite their growing proliferation.

In an attempt to fill this gap, the aim of this work is to provide a comparative corpus-based case study of Research Articles (RAs) from three different interdisciplinary fields: Educational Neuroscience [EN], Economic History [EH], and Science & Technology Studies [STS]. These cases have been chosen because they open up diverse and multiple possibilities to be explored, since they have originated from completely different disciplinary clusters: Neuroscience and Education in the first case, Economics and History in the second one, Ethics, Biomedicine and Engineering in the third one. Moreover, as this work is about interdisciplinary in academic writing, it is important to add that this scarcity of comparative approaches towards interdisciplines is also evident in previous research within the area. In fact, there is evidence of countless cross-disciplinary studies comparing academic language features as well as of some studies describing academic language features in only one interdisciplinary field. What is missing, then, is a call for studies comparing academic language features in different interdisciplinary fields, thus helping to *demystify* the naturalised assumptions explained before. Although completely exploratory in nature, this work goes in that direction.

In order to understand the epistemic nature and specific disciplinary characteristics of the interdisciplines under study, several theoretical considerations will be presented in the paragraphs that follow. After that, the characteristics that define an interdisciplinary journal will be introduced as well as some aspects that have been found to be typical of articles published in interdisciplinary journals. Finally, the linguistic aspects to be analysed will be announced together with a set of Research Questions.

1.2 What is an academic discipline?

It is clear that in order to understand the true essence of interdisciplinarity, a definition of *academic discipline* that is suitable for such understanding should be proposed. This conception of discipline first needs to challenge the idea of disciplinary homogeneity. On top of that, it also needs to challenge the existence of fixed disciplinary boundaries as a rigid notion and let some room for their crossing. The definition provided by Trowler, Saunders, and Bamber (2012), which is built on a social practice perspective, might be seen as an adequate starting point. According to the authors, disciplines are:

> Reservoirs of knowledge resources shaping regularised behavioural practices, sets of discourses, ways of thinking, procedures, emotional responses and motivations. These provide structured dispositions for disciplinary practitioners who reshape them in different practice clusters into localised repertoires. While alternative recurrent practices may be in competition within a single discipline, there is common background knowledge about key figures, conflicts and achievements. Disciplines take organisational form, have internal hierarchies and bestow power differentially, conferring advantage and disadvantage. (Trowler et al., 2012, p. 9)

The most noticeable merit of this definition is perhaps that, as acknowledged by its authors, it "allows for the division and conflict we see within most disciplines, but also recognises that there is a degree of commonality" (Trowler et al., 2012, p. 9). Moreover, the fact that disciplines might vary according to context is also pointed out. This definition, however, needs to be complemented by the understanding that no clear lines or boundaries between disciplines can be drawn, as argued by Weingart and Sterhr (2000, p. xi): "The organizational matrix of disciplines is beginning to dissolve […]. Disciplinary interests, boundaries, and constraints are dissolving and disciplines are merging in areas where their overlap forms a new field."

1.3 Multidisciplinarity, interdisciplinarity, and transdisciplinarity

As stated before, disciplines should not be regarded as homogeneous, but as multiplicities or heterogeneous unities marked by differences. Therefore, disciplinary boundaries are neither "entirely fixed nor fluid"; rather, they are "relational and in formation" (Barry & Born, 2013, p. 20). According to most research on the topic (Frodeman et al., 2017; Graff, 2015; Repko & Szostak, 2017; Repko, Szostak, & Buchberger, 2017) three main types of cross-disciplinary

practices can be commonly identified: *interdisciplinarity*, *multidisciplinarity*, and *transdisciplinarity*.

A first distinction is usually made between multidisciplinarity, which stands for "several disciplines cooperating" but at the same time "working within standard disciplinary framings," and interdisciplinarity, which stands for "an attempt to integrate or synthesise perspectives from different disciplines" (Barry & Born, 2013, p. 20). Multidisciplinarity, as posed by Repko and Szostak (2017, p. 76), is the study of "a complex issue, problem, or question from the perspective of two or more disciplines by drawing on their insights but making no attempt to integrate them." In other words, insights are juxtaposed and added together but they are not integrated. Interdisciplinarity, on the contrary, is the study of "a complex issue, problem, or question from the perspective of two or more disciplines by drawing on their insights and integrating them" (Repko & Szostak, 2017, p. 76). As a result, the interdisciplinary process is used to construct a more comprehensive understanding of the problem. In order to illustrate the difference between these two concepts, several metaphors have been coined. For instance, multidisciplinarity has been compared to a "bowl of fruit" containing a variety of fruits, each fruit representing a discipline and being in close proximity to the others (Repko et al., 2017, p. 133). Following the same metaphor, interdisciplinarity has been compared to a "fruit smoothie" (Repko et al., 2017, p. 134). As a smoothie is blended, the distinctive flavour of each fruit cannot be any longer recognised. Thus, when disciplines are integrated or blended together, they create something new.

The last approach, transdisciplinarity, is related to multidisciplinarity and interdisciplinarity, but it is different from them. As defined by Repko and Szostak (2017, p. 75) "transdisciplinarity involves the integration also of insights generated outside the academy, a team approach to research, the active involvement of non-academic participants in research design, and a 'case study' approach." Transdisciplinarity thus combines interdisciplinarity "with a participatory approach" (Tress, B., Tress, G., & Fry, 2007, p. 374). In this sense, transdisciplinarity not only builds bridges across disciplines, but also across disciplinary structures, since it links the academic world with the practical world as well as scholars with non-academics. No fruit metaphor has been coined to describe transdisciplinarity, but some other interesting attempts have been proposed.

For instance, Stevenson et al. (2013) provide a rich explanation of the differences between the three approaches as well as a thorough and comprehensive metaphor based on the stages of linguistic development. According to the authors, multidisciplinary, interdisciplinary, and transdisciplinary show "a progression of increasing synthesis across

intellectual domains, in which the admixture of ideas and breadth/depth of heterogeneous collaborations grow more developed" (Stevenson et al., 2013, p. 252). To illustrate this progression, they suggest that every discipline has its own language. Then, disciplinary languages intermingle when scientists decide to collaborate across disciplines, that is, when multidisciplinary research is carried out, thus giving origin to "multilingual" discussions. When interdisciplinary research involves even greater collaboration of disciplines coming together for the purpose of addressing a specific research objective, participants speak a simple, localised mixture of their disciplinary languages, similar to a "pidgin language," since this allows them to understand each other while maintaining their individual disciplinary languages. Finally, transdisciplinary research goes further because the community of collaborators extends beyond the initial network of scholars and the hybrid or pidgin language evolves into a broader research community that utilises a more stable "creole language," thus involving a larger process of synthesis and understanding (Stevenson et al., 2013, p. 253).

As a conclusion and in agreement with Petts, Owens, and Bulkeley (2008, p. 597), it can be argued that these three constructs point to a spectrum: "at its weakest, interdisciplinarity constitutes barely more than cooperation, while at its strongest, it lays the foundation for a more transformative recasting of disciplines." This is the reason why, perhaps, many scholars and myself in this work take *interdisciplinarity* as a generic term for this spectrum, while still being conscious of the salient issues from the definitional debate presented above. Having made this clear, it is now time to conceptualise the possible interrelations between different disciplinary forms of knowledge when interacting to build up interdisciplinary spaces. In other words, it is time to describe different *modes of interdisciplinarity*.

1.4 Modes of interdisciplinarity

According to Barry and Born (2013, p. 23), it is possible to identify three modes of interdisciplinarity, by which they mean three "ideal-typical arrangements of the interrelations between disciplines." These are the *integrative-synthesis* mode, the *subordination-service* mode, and the *agonistic-antagonistic* mode.

As part of an integrative-synthesis mode of interdisciplinarity, a given interdisciplinary practice "proceeds through the integration of two or more 'antecedent disciplines' in relatively symmetrical form." That is, interdisciplinary work is defined as a kind of work that "integrates knowledge and modes of thinking from two or more disciplines" (Barry & Born, 2013, p. 24). In other words, interdisciplinarity is understood additively as the sum of two or

more disciplinary components or as achieved through a synthesis of different disciplinary approaches through a process of integration or negotiation, as suggested by Petts et al. (2008).

In the second mode, named subordination-service, interdisciplinarity means one or more disciplines occupying a subordinate or service role in relation to other disciplines involved. By placing an emphasis on the hierarchical division of labour that characterises many forms of interdisciplinarity, "the service discipline(s) are typically conceived as making up for, or filling in for, an absence or lack in the other, (master) discipline(s)" (Barry & Born, 2013, p. 25).

Finally, in the agonistic-antagonistic mode, interdisciplinarity takes the form neither of a synthesis nor of a disciplinary division of labour; rather, it is driven by an agonistic or antagonistic relation to existing or prior forms of disciplinary knowledge. Here, interdisciplinarity "springs from a self-conscious dialogue with, criticism of or opposition to the limits of established disciplines, or the status of academic research or instrumental knowledge production in general" (Barry & Born, 2013, p. 26).

As a final consideration, it is important to acknowledge that different modes of interdisciplinarity might coexist in some fields.

1.5 On subdisciplines, interdisciplines, and interdisciplinary fields

Disciplinarity has been defined as the system of knowledge specialties called *disciplines* (Repko et al., 2017). A *subdiscipline* is a subdivision of an existing discipline, or, as also understood, a branch of or a specialty within disciplines. For example, the discipline of anthropology has developed several subdisciplines, such as cultural anthropology, physical anthropology, anthropology of religion, economic anthropology, among others. Differently, an *interdiscipline* literally means the space "between disciplines," that is, between the intellectual content of two or more disciplines (Karlqvist, 1999, p. 379). Furthermore, an interdiscipline may begin as an *interdisciplinary field* but over time it may become like a discipline, developing its own curriculum, journals, and, most important for interdisciplinary studies, its own perspective. The interdiscipline of biochemistry, for example, emerged as an interdisciplinary field that eventually grew to become their own mainstream discipline (Repko & Szostak, 2017). To sum up, it can be assumed that a subdiscipline is subordinated to a main discipline. However, an interdiscipline is an independent entity that might have originated from an interdisciplinary field, which is a broader concept. Finally, although still recognising that they are not exactly the same thing, most of the times the terms

interdiscipline and *interdisciplinary field* are interchangeable, as I refer to them throughout this work. As for disciplines, the terms *monodiscipline*, *monodisciplinary field*, or *single-domain discipline* are also used interchangeably to make a contrast with interdisciplines.

Leaving aside these terminology issues, the essence of the notion of interdiscipline is explored as follows. To Frickel (2004, p. 268), interdisciplines are "hybridized knowledge fields situated between and within existing disciplines." They "maintain themselves through interactions with other fields" and show more "epistemological variability than disciplines." Klein (1996, p. 192) first understands interdisciplines as "institutionalized hybrid fields" and distinguishes them from informal "disciplinary exchanges that remain at the level of topics and cross-disciplinary contacts." Later, Klein (2017, p. 22) adds that some of these hybrids "develop epistemological strength anchored by shared thematic principles, unifying core concepts, and a common interlanguage." In short, interdisciplines deal with subject matter that is beyond the competence of a single discipline by "interconnecting aspects of at least two existing fields to form a specialized area of study" (Fuchsman, 2012, p. 129).

Based on the definitional distinctions made as well as on the modes of interdisciplinary described, a presentation of the three interdisciplines studied follows, together with the description of the journals from which each sub-corpus has been built.

1.6 Description of the interdisciplines and their journals

1.6.1 Educational Neuroscience

Educational Neuroscience, as defined by Patten and Campbell (2011, p. 1), involves "syntheses of theories, methods, and techniques of the neurosciences, as applied to and informed by educational research and practice." In line with this definition, Campbell (2011) sees Educational Neuroscience as an area of educational research that draws on the neurosciences and is part of the broader interdisciplinary field of Neuroeducation. "Clearly a synthesis of sorts between Education and Neuroscience," Campbell (2011, p. 8) adds, "Educational Neuroscience can also be viewed variously as a multidisciplinary, interdisciplinary, or transdisciplinary endeavor."

Bringing back the differences between these three concepts, which have been explained before, Campbell (2011, p. 8) points out that Educational Neuroscience could be seen as a multidisciplinary activity if it is thought as "neuroscientists and educationists contributing their respective expertise to a common project, with little appetite for engaging each other's theories, methods, practices, or policies." That is, "each expert would essentially just do their own thing." Then, Educational Neuroscience would be seen as an interdisciplinary activity if

"neuroscientists and educationists actively engage each other's points of view in an attempt to jointly optimize each other's respective contributions to a given project." Finally, Educational Neuroscience would be conceived as a transdisciplinary activity if neuroscientists and educationists forge "new philosophical frameworks and research methodologies for variously bridging Education and Neuroscience" (Campbell, 2011, p. 8).

This *bridging-the-gap* issue between Neuroscience and Education has received much attention recently. In fact, in order to shed light on its nature as well as the possibilities to promote a linking process, Edelenbosch, Kupper, Krabbendam, and Broerse (2015) interviewed neuroscientists and education professionals about their perceptions as regards this gap between science and practice and "the role they play in creating, managing, and disrupting this boundary." Based on the interviewees' opinions, the authors conclude that if Neuroscience is to contribute to the complex and value-laden practice of Education, it is time to find the "middle road between scientific rigor and the more pragmatic approach of the field of education." In other words, it is clear that "transdisciplinary research is substantially different from the way research is done presently" (Edelenbosch et al., 2015, p. 48), and this is so because it cannot be expected that scientists and educators make this radical shift overnight. In agreement with this, Campbell (2011) also points out that although the conception of Educational Neuroscience as a transdisciplinary activity would be an ideal aim, several changes are still needed in order to achieve it. Based on these conclusions, it can be argued that Educational Neuroscience might be understood as an interdisciplinary activity on its road towards transdisciplinarity.

From the analysis of the two journals involved, similarities but also differences with this preliminary description of Educational Neuroscience as an interdisciplinary field have been found. One of the journals, which is called *Trends in Neuroscience and Education* (https://www.journals.elsevier.com/trends-in-neuroscience-and-education), aims at "bridging the gap between the increasing basic cognitive and neuroscience understanding of learning and the application of this knowledge in educational settings." The other journal, *Mind, Brain and Education* (https://www.onlinelibrary.wiley.com/journal/1751228x), aims at "supporting the development of a framework for new ideas to advance research efforts at the intersection of biology, brain, cognition, and education, and the practical innovations these research efforts inform." It should be noticed that while the *bridging-the-gap* metaphor is present in the first journal, the notion of *intersection* of fields towards the development of new ideas is present in the second one. Nonetheless, the same collaborative essence is evident in both aims, which coincides with the descriptions provided by Campbell (2011) and Edelenbosch et

al. (2015) above.

An additional aspect, moreover, is made present in both journals. On the one hand, *Trends in Neuroscience and Education* "will foster activities on the translational research," which is needed to find answers that will help to make progress in Education from research informed by Neuroscience. On the other hand, *Mind, Brain and Education* will report "basic and translational research that provides a framework for developing a critical understanding of advancing educational practices and curricula." The common aspect between both journals is thus the reference to the notion of *translational research*. As defined by Wethington (2016), translational research is "a systematic effort to convert basic research knowledge into practical applications to enhance human health and well-being." Translational research, Wethington (2016) adds, is broader than applied research. While applied research does not necessarily need to be taken to a practical level, translational research must include some "action steps" (Wethington, 2016, n.p.). Originally, translational research was designed for the medical world, aiming at *translating* findings in basic research into medical practice, thus implementing a *bench-to-bedside* model. In the context of Educational Neuroscience, translational research is to be applied to problems in Education instead of Medicine, following what some researchers have referred to as a *bench-to-blackboard* model. A final consideration is that while most applied research simply delivers incremental improvements on previous research findings, translational research takes a broader integrative approach that can involve multiple disciplines. Thus, it is clear now that any kind of interdisciplinary activity, and especially transdisciplinarity, aims at becoming translational also, as clearly explained by Stevenson et al. (2013).

In order to complete this description of Educational Neuroscience as an interdisciplinary activity, a last aspect needs to be considered. According to the *Aims and Scope* section of *Trends in Neuroscience and Education*, "neuroscience is to education what biology is to medicine and physics is to architecture." It is added that "biochemistry is not enough to cure a patient, and physics is not enough to build a bridge." However, as concluded, great work cannot be performed neither in medicine nor in architecture "against the laws of physics or biology." Similarly, in the same section of the other journal, *Mind, Brain and Education*, it is stated that research in that journal "emphasizes the reciprocal relationship in which education informs biological and behavioral and cognitive research as much as these inform educational research and practice." Going back to the notion of modes of interdisciplinarity introduced by Barry and Born (2013), it might be argued that Educational Neuroscience would fit the second mode proposed, that is, the *subordination-service* mode, mainly because there is a

service discipline which makes up for or fills in for an absence or lack in the other, which is the master discipline. In this case, Education lacks the knowledge provided by Neuroscience (master discipline), but Neuroscience needs to be informed by Education (service discipline) in order to fulfil the aims of the interdisciplinary activity.

1.6.2 Science and Technology Studies

Interdisciplinarity, as already stated, involves new territories of intellectual creativity permeated by questions about real-world problems. Consequently, a reconfiguration occurs and a new area of study, which is distinguished by its own logics of production and justification, is established. Science & Technology Studies, thus, can be described as such a field (Jasanoff, 2013). Science & Technology Studies is "an interdisciplinary field that investigates the institutions, practices, meanings, and outcomes of science and technology and their multiple entanglements with the world's people inhabit, their lives, and their values" (Felt, Rayvon, & Miller, 2017, p. 1). For Science & Technology Studies, understanding science and technology means interrogating not only how science and technology shape social life and the world around us but also how the latter in turn shape developments in science and technology. In short, Science & Technology Studies research "seeks to open up science, technology, and society to critical assessment and interrogation" (Felt et al., 2017, p. 1). For Jasanoff (2017, p. 299), Science & Technology Studies as an interdiscipline is literally that: "an autonomous formation situated among other disciplines." Furthermore, rather than trying to fit in around terms such as inter-, multi-, and transdisciplinary, the way in which Science & Technology Studies represents interdisciplinarity "problematizes the notion of discipline and stresses the idea of challenging disciplinary configurations." Therefore, interdisciplinarity is seen more as an "exploratory endeavor, a project of discovering new territories and inventing or creolizing discourses in which to speak of them" (Jasanoff, 2013, p. 158), which is in agreement with the language metaphor used by Stevenson at al. (2013), as already discussed.

Following the modes of interdisciplinarity proposed by Barry and Born (2013), then, Science & Technology Studies might position itself in an *agonistic-antagonistic* fashion, both "within its own emerging boundaries and in relation to the intellectual territories occupied by other disciplines" (Jasanoff, 2013, p. 152). These include the sciences and technologies, which constitute the particular topics of study, and the social sciences and humanities, which are the sources of most of the methods that Science & Technology Studies uses "to build its

distinctive representations of epistemic, material, and social realities" (Jasanoff, 2013, p. 152).

More specifically, Science & Technology Studies can be seen as a merger of two broad streams of scholarship. On the one side, the focus is placed "on the nature and practices of science and technology as social institutions." On the other, there is an emphasis "on the impacts and control of science and technology," as well as "on the risks that science and technology pose to human values," such as health and safety, peace, security, privacy, community, democracy, development, and environmental sustainability (Jasanoff, 2017, p. 298). This latter stream, which is more connected with human values, is precisely the object of study of the Science & Technology Studies journals that have been selected for analysis: *Science, Technology, & Human Values* and *Science and Engineering Ethics*. In both of them, articles referring to two different broad topics have been mostly encountered: bioethical issues on the one side and issues connected with the ethical dimension of engineering on the other. In the paragraphs that follow, a general description of each journal is presented. After that, the relationship between Science & Technology Studies in connection with both types of ethical issues is explained.

Science, Technology, & Human Values (https://www.journals.sagepub.com/home/sth) provides the forum for "cutting-edge research and debate in the field of Science & Technology Studies." More specifically, it is "an interdisciplinary journal that covers research on the relationship of science and technology with politics, society and culture." As scientific advances improve our lives, the editors point out, they also complicate how we live and react to the new technologies. More and more, "human values come into conflict with scientific advancement" as we deal with important issues such as nuclear power, environmental degradation, and information technology.

The second Science & Technology Studies journal, which is *Science and Engineering Ethics* (https://www.link.springer.com/journal/11948), is "an interdisciplinary journal that explores ethical issues of direct concern to both, science and engineering." As stated by the editors, "recent controversies and instances of misconduct in science" have attracted considerable media attention. In addition, "the power of new technologies developed through science and engineering have inspired growing popular concern." Thus, *Science and Engineering Ethics* offers a forum for the examination and discussion of ethical issues which arise in the practice of scientific research and engineering as well as in the practical application of that work.

As for the two main topics, or problems, dealt with in both journals, I will first refer to bioethical issues. Science & Technology Studies research casts new light on a range of issues associated with bioethical questions and concerns. In fact, Science & Technology Studies can provide a better understanding of those practices "which are deemed as unethical," and of those problems "which might be overlooked by bioethicists," as pointed out by Pickersgill (2013, p. 31). Furthermore, empirical Science & Technology Studies research challenges the focus of bioethical scholarship concerned solely with the "implications of biomedicine" through "highlighting the degree to which moral and ethical decision-making and action is a constitutive dimension of work and everyday life" (Pickersgill, 2013, p. 32).

As regards the second set of problems, which derive from ethical engineering issues, Science & Technology Studies' concepts and theories, again, might shed new light on engineering practice and open up new avenues for the ethical analysis of engineering. Scholars in the field of Engineering Ethics have long recognised the complexity of engineering practice. Indeed, the central issue seems to be to understand "how engineers can and should manage this complexity responsibly." Thus, Science & Technology Studies theory is helpful to engineering ethicists precisely because it provides ways to "understand, conceptualize, and theorize this complexity," given the fact that nearly every decision an engineer makes is not simply "a detached technical decision" but involves "ethical and value content and implications" (Johnson & Wetmore, 2008, p. 568).

To sum up, the concepts and theories provided by Science & Technology Studies can help to the analysis of the social processes that constitute science and technology and the social institutions of which science and technology are part. In this way, these concepts and theories have "the potential to contribute to ethical perspectives and point the way to positive change" (Johnson & Wetmore, 2008, p. 567).

1.6.3 Economic History

As stated by Shanahan (2015, p. 184), "defining the 'boundaries' of economic history is not simple." The intersections and overlaps with other fields are multiple. *The Journal of Economic History* (https://www.cambridge.org/core/journals/journal-of-economic-history), which is part of the sub-corpus studied, notes that Economic History "is devoted to the multidisciplinary study of history and economics, and is of interest not only to economic historians but to social and demographic historians, as well as economists in general." Similarly, according to *The Economic History Society*'s homepage (http://www.ehs.org.uk), Economic History is the study of our past development, particularly in relation to economics,

labour, and business. It includes, for example, the economic development of nations, the growth of business enterprise, and the organisation of work. Finally, the second journal included in the analysis, which is *The Economic History Review* (https://onlinelibrary.wiley.com/journal/14680289), aims to "keep anyone interested in economic and social history abreast of current developments in the subject." It also provides a broad coverage of themes of economic and social change, including the intellectual, political, and cultural implications of these changes.

Moyker (2010, p. 24) points out that Economic History is one field "that speaks to all social sciences, especially because it is interdisciplinary and must speak many languages." Besides, he adds, many of its most prominent scholars have found an audience "beyond the rational boundaries delimiting economic and history" (Moyker, 2010, p. 24). Thus, while Economic History draws extensively on its close relationships with the disciplines of Economics and History, its ultimate strength lies in its broad interdisciplinary connections across a wide range of social science and business subjects. Furthermore, it encourages diverse but rigorous approaches to understanding our economic past, which draw upon theories, concepts, and a wide range of historical information sources. For example, Ritter and Horn (1986, p. 439) point out to a productive "cross-fertilization between history and quantitative economics." In this case, historians can adapt computer-based models and techniques, as well as methods of statistical projection developed by theoretical economists. Then, they can apply them to the study of past rates of economic growth and a variety of other specific economic issues. Finally, modern Economic History blends two approaches: cliometrics, which focuses on measuring economic variables and explicitly testing theories about the historical performance and development of the economy, and the New Institutional Economics, which focuses on how social, cultural, legal and organisational norms and rules shape economic outcomes and their evolution (Whaples & Parker, 2012). These two perspectives have co-existed, and still do, while adding to the interdisciplinary flavours of the field.

To conclude, as well as defining the boundaries of Economic History is not an easy task, identifying which mode of interdisciplinarity it might belong to is not simple either. Clearly enough, a subordination-service relationship between the disciplines involved is not the case. Furthermore, no traits of an agonistic-antagonistic tension are evident. Perhaps the cleverest way to understand the relationship between the disciplinary forms of knowledge encountered, mainly Economics and History, is to think of them as part of a synthesis through a process of

integration or negotiation, typical of an *integrative-synthesis* mode of interdisciplinarity. As Klein (2017, p. 75) argues, Economic History can be conceptualised as a "hybrid" or "intersticial cross-discipline." It is in those interstices, I claim, where the integration of the two antecedent disciplines (Barry & Born, 2013) occurs in relatively symmetrical ways.

1.7 Interdisciplinary journals and articles: Contextual and linguistic characteristics

The six journals presented in the previous section, leaving individual differences aside, share a similar nature: they might be understood as clear examples of *interdisciplinary journals*. Thompson (2015) defines an interdisciplinary research journal from the perspective of the intended readership. He states that "it is a journal in which researchers from a range of disciplines write papers for an audience that is similarly composed of researchers from a broad range of disciplines," and concludes that "such a journal often addresses a set of real world problems around a central topic and offer a fresh perspective, e.g. on conceptual, theoretical or methodological issues" (Thompson, 2015, n.p.). More specifically, the Centre for Corpus Research (CCR, 2017) of the University of Birmingham has presented a series of guidelines on how to write articles to be published in an interdisciplinary journal. Several recommendations have been provided, which, at the same time, define the typical features of such articles. For the purpose of this study, I have found some of them particularly interesting as starting points to the selection of the linguistic aspects to be explored.

In articles published in interdisciplinary journals, writers "draw on a broader range of literature" to demonstrate the applicability of the research beyond their own discipline (CCR, 2017, p. 7). To reach that aim, they also "emphasise the relevance of the proposed method" (CCR, 2017, p. 17) and, on top of that, they place the focus on "the relevance of the proposed study to 'real-world' concerns" (CCR, 2017, p. 4). Thereby, stemming from the first feature, namely that writers rely on a wide range of literature, citations will be explored again in this study, as already done in Modules 1 and 2 (Muguiro, 2015; 2016). This time, however, two new sets of interdisciplinary/monodisciplinary fields will be added and a complementary, although related framework of analysis will be introduced. As for the fact that writers emphasise the *relevance* of their proposed methods and studies to real-world problems, the concept of "parameters of evaluation", more specifically the "parameter of importance or relevance" (Hunston & Thompson, 2000, p. 22), was explored. In other words, it is expected that if writers need to highlight the relevance of their research as well as to emphasise the distinctiveness of their approach, they will evaluate propositions and entities as more or less *important, relevant,* etc., and that is why adjectives of importance will be studied.

1.8 Research questions

Based on the premise that "differences in fields of knowledge are reflected in differences in linguistic form" and, by the same token, "differences in linguistic form signify differences in fields of knowledge" (Becher, 1987, p. 261), an exciting research area of inquiry emerges when those different fields of knowledge interact in dynamic ways to form new, now interdisciplinary knowledge fields. As Hood (2011, p. 107) claims, much still needs to be investigated around questions of disciplinarity and this quest becomes even more significant "in the context of widespread promotion of interdisciplinary research." As explained at the beginning of this chapter, the main aim of this work is to compare three different interdisciplinary fields through the study of two language features: citations and adjectives of importance. In order to reach that aim, the single-domain disciplines that merge in each interdiscipline also need to be explored to see whether the resulting fields are more or less different or more or less similar to the monodisciplines.

Following this aim of exploring the typicality of interdisciplinary writing and, above all, of comparing distinct interdisciplinary fields to describe them accordingly, an interesting debate is open about how disciplinary differences lead to differences in discourse and vice versa. In other words, the interdisciplinary fields under study were chosen *a priori* because they were very different from an **epistemological** point of view and because they represented different modes of interdisciplinary. However, the focus of this research will be placed on demonstrating whether these fields are also different *a posteriori*, now from a **linguistic** point of view. On top of that, the influence that the related single-domain disciplines might be wielding on each interdiscipline is to be taken into account in order to provide a clearer description of each resulting knowledge form.

To conclude, as pointed out by MacDonald (1994, p. 21), "if academic writing is a form of knowledge making, then differences in knowledge problems or ways of addressing such problems should account for much of the variation among the disciplines." I argue here that these differences might also account for the variation among interdisciplines. Based on this hypothesis as well as on the theoretical considerations expressed in this introductory chapter, the following Research Questions have been proposed:

RQ 1) How does the use of citations differ across the three interdisciplines?
RQ 2) How does the use of adjectives of importance differ across the three interdisciplines?
RQ 3) What evidence is there that practices in the interdisciplines are drawn from those in the single-domain disciplines?

1.9 Outline of the thesis

The remainder of this thesis is organised as follows. Chapter 2 deals with the description of the corpus and the methodology. After that, Chapters 3 presents the analysis of citations in order to find out answers for RQ1. Chapter 4 follows, in which adjectives of importance will be examined so as to address RQ2. The analysis of the linguistic features in the interdisciplinary articles in comparison with those from the single-domain disciplines will be treated transversally across Chapters 3 and 4 aiming at providing answers for RQ3. It is important to highlight that, as I have not developed an overall literature review, relevant previous research will be discussed in each chapter together with specific theoretical concepts that might shed light on the topics involved. Finally, general conclusions, limitations and suggestions for further research will be presented in Chapter 5.

Chapter 2: CORPUS AND METHODS

2.1 A corpus-based approach

According to Hunston (2002, p. 2), the word *corpus* is used to describe "a collection of naturally occurring examples of language" consisting of collections of texts or parts of texts that are stored electronically, which have been collected for linguistic study. A corpus is defined in terms of both its form and its purpose and, although it provides information, it does not provide interpretation. In other words, the corpus offers the researcher countless examples, but it is the researcher who has to interpret them (Hunston, 2002). Along the same lines, Biber et al. (1998, p. 5) point out that the goal of corpus-based investigations "is not simply to report quantitative findings, but to explore the importance of these findings for learning about the patterns of language use."

As emphasised by Hyland (2015), the importance of corpora in the study of written academic English has been noticeable over the last decades. That relevance is based on the fact that a corpus-based approach focuses on community practices. As a result, the views of the members from different disciplines as well as their language experience in each particular domain are represented (Hyland, 2015). This empirical dimension is beneficial to the study of academic writing in the sense that it permits to give greater support to intuitions and strengthen available interpretations, thus allowing to refer to academic genres with more confidence. At the same time, this empirical nature of corpus-based methods contrasts markedly with other methods of text analysis which usually show findings that are rather partial or prescriptive (Hyland, 2015). For the purpose of this study, what is more significant about a corpus-based approach to academic writing is, perhaps, that it provides "insights into disciplinary practices which help to explain the mechanisms by which knowledge is socially constructed through language" (Hyland, 2015, p. 292), which is in line with the proposed aims and the theoretical framework described.

2.2 General description of the methodology

Hood (2011, p. 125) argues that "the understanding of the ways in which disciplines use language differently" is fundamental to understanding "their potential for effective collaboration" as well as to providing meaningful support for research across disciplinary boundaries, as the case for this study is. In Applied Linguistic studies, as Hood (2011, p.125) continues, the response to "a concern for understanding disciplinary differences has largely been corpus-based." Such studies have focused mainly on identifying disciplinary specific

generic differences or move structures as well as disciplinary preferences for particular grammatical constructions or lexical choices. Following these considerations, this study is rooted in the same tradition.

As stated in the title of this thesis, this is a *corpus-based case study* of three interdisciplines. This last distinction basically means that only three cases from all the existing interdisciplinary fields have been analysed. Thereby, the findings from these cases cannot count as valid for the representation of other interdisciplines, or for interdisciplinary academic writing in general. Finally, and because of the fact that the main aim of this exploratory work is to compare those cases, a corpus-based methodology is once again adequate because the nature of corpus data is "inherently comparative," as highlighted by Stubbs (2001, p. 149).

More specifically, this work has been carried out through the combination of quantitative and qualitative corpus-based methods. In essence, this combination refers to the moving backwards and forwards between the analysis of quantitative data and their qualitative interpretation by means of close reading. As pointed out by several researchers (Carter, 2004; O'Keeffe, 2006; O'Keeffe et al., 2007), combining automatic corpus analytic techniques with more fine-grained qualitative investigation might become a reliable methodology for dealing with the complexity of language. In sum, this means that the quantitative findings revealed by corpus analysis need to be complemented with qualitative interpretations (Flowerdew, 2004). Finally, it is important to note that the description of the methodological stages and procedures for the analysis of the two linguistic aspects studied, namely citations and adjectives of importance, will be provided in each of the corresponding chapters.

2.3 The corpus

2.3.1 Genre and disciplines

The corpus of this study is divided into ten sub-corpora of Research Articles (RAs) published in different monodisciplinary and interdisciplinary scientific journals. Two main different kinds of choices underline the selection criteria to the building of the corpus and its sub-corpora. On the one hand, a decision was made about which genre to study. On the other hand, there was a decision about which disciplines and interdisciplines to include.

The decision to study RAs is grounded on the fact that, as Canagarajah (2002, pp. 32-33) affirms, there is consensus among recognised scholars in the academy that "the journal article is the primary mode of validating their research findings." The value of the research is not considered complete until it is made available to the disciplinary community through its

published journals. Thus, refereed journals become the gatekeepers of knowledge in each discipline. Such is the status of RAs that academic communities depend on them to legitimate new knowledge across fields (Canagarajah, 2002). Along the same line, Charles and Pecorari (2016, p. 176) point out that RAs occupy a special status in the English for Academic Purposes (EAP) area since they represent "the most thoroughly researched expert genre." Peer-reviewed RAs, particularly when they appear in a top-ranked journal, "trigger the academic reward system at all levels." Finally, the RA constitutes an "extremely prestigious form of publication across the university" and it is mostly used "as a measure of research productivity" (Charles & Pecorari, 2016, p. 176). As the main aim of this work is to study interdisciplinarity in academic **writing**, then, to study RAs means to study the type of text that is most significantly valued by academic **writers** and their research communities.

RAs have been described as having a structure consisting of four main parts: the introduction, methods, results and discussion, as well as some additional features such as the title, abstract and reference list. This typical structure, which is known as IMRD, is subject to variation. In Educational Neuroscience, Education, and Neuroscience articles, for example, the four sections are clearly distinguished, which allowed me to focus only on the Introduction sections in Modules 1 and 2. In some other articles, however, it is very difficult to distinguish between different sections, since "headings are likely to be thematic rather than generic" (Charles & Pecorari, 2016, p. 176), as in History, Ethics, Economic History or Science & Technology Studies journals, for example. It is because of this reason that the whole articles and not the Introduction sections only have been included in the present corpus. Furthermore, no cross-sections comparisons could be carried out due to the same reason.

As regards the disciplines and interdisciplines involved, decisions were made according to the type of disciplinary *mixture* that the interdisciplines involved might show. Thus, it was necessary to rely on one or several disciplinary taxonomies to describe the nature of each discipline and, at the same time, to explore different ways in which these disciplines could interact when forming new interdisciplinary knowledge forms.

In their well-known and highly influential study about academic disciplines, Becher and Trowler (2001), based on Biglan's (1973) model, describe disciplines as *academic tribes* which occupy different *disciplinary territories*. The ways in which "academics engage with their subject matter" (the tribal part) are "important structural factors in the formulation of disciplinary cultures" (the territorial part) (Becher & Trowler, 2001, p. 23). Following these assumptions, and departing from the traditional division between the natural sciences, the

social sciences and the humanities, Becher and Trowler (2001) include the area of application and focus on the epistemological properties of knowledge fields as well as to the social characteristics of research groups. Accordingly, they propose a system in which four knowledge domains can be distinguished: "hard-pure" (Physics, Chemistry, etc.), "soft-pure" (History, Anthropology, etc.), "hard-applied" (Medicine, Engineering, etc.), and "soft-applied" (Education, Law, etc.) (Becher & Trowler, 2001, p. 35).

Although Becher and Trowler (2001, p. 64) recognise that boundaries between disciplines "are constantly shifting and are sometimes poorly demarcated," and that "there are numerous gaps and overlaps in their pattern of coverage of knowledge domains," they identify certain features that help to distinguish each domain: "Hard-pure" disciplines are concerned with universals and quantities; they are impersonal and value-free, they construct knowledge cumulatively, and their results are based on discovery and explanation. As regards "soft-pure" disciplines, they deal more with particular cases and are more personal and value-laden. They construct knowledge reiteratively and their results are communicated by means of understanding and interpretation. "Hard-applied" disciplines are purposive and they are concerned with a pragmatic know-how and with the mastery of the physical environment. They are functional and their results are products and techniques. Finally, "soft-applied" fields are also functional but they are more concerned with a utilitarian know-how that permits the enhancement of the professional practice. They apply case studies and their results are expressed in terms of protocols and procedures (Becher & Trowler, 2001, p. 35).

It is important to highlight that although this *tribes-and-territories* metaphor for the description of academic disciplines has been extensively used for the last decades, it has also been object of sound criticism. Trowler (2012) himself stated, a decade later, that "more fluid metaphors" are required as it is unhelpful to draw clear lines between particular domains and disciplines, or between one discipline and another, as well as to use the imagery of "fields", "boundaries", "territories", "tribes" and so on (Trowler, 2012, p. 11). According to his even more recent criticism towards these "essentialist views of disciplines," Trowler (2013) points out that the category *discipline* does not have a set of essential characteristics which are all necessarily present in every instance. He also adds that each individual discipline has no essential "core characteristics" either, in the sense of being "all present and identifiable at all times" (Trowler, 2013, p. 4), which is in line with the definition of *academic discipline* provided in the Introduction of this work.

Along the same line, Manathunga and Brew (2012, p. 65) propose to leave aside "land-based" metaphors such as *territories* so as to explore disciplinarity in terms of *oceans* and to

see knowledge domains in terms of *fluidity*. Similarly, Martin (2011) proposes to embark through interdisciplinary *troubled waters*. This view also goes in agreement with the idea of *interdisciplinarity* underlying this work. Furthermore, Manathunga and Brew (2012, p. 67) have noticed that, although Becher and Trowler's (2001) somehow "pejorative" description of academic communities as "tribes" (due to the colonial and imperialistic denotation that the term implies) still persists, references to them as "academic cultures" have become more abundant. In fact, this is the term Kagan (2009) uses when he skillfully describes the *three cultures*: the culture of the natural sciences, the culture of the social sciences and the culture of the humanities.

Despite acknowledging the conceptual limitations that a model presented almost two decades ago might present, Becher and Trowler's (2001) model still constitutes a valid approach to describe disciplinary differences. In fact, this is the model that many researchers have used, especially in the field of Applied Linguistics, to study disciplinary differences from a linguistic perspective. As a conclusion, and leaving the controversies around Becher and Trowler's (2001) taxonomy aside, the necessity of classifying disciplines somehow cannot be ignored. Disciplines are inherently different in terms of their subject matter, how they conceptualise knowledge, the methods they use and the type of results they obtain. However, because disciplines are fluid and do not have fixed boundaries, they have more in common with *oceans* than with *territories.*

As the main aim of this work is to compare different interdisciplines, the focus was placed on exploring those in which the disciplines involved would be different from each other. On top of that, the three interdisciplines would need to be different as regards the kind of disciplinary mixture involved. In other words, and based on a *watery* metaphor, I am referring to the possibility of finding different disciplinary "oceans" that would "flow" into each other, thus "merging" to form different kinds of knowledge groupings (Manathunga & Brew, 2012, p. 68). Summing up, each interdiscipline chosen is a mixture of two disciplines which are different in nature, and, at the same time, the type of mixture is of a different nature in the three interdisciplines.

I will start by describing the interdisciplinary field of Educational Neuroscience [EN], which has been already explored in Module 2, now from the point of view of the nature of its constituent disciplines. In this case, the two disciplines that make up the mixture are Education [EDU] and Neuroscience [NEU], the latter a branch of Biology, also called Neurobiology. Education shares the culture of the *social sciences* while Neuroscience is a *natural science*. In the case of Economic History [EH], the mixture is made between another

social science, Economics [ECO] in this case, and History [HIS], which is a *humanity*. Finally, Biomedicine [BIO] and Computer Engineering [ENG], which are both *technologies* or *applied sciences*, in combination with Ethics [ETH], which is another *humanity*, merge into the interdisciplinary field of Science & Technology Studies [STS]. More specifically, when Biomedicine [BIO], which is defined as the branch of Medical Sciences that applies biological and physiological principles to clinical practice, is in contact with Ethics [ETH] (a branch of Philosophy), issues within the area of Bioethics arise. In the same fashion, when Computer Engineering. [ENG], defined as the branch of Engineering that integrates several fields of Computer Science and Electronics Engineering, interacts with Ethics, Engineering Ethics issues arise this time. These two main areas and their typical problems and issues constitute, among others, the objects of study of the broader interdisciplinary field of Science & Technology Studies [STS].

As I explained before, the disciplines that interact in the three interdisciplines are different in nature, but also the kind of interaction in each interdiscipline is different. These relationships have been illustrated in the following diagram, where disciplines of the same nature share the same colour and arrows indicate the resulting interdisciplines for each set. Furthermore, as already stated in the Introduction, each interdiscipline might be showing different modes of interdisciplinarity, which have been incorporated as speech bubbles into the diagram.

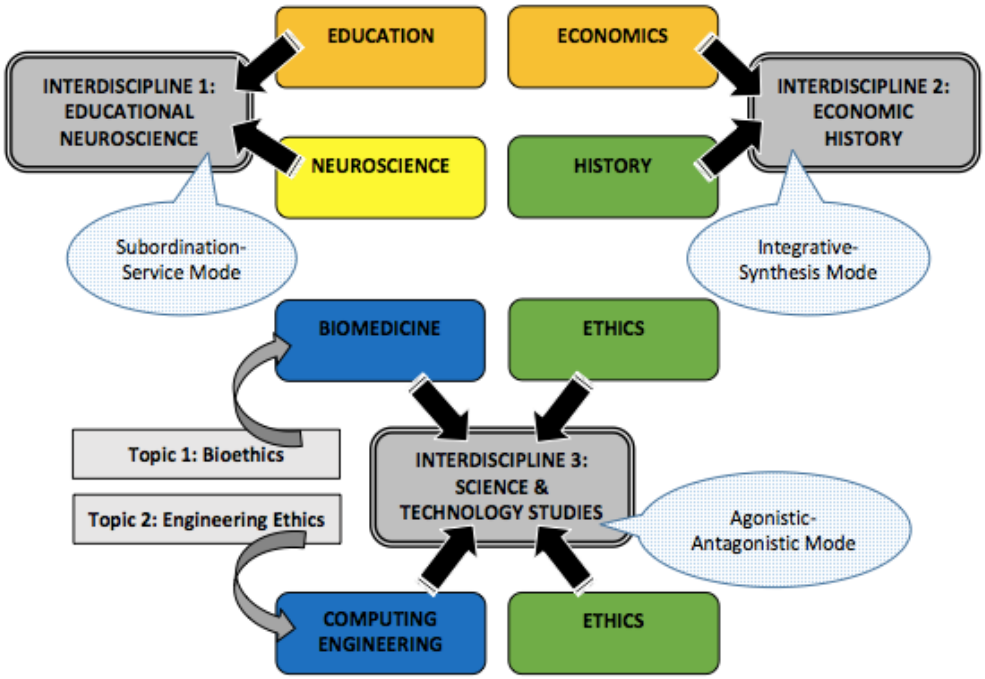


Figure 2.1 Description of the disciplines/interdisciplines and their relationships in the corpus

2.4 Corpus design

2.4.1 General description: Number of journals, texts, and words

Four hundred and fifty complete RAs were collected to build the corpus comprising a total of 3,309,307 running words approximately. Every sub-corpus for the interdisciplinary fields is made of fifty articles from two different journals (twenty-five from each journal), and every sub-corpus for the single-domain disciplines is made of fifty articles too. In the cases of five of the single-domain disciplines (Education, Neuroscience, Economics, History, and Ethics), the fifty RA are all from the same journal in each field. In the case of the other two single-domain disciplines (Biomedicine and Engineering), twenty-five articles from each discipline have been collected to make the two *topical* sub-corpora. However, depending on the purpose of the analysis, the fifty articles have been sometimes blended together as representative of the *technologies* sub-corpus. Educational Neuroscience and its related disciplines form Set 1, Economic History and its related disciplines form Set 2, and Science & Technology Studies and its related disciplines form Set 3. The number of word tokens for each sub-corpus in each set is detailed below in Table 2.1.

Discipline	Journal Name	Texts	Words
Neuroscience [NEU]	*Neuroscience*	50	232,092
Education [EDU]	*International Journal of Educational Research*	50	318,513
Educational Neuroscience [EN]	*Trends in Neuroscience and Education*	25	143,995
	Mind, Brain & Education	25	131,471
Total Set 1		150	275,466
Economics [ECO]	*The Quarterly Journal of Economics*	50	607,852
History [HIS]	*Journal of Contemporary History*	50	462,631
Economic History [EH]	*The Journal of Economic History*	25	208,415
	Economic History Review	25	207,647
Total Set 2		150	416,062
Ethics [ETH]	*Ethics*	50	549,235
Biomedicine [BIO]	*Biology and Medicine*	25	48,336
Engineerning [ENG]	*Int. Jour. of Advanced Research in Computer Engineering & Technology*	25	59,017
Science & Technology Studies [STS]	*Science and Engineering Ethics*	25	171,688
	Science, Technology, & Human Values	25	168,315
Total Set 3		150	340,003
Total Corpus		**450**	**3,309,207**

Table 2.1 Description of the corpus according to journal name, number of texts, and number of words

2.4.2 Selection of journals and sampling of texts

Having determined which disciplines to include in the corpus, journals that are most representative of those disciplines were selected. For this purpose, the main criterion was to choose the most influential or prestigious journals across the range of disciplines. Thus, the journals selected are all renowned and their RAs are subject to a rigorous peer review process

before being published. Eleven from the thirteen journals are registered in the *Journal Citation Reports* (JCR), which is one the most authoritative tools used by the academic community to identify the most important journals based on their impact factor (IF). Furthermore, searches were made through the *Scimago Journal Rank* system (based on information from Scopus) so as to make sure that the journals chosen were ranked between the 1st to the 25th positions in each field. However, an additional criterion for the selection of the topical monodisciplinary journals from Set 3 (Science & Technology Studies and their related disciplines) was considered. As the two selected journals from Science & Technology Studies deal with only two specific topics or areas (Engineering Ethics issues and Bioethics issues) within the broad spectrum that this particular interdisciplinary field offers, the selection of the journals that could represent the single-domain disciplines for comparison purposes (Computer Engineering and Biomedicine) was based more on the representativeness of the topics covered than on the prestige of the journals selected. For this reason, these are the only two journals that are not registered in the JCR index. However, both journals report high-impact values based on other metrics, such as the Scientific Journal Impact Factor (SJIF) or the Source Normalised Impact per Paper (SNIP).

As regards the sampling of the texts, my aim was to include the most recent RAs published in each selected journal. In order to do so, the *Tables of Contents* of the journal issues were examined and texts such as editorials, book reviews, letters, etc. were excluded. In some journals, labels other than *Research Article* were used. In those cases, I skimmed the texts (labeled *Original Articles* or just *Articles*) to check that they had the structure of RAs and reported new knowledge claims or brought contributions to the field. As regards year of publication, all the sampled articles were published between 2007 and 2017. It should be noted, however, that because the journals were not alike in the number of RAs published each year, the number of texts from each journal also differs.

Finally, when considering the storing of the articles and their preparation for corpus-based analysis, several aspects were taken into account. First, the articles were all retrieved in their electronic version as PDF or HTML files and were converted into plain text files (Unicode format) by using the *AntFileConverter* (Anthony, 2017) software tools. Then, the abstracts, acknowledgements, explanatory footnotes or endnotes, appendices and lists of references were removed from the texts. As for the computer-based identification and retrieval of linguistic features, namely citations and adjectives of importance, I used *AntCont* (Anthony, 2018) software, which is a freeware toolkit for concordancing and corpus analysis in written texts.

2.4.3 Corpus type and size: A specialised small corpus

According to its type, this corpus can be described as *specialised*. As for its size, this is the case for a *small* one. Thereby, the corpus of this study can be defined as a *specialised small* corpus (Koester, 2010). It is "specialised" because it is "a corpus of texts of a particular type," the RA in this case. And it is also "specialised" because it is used "to investigate a particular type of language," which is written academic language in this case (Hunston, 2002, p. 14). Specialised corpora are usually smaller in scale than general language corpora due to their narrower focus precisely. However, this is not seen as a problem because the greater homogeneity of the texts in the specialised area "confers the advantage of fewer texts being required for the corpus to be representative of that language variety" (Lee, 2010, p. 114). As a matter of size, according to Flowerdew (2004) any written corpus under five million words is considered small. However, many small corpora are much smaller than that (Koester, 2010) and there is a general agreement that small corpora have up to 250,000 words (Flowerdew, 2004), which is the case for most of the sub-corpora in this study.

As Koester (2010, p. 67) points out, the advantage of small specialised corpora is that they allow "a much closer link between the corpus and the contexts in which the texts in the corpus were produced." While very large corpora allow for insights into the linguistic features of language as a whole, smaller specialised corpora allow for insights into language use features in particular settings. Furthermore, the quantitative data obtained from corpus analysis can be more easily complemented with qualitative interpretation, as shown in this study.

A last consideration when designing a small specialised corpus, as any other corpus, is that it needs to be representative. Biber (1993, p. 243) defines representativeness as "the extent to which a sample includes the full range of variability in a population." In corpus design, Biber (1993) adds, variability should be considered from a situational and from a linguistic perspective, and both of them are important in determining representativeness. As summarised by Koester (2010, p. 69), situational variability refers to "the range of registers and genres" included in the corpus, while linguistic variability refers to "the range of linguistic distributions" found in the population of texts. Thereby, the samples collected for the corpus should reflect both criteria, but the situational one must be first considered, since it cannot be established that the corpus is "linguistically representative" without first knowing that it is "situationally representative" (Koester, 2010, p. 69).

As regards the corpus of this study, situational representativeness is quite straightforward

because of the specific type of genre that is being investigated; in other words, all the samples collected accurately represent the genre because they are all RAs. However, it needs to be pointed out that it is not possible "to evaluate representativeness entirely objectively" (Tognini Bonelli 2001, p. 57). As for linguistic representativeness, Biber (1993) argues that it depends first of all on the situational representativeness, as already stated, but also "on the number of words per text sample and the number of samples per register or genre included in the corpus," as described by Koester (2010, p. 70). Rooted in a number of statistical tests carried out by Biber (1990), it is agreed that any sub-corpus within a corpus should be represented by at least 1,000 words, and that every sub-corpus should contain at least ten different samples (Koester, 2010, p. 70). Thereby, the characteristics of the corpus of this exploratory study meet both parameters for linguistic representativeness. However, as the two different types of linguistic features (citations and adjectives of importance) are likely to occur differently as regards frequency, the extent to which linguistic representativeness is entirely objective cannot be evaluated, which is indeed logical since this is an exploratory study.

2.5 Variation across journals from the same interdiscipline

As explained above, the RAs from each interdisciplinary field were taken from two different journals. It has been so for two reasons. On the one hand, there are no previous studies, to my knowledge, that explore citation practices and adjectives of importance in interdisciplinary fields. Thus, I considered it important to select articles from more than one journal in each sub-corpus in order to make the sample a bit more representative, since no comparisons could be made with similar corpora from previous studies. On the other hand, comparing two journals from the same interdisciplinary field might become interesting in order to explore the degree of internal journal homogeneity/heterogeneity as regards the occurrence of the linguistic features studied. Following these considerations, when citation density rates and normalised frequencies of the adjective *important* were calculated, findings from the interdisciplinary journals were reported first as wholes but also separately according to the journal. As a result, the problem of possible *local densities* (Moon, 1998) was at least taken into account. In the context of this work, this phenomenon is concerned with the possibility that certain features (citations and adjectives of importance in this case) may appear as more or less frequent in the interdisciplinary fields simply because they occur more or less frequently in only one of the journals.

2.6 Variation across individual texts in interdisciplinary journals

Another important aspect that was taken into consideration was the analysis of the range and dispersion of the linguistic features across every individual text from each interdisciplinary sub-corpus. As explained by Biber (1995), every linguistic feature shows a certain degree of variability across the texts of a corpus. Thus, a linguistic feature can be relatively common in some texts but it can be relatively rare in others. This variance of the distribution of a certain feature (citations and the adjective *important* in this study) serves to measure how dispersed those values are across the total range of variation. In other words, as Biber (1995, p. 109) points out, it is important to examine whether "most values are closer to the mean value" (with only a few texts whose values are nearer the minimum and maximum), or whether "the values are more widely scattered" (with many texts whose values are nearer the minimum and maximum). To sum up, by paying attention to the range and dispersion of the linguistic features across the individual papers of each interdisciplinary sub-corpus, a clearer picture of how uniform the distribution of the features across the articles is can be obtained. Therefore, it is clear that if the distribution of the linguistic features is not relatively uniform across the texts, the validity of the results obtained might be challenged. In order to examine the possible influence of these aspects, boxplot diagrams have been included in each corresponding chapter.

Chapter 3: CITATION PRACTICES AND ATTRIBUTION IN INTERDISCIPLINARY WRITING

3.1 The importance of citation practices in academic writing

As simply put by Charles (2006, p. 311), citation plays a key role in academic writing because "it shows how a new piece of research arises out of and is grounded in the current state of disciplinary knowledge." Furthermore, citations are central in academic writing because they help to provide justification and evidence for arguments and claims to demonstrate familiarity with the literature (Hyland, 2000). As citations show rhetorical and social meanings which are represented by the choices writers make, they serve writers to establish a somehow persuasive stance, since "new work has to be embedded in a community-generated literature to demonstrate its relevance and importance" (Hyland, 2000, p. 22). In short, as put by Swales (2014, p. 119), writers introduce and discuss the contributions of other researchers and scholars, and by showing knowledge about previous research they "establish membership in the relevant disciplinary community."

Abundant work has been therefore carried out to the examination of citation practices in academic writing through the analysis of different aspects across disciplines, genres, writer's proficiency, cultures, and languages. Since the 1980s, many scholars have acknowledged citations as useful resources for rhetorical purposes (Swales, 1986; 1990; Berkenkotter & Huckin, 1995; Dudley-Evans, 1986; Hopkins & Dudley-Evans, 1988; Myers, 1990). In addition, cross disciplinary variation has been widely studied (Hyland, 1999, 2000; Thompson, 2005; Charles, 2006), as well as variation according to genre (Thompson & Tribble, 2001), language and culture (Fløttum et al., 2006; Atkinson, 2004; Hu & Wang, 2014), and the language proficiency level of writers (Petrić, 2012, Lee et al., 2018). Furthermore, several aspects like citation density (Coffin, 2009; Fløttum et al., 2006; Hyland, 1999, 2002; Thompson, 2005; Thompson & Tribble, 2001), rhetorical functions (Harwood, 2009; Harwood & Petrić, 2012; 2013), writer stance (Coffin, 2006), or reporting verbs (Thompson & Ye, 1991; Hunston, 1993; Thomas & Hawes, 1994; Hyland, 2000; Bloch, 2010) have been specifically explored. Due to this wide variety of previous research studies on the topic, deciding which citation features should be focused on in the analysis of the corpus was not an easy task. However, as this work is supposed to be somehow related to the previous Modules, I started by exploring such connections.

Stemming from the previously acknowledged consideration, this chapter has a two-fold aim. First, it is a continuation of Module 2, in which the presence of external sources in

Educational Neuroscience was analysed in comparison with the two single-domain disciplines that give origin to it, which are Neuroscience and Education. More specifically, the results obtained in Module 2 gave rise to some preliminary hypotheses that need a stronger confirmation. Secondly, this chapter seeks to explore two additional disciplinary sets with the aim of comparing the three resulting interdisciplines in the light of the theoretical concepts introduced and the research questions proposed at the beginning of this work.

3.2 Previous work and evaluation of preliminary hypotheses

As stated before, this chapter is a continuation of Module 2. In that previous work, the citations encountered in 120 RA Introductions (152,202 words) from Neuroscience, Education and Educational Neuroscience were analysed considering the following three parameters:

1) *Visibility* of the source: this analysis was carried out by distinguishing between integral and non-integral sources (Swales, 1990) as well as by categorising different types of sources according to their nature (Hood, 2011).

2) *Strength* of the source: this analysis was carried out by distinguishing between averred and attributed sources (Sinclair, 1988; Hunston, 2000).

3) *Credit* given to the external sources: this analysis was carried out by distinguishing different types of writer stances towards attributed propositions (Coffin, 2006) as well as by classifying averred sources into different categories (Hyland, 2002; Thompson, 2005).

After the analysis of these parameters in the three sub-corpora was completed, several preliminary results were reported, which gave rise to these three main summarised conclusions:

1) As regards **visibility**, external sources in Educational Neuroscience are more visible than in Neuroscience but not as visible as in Education according to, mainly, the rates of frequency of integral and non-integral sources registered.
2) As regards **strength**, external sources in Educational Neuroscience are slightly stronger than in both Neuroscience and Education introductions because of a higher frequency of cases of attributed sources over averred ones.
3) As regards **credit**, attributed propositions from Educational Neuroscience introductions are given more credit than attributed propositions from Neuroscience

and Education because of a higher frequency of ‘endorse’ writer stances over ‘acknowledge’ ones.

Finally, these conclusions gave support for the development of three main hypotheses. First, that the visibility of external voices in interdisciplinary writing stands in the middle when compared with the single-domain disciplines; second, that external voices are likely to be stronger in interdisciplinary writing; and third, that greater credit to previous research is likely to be given in interdisciplinary writing.

Although highly attractive, the case for these hypotheses needs to be made stronger, mainly because of the small size of the corpus studied in Module 2. As already stated, the first aim of this chapter is to test these preliminary hypotheses on more solid grounds. Specifically, the present corpus is both much bigger (3,300,000 words) and more varied for comparison purposes, since it opens up the possibility to test the hypotheses on two additional sets of disciplines. Based on these considerations, the methodological stages followed for the testing of each previous hypothesis in the new corpus will be described in the following paragraph.

First, every occurring citation was identified in the 450 complete RAs that make up the whole corpus. Then, citations were counted and citation density rates were calculated for each discipline in the three disciplinary sets. This first stage helped to find out whether citations are more frequent in the interdisciplinary fields when compared with the single-domain disciplines. This is a very important aspect to explore bearing in mind that in interdisciplinary articles writers usually draw on “a broader range of literature” to situate their research as well as “to demonstrate the applicability of the research beyond their own discipline.” (CCR, 2017, p. 17), as I have already stated. It is clear, though, that neither the purpose for citing nor the rhetorical functions that citations play are considered in this study. However, finding out whether citations are more or less frequent in interdisciplinary writing is a valid first step to show differences, since it is likely that if citations are more varied and cover more topics they might also be more frequent.

Once this first stage was finished, citations were classified into integral and non-integral to test the hypothesis on visibility of the external sources derived from the first conclusion arrived at in Module 2. After that, citations were classified according to the attribution-averral dimension to analyse the strength given to their external voices and then test the second hypothesis.

3.2.1 Identification of citations

It is important to highlight firstly that citations can be expressed differently according to the style conventions required for each journal. Specifically, three different types of guidelines are used in the journals that make up the corpus; i.e., the American Psychological Association Style (APA), the Chicago Manual of Style (CMOS), and the Council of Sciences Editors (CSE).

In the journals from Neuroscience (*Neuroscience*), Education (*International Journal of Educational Research*), and Economics (*Quarterly Journal of Economics*), as well as in one of the Educational Neuroscience journals (*Mind, Brain & Education*), and in one of the Economic History journals (*The Journal of Economic History*), citations follow the APA guidelines, which basically consist of the surname(s) of the author(s) followed by the year of publication, as in the examples that follow:

(1) Nonetheless, Hacker, Hilde, and Jones (2010, p. 49) find little evidence of a "marriage squeeze" for women, noting that, instead of forgoing marriage entirely, women may have "relaxed their standards of acceptable partners." [EH]

(2) In recent years, motilin has been considered as a new treatment modality (Chapman et al., 2013). [NEU]

The CSE guidelines are applied in one of the Educational Neuroscience journals (*Trends in Neuroscience and Education*) as well as in the journals from Biomedicine *(Biology and Medicine Journal)* and Engineering *(International Journal of Advanced Research in Computer Engineering & Technology*). According to this system, citations are expressed through indicating references by number(s) in square brackets in line with the text. The actual authors can be referred to, but the reference number(s) must always be given, as in the following examples:

(3) The formation of new capillaries also took place at this phase, which began when there was in ammation [12,13]. [BIO]

(4) For example, Seger et al. [64] tracked neural response patterns as individuals became more proficient at classifying instances into categories. [EN]

Finally, the CMOS offers two different systems. One is the *notes and bibliography* system, according to which sources are cited in numbered footnotes or endnotes, where each

note corresponds to a raised (superscript) number in the text. The other is the *author date* system, according to which sources are briefly cited in the text, usually in parentheses, by author's last name and year of publication, which is similar to APA style. For example, in one of the journals from Science & Technology Studies (*Science, Technology, & Human Values*) the CMOS author-date system is used, while in the other (*Science and Engineering Ethics*) both CMOS systems are permitted. In the journals from Ethics (*Ethics*), History (*Journal of Contemporary History*), and one of the journals from Economic History (*The Economic History Review*), however, only the CMOS notes and bibliography system can be used, as exemplified bellow:

(5) For Gibbard, this determines just what sorts of judgments have moral content: "to think an act morally reprehensible is to accept norms that prescribe, for such a situation, guilt on the part of the agent and resentment on the part of others."[13] [STS]

(6) As a consequence, historians have focused almost exclusively on the most visible, most abrasive German campaign of the early 1920s, which publicized the 'black horror', that is the alleged outrages of French colonial troops in the occupied Rhineland, in order to widen the breach between the Allies and secure US support in the reparations negotiations.[7] [EH]

Due to the variety of citation styles employed, the search and identification of citations was not an easy task, especially in the History, Ethics, Economic History, and in one of the Science & Technology Studies sub-corpora, since footnotes or endnotes not always refer to references but also to different comments or clarifications. It is important to note that footnotes and endnotes had been removed from the articles when preparing them for storing as *.txt* files. However, those that referred to external references (not those that were explanatory) had to be included for matters of identification when these specific sub-corpora were analysed.

In order to cover all instances of citations, the corpus was computer-searched for numerous features (Hyland, 2000) such as: dates between parentheses, numbers in square brackets, superscripted numbers, quotation marks and references to other citations (for example *op cit.*, *ibid.*, etc.). Furthermore, concordance searches were made with the surnames listed in the references for confirmation, and third person pronouns and phrases such as *these researchers* or *these authors* were also searched. However, instances of self-citations were excluded following Hyland (2000) and Petrić (2012).

3.2.2 Frequency of citations

In this first stage of the analysis, a total of 21,636 citations were identified in the whole corpus and citation density rates per 1,000 words were calculated for every sub-corpus. In the case of the sub-corpus of Science & Technology Studies, RAs were grouped according to the two topics selected. In this way, twenty-five RAs relate to bioethical issues while the other twenty-five are about the ethics of engineering. It is important to make clear that both topics are covered in both Science & Technology Studies journals. Thus, in order to keep balance, thirteen texts from one journal and twelve texts from the other journal were grouped to make up one topical sub-corpus (Bioethics), while twelve texts from the first journal and thirteen texts from the second journal were put together to make up the second topical sub-corpus (Engineering Ethics). Finally, it is important to bear in mind that calculating the number of citations per number of words is a problematic issue, as they are units of very different types (Charles, 2006). Despite this, calculations were made and findings have been summarised in Tables 3.1, 3.2, and 3.3 as follows:

SET 1	Number of words	Citation tokens	Citation density (per 1,000 words)
Neuroscience	232,092	2,593	**11.17**
Education	318,513	2,853	**8.95**
Educational Neuroscience	275,466	3,149	**11.43**

Table 3.1 Citation density in Set 1: Neuroscience, Education, and Educational Neuroscience

SET 2	Number of words	Citation tokens	Citation density (per 1,000 words)
Economics	607,852	1,893	**3.11**
History	462,631	3,380	**7.3**
Economic History	416,062	3,159	**7.59**

Table 3.2 Citation density in Set 2: Economics, History, and Economic History

SET 3	Number of words	Citation tokens	Citation density (per 1,000 words)
Ethics	549,235	1,750	**3.18**
Biomedicine	48,336	432	8.93
Engineering	59,017	299	5.06
Total (Biomedicine/ Engineering)	107,353	731	**6.8**
STS Topic 1: Bioethics	149,542	1,138	7.6
STS Topic 2: Engineering Ethics	190,461	990	5.19
Total STS	340,003	2,128	**6.25**

Table 3.3 Citation density in Set 3: Ethics, Biomedicine, Engineering, and Science & Technology Studies

Reported findings show that the frequency of citations varies between disciplines in the three sets studied. In order to explain the variation between the single domain disciplines and the interdisciplines in each set, it is necessary first to provide some parameters of comparison between the rates found in this study for the single disciplines and the rates found by other researchers in similar disciplines. For example, Hyland (2000) calculated rates of 10.1 to 12.5 in social science texts, which could be compared with the rate for Education, which is 8.95, and the rate for Economics, which is 3.11, in this study. In this case, findings are rather different, since although the citation rate is slightly lower for Education, it is even more markedly lower for Economics. However, Thompson (2001) found a citation density rate of 6.7 per 1,000 words in his corpus of Agricultural Economics journal papers and of 5.25 per 1,000 words in his corpus of Agricultural Economics PhD Thesis, also showing disagreement with the rates calculated by Hyland for other social sciences. Thompson (2005, p. 41) suggests that this could be a specific feature of writing in the discipline of Economics. Thus, the lower citation density rate calculated for Economics in this study might provide evidence for the same reasoning. As a final reinforcement of this disciplinary specificity, Fløttum et al. (2006) also calculated a citation density level of 3.96 in his corpus of Economics Research Articles.

As regards frequency of citations in the hard sciences, exemplified in this corpus by Neuroscience, Biomedicine, and Engineering articles, similar figures than those reported by other researchers were encountered. A citation density rate of 11.17 per 1,000 words was calculated for articles in Neuroscience, followed by 8.93 in the articles from Biomedicine, and 5.6 in those from Engineering. Hyland's (2000) rate for Biology was 15.15 citations per 1,000 words, while Thompson (2005) reported a rate of 9.00 citations per 1,000 words in his Agricultural Botany corpus. Therefore, the rate calculated in this study would be standing between both, although nearer Thompson's (2005) figure. As for Biomedicine articles, which reported a density rate of 8.93 citations per 1,000 words, it is to be highlighted that Hyland's (2000) rate for Biology is higher again when compared. However, a study by Hu and Wang (2014) reported a citation density rate of 8.75 per 1,000 words in General Medicine articles, thus showing a clear similarity with my findings. Finally, Hyland (2000) reported a rate between 7.3 and 8.4 citations per 1,000 words for his two branches of Engineering, which is, again, higher than the 5.6 rate calculated in this study for Engineering articles. However, it might be considered to be situated within the same range.

As for humanities, a citation density rate of 7.32 citations per 1,000 words was calculated for History articles, while 3.18 citations per 1,000 words were counted in Ethics articles. While the rate for History is similar to that calculated by Hyland (2000) for Philosophy (10.8) and by Thompson (2005) for Psychology (8.5), both humanities, the much lower rate calculated for Ethics would need additional explanations that might be offered if a more throughout study of this discipline in particular is carried out. To my knowledge, no citation studies on the field of Ethics have been published for comparison purposes.

Focusing now on the comparison between each interdiscipline with the two related disciplines in each set, some insightful findings are worth to be pointed out. The citation density rate for Educational Neuroscience articles is 11.43, which is higher than both, Education (8.95) and Neuroscience (11.17) texts. In a similar fashion, the frequency of citations for Economic History is 7.59 per 1,000 words, which is higher than both Economics (3.11) and History (7.31). In the case of Science & Technology Studies, the same trend is observed when the citation rate of 5.19 for Science and Technology Studies articles dealing with topic 2 (Engineering Ethics) is compared with the rates in Ethics (3.18) and Engineering (5.06) respectively. However, the calculated citation rate of 7.6 for articles which deal with Topic 1 (Bioethics) is lower when compared with the rate for Biomedicine (8.93), although this higher frequency of citations which occurs in Biology articles in particular has been specifically highlighted by Hyland (2000) and Swales (2014) as a typicality of the discipline.

What is interesting to observe is that the citation density rate of the Science & Technology Studies articles about Bioethics issues (7.6) is indeed higher than the rate calculated for the Science & Technology Studies articles about Engineering Ethics issues (5.19), thus showing the stronger influence of Biology even in the interdiscipline. Despite this single discrepancy, the findings obtained provide evidence that similar or even higher citation frequencies have been calculated for the interdisciplines when compared with their related single-domain disciplines. As stated before, probing this is a valid first step to find out more about the fact that in interdisciplinary articles writers draw on a broader, and probably more extensive, range of previous literature.

3.3.3 Citation density: Variation across journals from the same interdisciplines

As stated in Chapter 2, a comparison between the two different journals from each interdiscipline was carried out so as to prevent possible problems of *local densities*. Thus, citation density rates were calculated for the interdisciplinary journals sub-corpora and the results have been reported in Table 3.4 below.

Educational Neuroscience Journals	**Number of words**	**Citation tokens**	**Citation density (per 1,000 words)**
Trends in Neuroscience and Education	143,995	1,784	**12.39**
Mind, Brain & Education	131,471	1,365	**10.38**
Economic History Journals	**Number of words**	**Citation tokens**	**Citation density (per 1,000 words)**
The Journal of Economic History	208,415	1,450	**6.95**
The Economic History Review	207,647	1,709	**8.23**
Science & Technology Studies Journals	**Number of words**	**Citation tokens**	**Citation density (per 1,000 words)**
Science and Engineering Ethics	171,688	1,038	**6.04**
Science, Technology, & Human Values	168,315	1,090	**6.47**

Table 3.4 Comparison of citation density rates in different journals from each interdiscipline

According to the findings, citations show similar normalised frequencies in both journals from the same interdisciplines. This similarity is more marked in the two journals from Science & Technology Studies, where a citation density rate of 6.04 was found in *Science*

and Engineering Studies and a rate of 6.47 was calculated in *Science, Technology & Human Values.* In the journals from Economic History, the variation between journals is very low. While a rate of 6.95 citations per 1,000 words was found for *The Journal of Economic History*, in *The Economic History Review* the rate was 8.23. As for Educational Neuroscience, a higher normalised frequency of 12.39 citations per 1,000 words was encountered in *Trends in Neuroscience and Education* when compared with *Mind, Brain & Education* (10.38). As a whole, it might be concluded that there is certain homogeneity between the two journals from each interdiscipline as regards citation density, thus leaving aside any serious concern about journal variability in this particular aspect.

3.3.4 Citation density: Variation across individual articles from interdisciplinary journals

As also pointed out in Chapter 2, the issue of range and dispersion of the linguistic features across individual papers was considered in the interdisciplinary sub-corpora. As regards the distribution of citations, the findings obtained have been summarised in Figure 3.1 below.

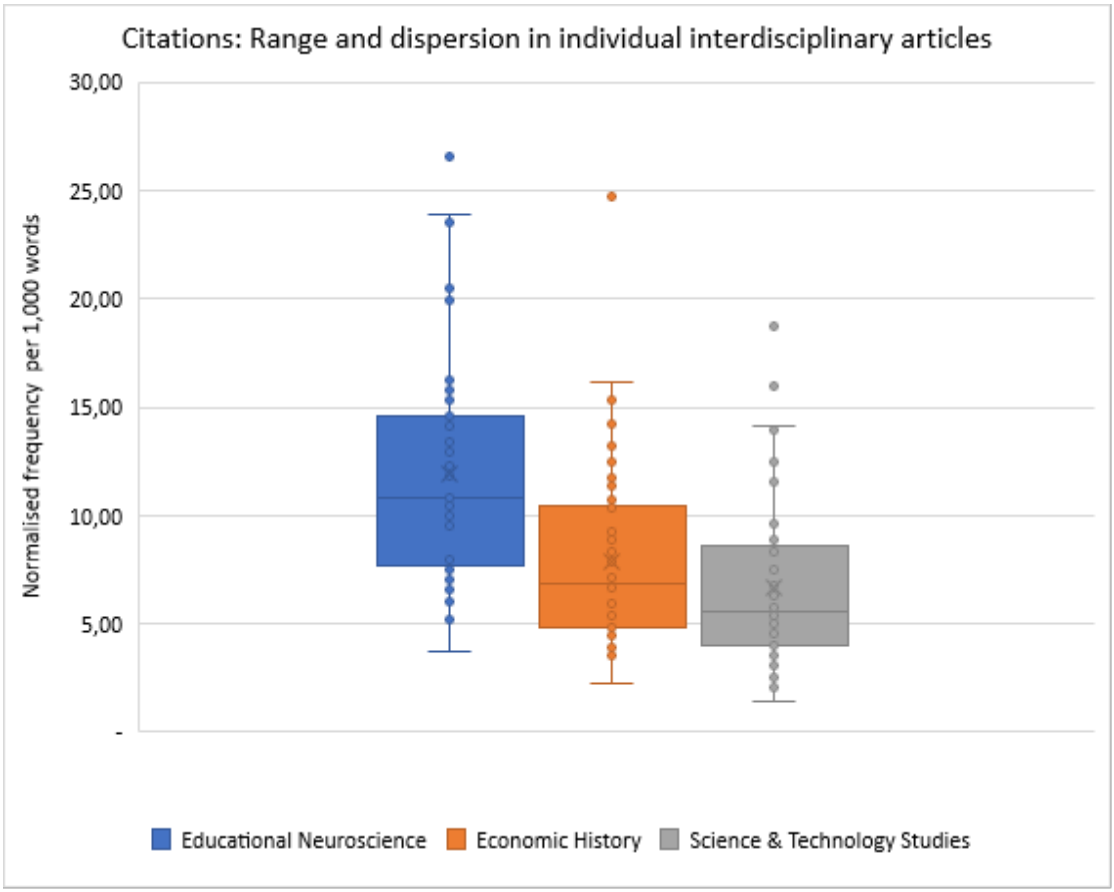


Figure 3.1 Range and dispersion of citations in individual articles from the three interdisciplines

Findings show that the three sub-corpora are more or less uniform as regards the range and dispersion of the frequencies of citations normalised per 1,000 words in each individual article. Nevertheless, some issues need to be acknowledged. First, citations in Educational Neuroscience corpus are more widely dispersed than in the other two corpora. In other words, the Economic History and Science & Technology Studies texts are more uniform as regards the distribution of citations. Second, there are a few cases in the three sets that stand out and are displayed outside the scope of the whiskers as separate data points, which can constitute outliers. However, as they are represented by only 4 texts out of 150, it is likely that the results have not been markedly skewed.

So far, citations have been identified and citation density rates have been calculated for the articles in the whole corpus. Furthermore, the issues of variation across interdisciplinary journals from the same field as well as variation across the individual articles from each interdisciplinary sub-corpus have been considered. It is time now to advance on the testing of the hypothesis coined in Module 2 about *visibility* and *strength* of external sources and *credit* given to previous research on the new corpus, which is bigger and more varied, as already explained.

3.2.3 Visibility of external sources: Integral vs. non-integral citations

In this second stage, as done in Module 2, citations have been classified according to the integral / non-integral types (Swales, 1990) to examine the degree of visibility of the sources. Integral citations are sometimes referred to as "author prominent," while non-integral citations are also called "research prominent" (Feak & Swales, 2009, p. 45).

Integral citations include the cited author(s) within the grammar of the sentence, thus placing prominence on the messenger. Examples (7), (8) and (9) from articles with different style conventions are all cases of integral citations:

(7) Our data provided further empirical evidence for the three sources of vulnerability, as defined by Kelchtermans (2009, 2011): teachers' inability to control essential working conditions, difficulty to prove one's effectiveness as a teacher, and the inevitable uncertainty in their judging and decision-making. [EDU]

(8) A recent study by Christakou et al. [5] investigated the neural maturation that accompanies this. They found that the previously observed age-related decrease in impulsive choices during adolescence was associated with changes in activation in the limbic corticostriatal network in the brain, including the ventromedial prefrontal cortex. [EN]

(9) Lucía Prieto Borrego and Encarnación Barranquero Texeira, who have examined the Republican authorities' establishment of 'popular tribunals' in Malaga, similarly acknowledge that some of the new groups which emerged at the start of the war 'enjoyed a measure of institutional support and a number of them even played a role in the government court system'.[21] [HIS]

In contrast, non-integral citations refer to sources between parentheses, square brackets, or superscript numbers, where the emphasis is placed on the reported message, as in examples (10), (11) and (12).

(10) In a previous study, it is found that the motilin receptor agonist erythromycin can significantly inhibit the mouse hippocampal neurons (Lu et al., 2009). [NEU]

(11) Heat stroke is also an ancient illness dating back more than two thousand years and its pathology has been attributed to the effects of hyperthermia and heat toxicity [3-5]. [BIO]

(12) In particular, some authors depart only partially from the established idea that female-owned businesses were not only smaller than male-owned ones but also traded in traditionally 'feminine' industries and in a semi-invisible way among family and friends, outside the public marketplace.[10] [EH]

Once identified, citations were classified according to the distinctions of both types into integral and non-integral citations. The findings obtained for each set and their respective disciplines and interdisciplines have been summarised in the Tables and Figures that follow:

SET 1	Integral citations	Non-integral citations	Total citations
Neuroscience	152	2,441	2,593
	5.80%	**94.20%**	**100%**
Education	817	2,036	2,853
	28.63%	**71.37%**	**100%**
Educational Neuroscience	466	2,683	3,149
	18.17%	**81.83%**	**100%**

Table 3.5 Frequency of integral/non-integral citations in Set 1: Neuroscience, Education, and Educational Neuroscience

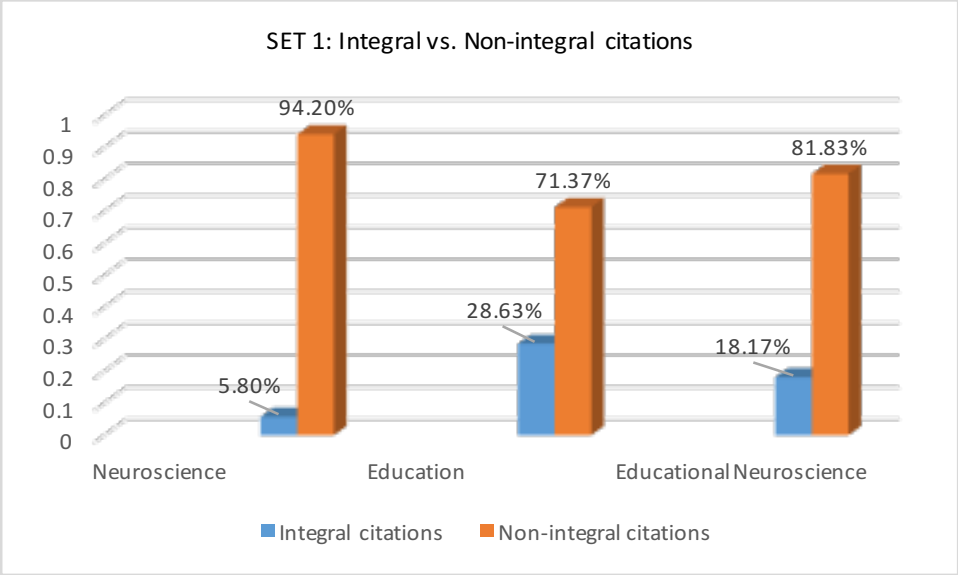


Figure 3.2 Frequency of integral/non-integral citations in Set 1: Neuroscience, Education, and Educational Neuroscience

SET 2	Integral citations	Non-integral citations	Total citations
Economics	1,150	743	1,893
	60.75%	**39.25%**	**100%**
History	935	2,445	3,380
	27.67%	**72.33%**	**100%**
Economic History	975	2,184	3,159
	30.86%	**69.14%**	**100%**

Table 3.6 Frequency of integral/non-integral citations in Set 2: Economics, History, and Economic History

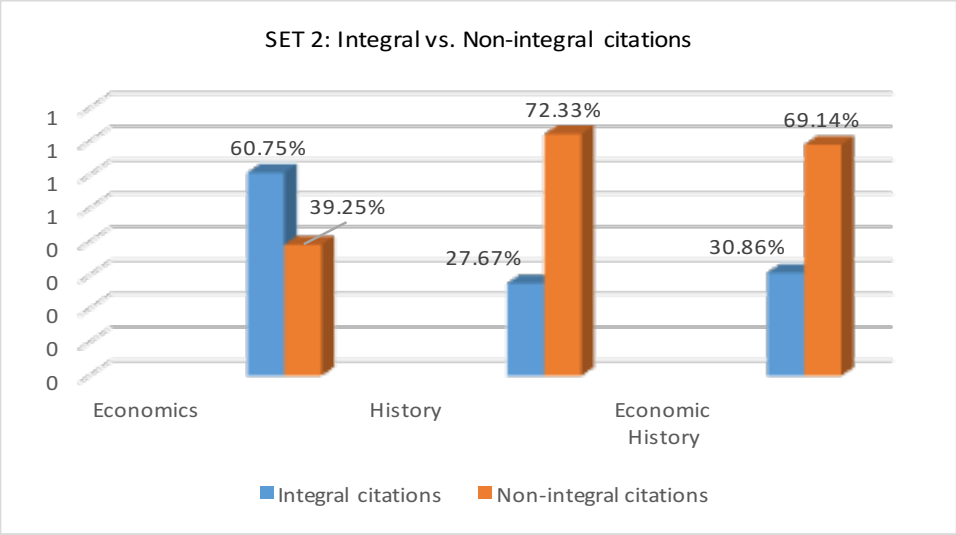


Figure 3.3 Frequency of integral/non-integral citations in Set 2: Economics, History, and Economic History

SET 3 Topic 1	Integral citations	Non-integral citations	Total citations
Ethics	976	774	1,750
	55.77%	**44.23%**	**100%**
Biomedicine	65	367	432
	15.04%	**84.96%**	**100%**
STS (Bioethics)	200	938	1,138
	17.57%	**82.43%**	**100%**

Table 3.7 Frequency of integral/non-integral citations in Set 3 (Topic 1): Ethics, Biomedicine, and Science & Technology Studies

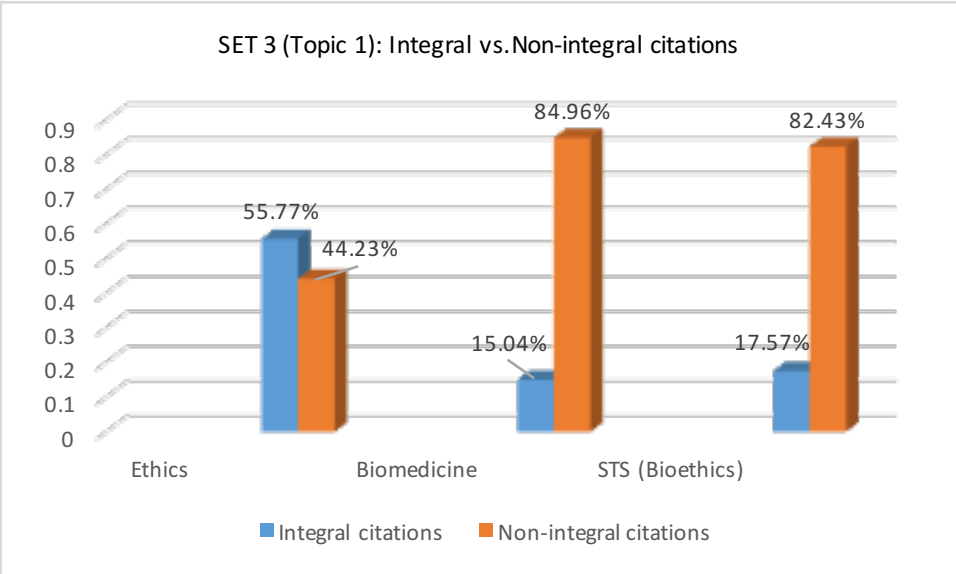


Figure 3.4 Frequency of integral/non-integral citations in Set 3 (Topic 1): Ethics, Biomedicine, and Science & Technology Studies

SET 3 Topic 2	Integral citations	Non-integral citations	Total citations
Ethics	976	774	1,750
	55.77%	**44.23%**	**100%**
Engineering	82	217	299
	27.42%	**72.58%**	**100%**
STS (Engineering Ethics)	321	669	990
	32.43%	**67.57%**	**100%**

Table 3.8 Frequency of integral/non-integral citations in Set 3 (Topic 2): Ethics, Engineering and Science & Technology Studies

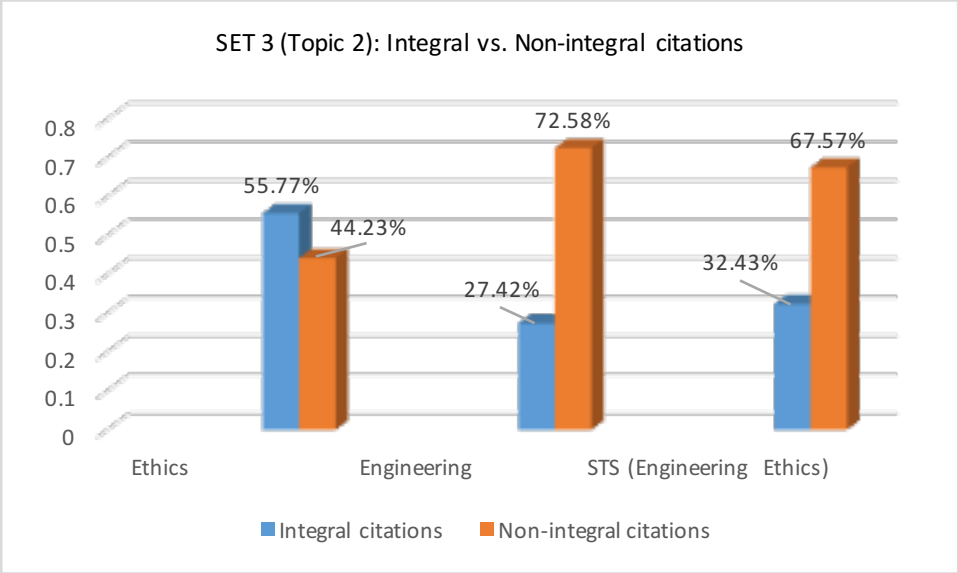


Figure 3.5 Frequency of integral/non-integral citations in Set 3 (Topic 2): Ethics, Engineering, and Science & Technology Studies

The first possible conclusion derived from these findings is that the frequency of integral and non-integral citations in the single-domain disciplines is mostly concurrent with previous research. It has been acknowledged that, although both hard and soft sciences use more non-integral than integral references, there is a greater proportion of integral references in the soft sciences when compared with the hard sciences (Hyland, 2000). In this corpus, indeed, it can be observed that the frequency of integral citations is lower in Neuroscience, Biomedicine and Engineering when compared with the rest of the disciplines. The only exception in Hyland's (2000) study was Philosophy, a humanity, where the frequency of integral citations was higher than non-integral ones. Interestingly, a similar trend is observed in this corpus for Ethics, which is, in fact, a branch of Philosophy.

However, some discrepancies are observed in the fields of Economics and History. In Economics, which is a social science, the frequency of integral references (60.75%) is higher than in History (39.25%), which is a humanity, thereby contradicting not only Hyland's (2000) conclusions but also Hood's (2011) understanding of the existence of a continuum that goes from the least visible end (natural sciences) to the most visible end (humanities) when locating projected sources according to their degree of visibility. However, my finding concurs with Thompson and Tribble (2001, p. 94), who reported that 61.90% of citations were integral and 38.10% were non-integral in their corpus of Agricultural Economics PhD theses. Although there is a difference as regards genre, the coincidence is worth mentioning for the purpose of this study. As for the lower frequency of integral references in History articles in this corpus, a plausible explanation might be that, as pointed out by Bondi (2015,

p. 163), the "basically narrative structure of historical discourse may **reduce the visibility** of argument" (emphasis is mine). As historians present an interpretation of historical facts and argue for their own interpretation, "they do so by bringing in relevant facts and relevant sources and by showing how these facts and sources support their interpretation" (Bondi, 2015, p. 153). My claim is that if there is an emphasis on self-interpretation rather than on attribution to others, those others are brought into the text in less visible ways, that is, by means of non-integral references. Furthermore, Coffin (2009, p. 174) argues that when a source is "assimilated" (the referenced proposition is re-interpreted in the writer's words by paraphrasing and summarizing) and there is a non-integral citation, "the referenced proposition merges so seamlessly into the writer's argument that it resembles text which is entirely in the writer's voice." Coffin (2009) adds that this is particularly the case when footnotes are used for referencing, as in the articles from the History corpus in this study.

It is time now to move to the reporting of the findings for the frequency of integral and non-integral references in the three interdisciplines when compared with their related disciplines in each set. Figures show that in the three cases the frequencies of integral and non-integral citations in the interdisciplines stand in the middle when compared with the single-domain disciplines. This finding is thus in line with the preliminary results reported in Module 2 for the Introduction sections of Educational Neuroscience articles, thus helping to prove the first hypothesis stated before. However, although the values stand in the middle in the three sets, some important differences between each set need to be acknowledged.

In Set 1, the differences between the percentages of integral and non-integral citations across Neuroscience, Education, and Educational Neuroscience are similar (around 10%), thus indicating a balanced influence form each discipline over the interdiscipline. In Set 2, however, the difference is much higher when the percentage of integral and non-integral citations in Economic History is compared with Economics (around 30%) than when compared with History (around 3%). In this case, a clearer resemblance between History and Economic History articles can be observed, thereby showing a greater influence from the humanity. Similarly, in Set 3, the percentages of integral and non-integral citations in Science & Technology Studies stand in the middle between Ethics and Biomedicine and Ethics and Engineering respectively. Again, the difference is much higher when compared with Ethics, which is around 40% in the case of Topic 1 (bioethics issues) and around 20% in the case of Topic 2 (engineering ethics issues), than when compared with Biomedicine (around 2.5%) and Engineering (around 5%) respectively. In this last case, it can be argued that Science &

Technology Studies articles are more similar to Biomedicine and Engineering articles than to Ethics ones, thus showing a greater influence from the hard sciences.

As a preliminary conclusion, it can be acknowledged that as regards the degree of visibility of external sources according to the frequency of integral and non-integral citations, there is a tendency for interdisciplinary writing to be located in the middle of the two mono-disciplinary fields. Yet, the differences encountered between a more or less marked influence from each single-domain discipline deserves special attention. More specifically, it would be interesting to explore how other interdisciplinary fields involving humanities interact with fields of a different nature. As shown in this study, when a humanity (History) interacts with a social science (Economics), the interdiscipline is more similar to the humanity. On the other hand, when a humanity (Ethics) interacts with a hard science (Biomedicine or Engineering), the interdiscipline resembles the latter more. These different ways in which disciplinary features interact when conforming interdisciplinary fields might be enriched by means of complementary dimensions when describing the degree of visibility of the sources. For example, the analysis of the *nature of the source* (Coffin, 2009) might add useful information as regards different degrees of personalisation and identification of the cited sources. Although this analysis was carried out in Module 2, it will not be replicated here mainly due to length restrictions.

3.2.4 Strength given to external sources: Attributed vs. averred citations

Averral and *attribution* are basic notions for the organisation of interaction in a written text (Tadros, 1993, p. 100). As put by Hunston (2004, p 16, following Sinclair, 1988), "an attributed statement is essentially one that is said to belong to someone other than the current writer," while an averred statement "is made by the current writer." Thus, averral is the "default condition" of a written text (Tadros, 1993, p. 101) in that "it identifies, and is thus identified with, the textual voice of the writer herself or himself." Attribution, as stated by Thompson (2012, p. 121) is "the use of manifest intertextual markers (usually citations) to acknowledge an antecedent authorial voice." Attribution, Hunston (2004, p. 19) concludes, is a way in which "voices other than the writer's are brought into a text and manipulated by the writer." Finally, although these two conditions are in a certain sense oppositional, evaluation may be expressed just as much through attribution as through averral (Hunston, 2000), and it is often the interplay or weaving of the two which allows the writer to gain position.

In Module 2, and based on the consideration that "attribution involves both the writer's voice and that of the attribute," and that "the **writer's voice** is **stronger** where the attribution **is not** expressed through a *that*-clause" (emphasis is mine) (Hunston, 2011, p. 38), I coined the idea that the **external author's voice** is **stronger** where the attribution **is** expressed through a *that*-clause. Consequently, the external author's voice might become less strong when other markers of attribution are used (for example *according to, as, for*, etc.) and even weaker in cases in which citations are part of averred statements. It is clear then that when I refer to *strength* as a parameter of analysis, I am referring to the strength of the author's voice, which is stronger in a citation that introduces an attributed proposition and weaker in a citation which is embedded in an averred statement. Thus, according to this view, the strength of the external author's voice is shown as a syntactic property. Examples (13), (14), (15) and (16) show all cases of *attribution through citation.* In other words, in all the cases a proposition has been attributed to an external source:

(13) Reifel (1984) suggests that blocks allow children to play directly with spatial concepts, which in turn could assist their developing representations of spatial relationships between objects in the physical world (e.g., into, out, together, on top, beside, etc.). [EN]

(14) As pointed out by LaFallotte (2007), moral habits are of critical importance to moral practice as they are often influenced by rich interactions with the social environment and are exhibited in overt behavior in a variety of circumstances. [STS]

(15) According to historian Vijay Prashad, this cooperation aimed to work against what many delegates viewed as the 'indignity of imperialism's cultural chauvinism'.[46] [HIS]

(16) For Vaughan (1996), the answer lies in the strength and obduracy that the engineers' own culture developed as their prior decisions about acceptable risk became alienated from their own control and established themselves within NASA culture as a whole. [STS]

As for *averral through citation*, or *averred sources*, the examples below show different cases. For instance, in example (17) "while the evidence for the truth value of the statement is attributed to the other, the voice of the text is that of the writer" (Thompson, 2005, p. 36), since it is the writer who has interpreted the propositions. This phenomenon has been also called "sourced averral" (Hunston, 2000, p. 192) and its use is meant basically to acknowledge the identification of the external source:

(17) Allopregnanolone is one of the most potent and efficacious positive allosteric modulators of GABA receptor function (Majewska, 1992; Lambert et al., 1995), and its administration induces marked anxiolytic effects in animals (Majewska, 1992; Bitran et al., 1995). [NEU]

In example (18), the citation is attached to "a summary or interpretation of what other researchers found" (Thompson, 2005, p. 37) and it is clear that the cited authors are not responsible for the proposition because it is the writer who is responsible for the summary:

(18) There are several studies that examine the role of human capital in context of the Industrial Revolution since the seminal work of David Mitch (1999, 2004) and Lars G. Sandberg (1979) showed the relative unimportance of traditionally measured human capital (i.e., formal schooling and literacy). [EH]

There are other cases in which the source of the citation is accompanied by a reporting verb that describes a research process, as in example (19). In these cases, there is a summary or retelling of what the other authors did and, again, it is the writer who is responsible for that summary or interpretation:

(19) Authors in [6] used CNN with pre trained models. Authors in [7][8] used 3d CNN rather 2d CNN to detect Alzheimer's disease. Authors in [9] used CNN architecture to brain identified graph detected from MRI DTI (diffusion tensor imaging). [ENG]

Following these considerations for the identification of attributed or averred sources, in Module 2 every occurring citation was classified into cases of attribution through citations (without differentiating between different grammatical structures) or averral through citations (without differentiating between different types). The main preliminary finding was that external authors' voices in the Introduction sections of the Educational Neuroscience articles are slightly stronger than in both single-domain disciplines because of a higher percentage of cases of attributed sources over averred ones. The same procedure has been replicated in this study and the findings obtained for each set of disciplines and interdisciplines have been summarised in the following Tables and Figures:

SET 1	Averral	Attribution	Total citations
Neuroscience	2,127	466	2,593
	82.03%	**17.97%**	**100%**
Education	2,467	386	2,853
	86.47%	**13.53%**	**100%**
Educational Neuroscience	2,701	448	3,149
	85.78%	**14.22%**	**100%**

Table 3.9 Frequency of attributed/averred citations in Set 1: Neuroscience, Education, and Educational Neuroscience

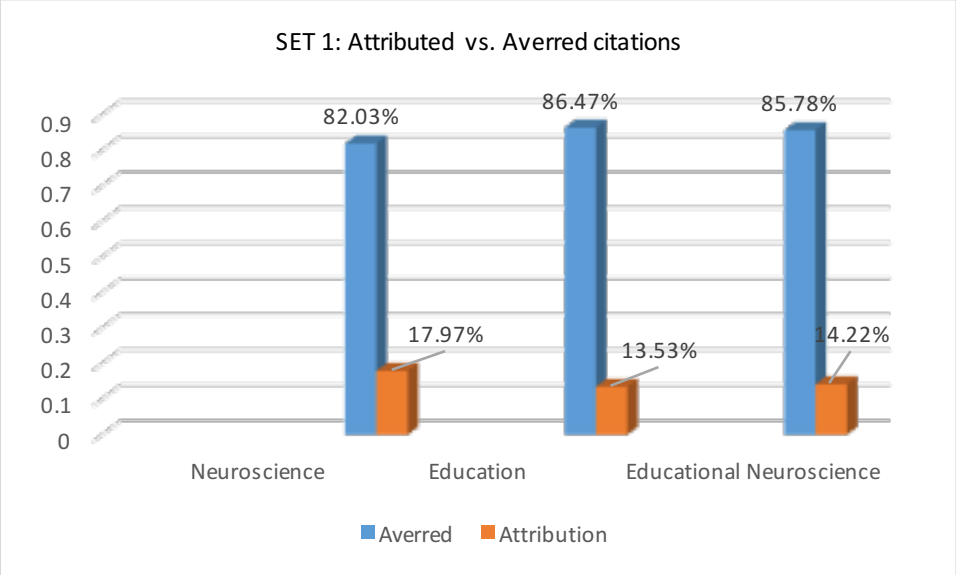


Figure 3.6 Frequency of attributed/averred citations in Set 1: Neuroscience, Education, and Educational Neuroscience

SET 2	Averral	Atribution	Total citations
Economics	1,640	253	1,893
	86.64%	**13.36%**	**100%**
History	2,040	1,340	3,380
	60.35%	**39.65%**	**100%**
Economic History	2,623	536	3,159
	83.03%	**16.97%**	**100%**

Table 3.10 Frequency of attributed/averred citations in Set 2: Economics, History, and Economic History

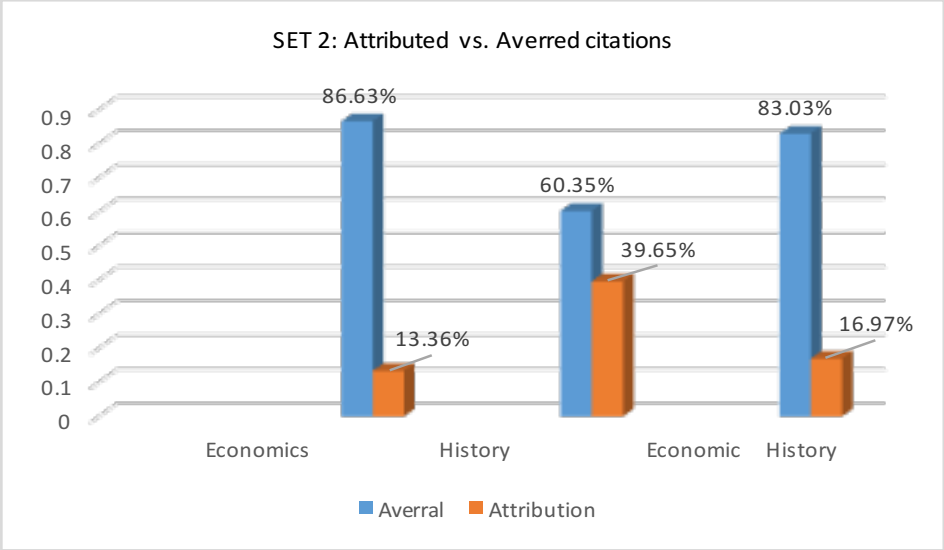


Figure 3.7 Frequency of attributed/averred citations in Set 2: Economics, History, and Economic History

SET 3 Topic 1	Averral	Atribution	Total citations
Ethics	976	774	1,750
	55.77%	**44.23%**	**100%**
Biomedicine	342	90	432
	79.17%	**20.83%**	**100%**
STS (Bioethics)	855	283	1,138
	75.13%	**24.87%**	**100%**

Table 3.11 Frequency of attributed/averred citations in Set 3 (Topic 1): Ethics, Biomedicine and Science & Technology Studies

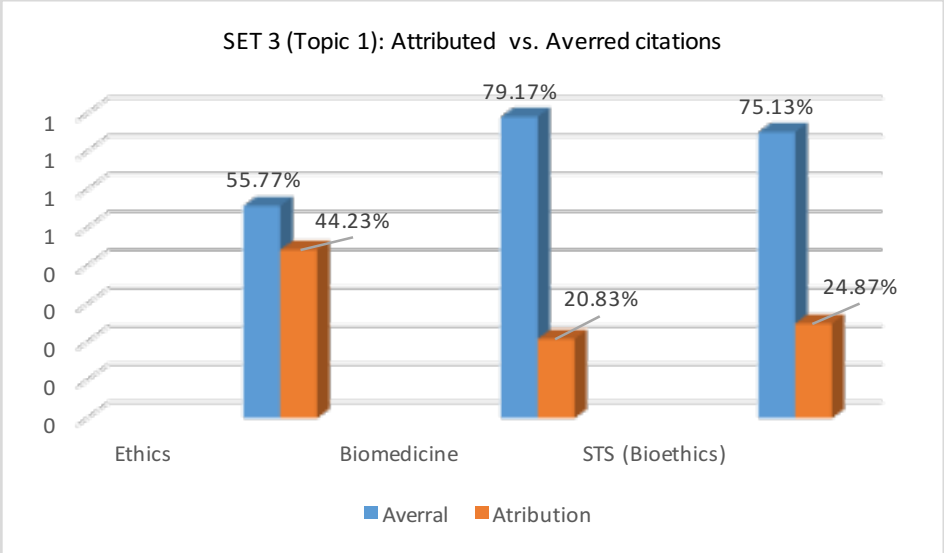


Figure 3.8 Frequency of attributed/averred citations in Set 3 (Topic 1): Ethics, Biomedicine and Science & Technology Studies

SET 3 Topic 2	Averral	Atribution	Total citations
Ethics	976	774	1,750
	55.77%	**44.23%**	**100%**
Engineering	266	33	299
	88.97%	**11.03%**	**100%**
STS (Engineering Ethics)	692	298	990
	69.90%	**30.10%**	**100%**

Table 3.12 Frequency of attributed/averred citations in Set 3 (Topic 2): Ethics, Engineering and Science & Technology Studies

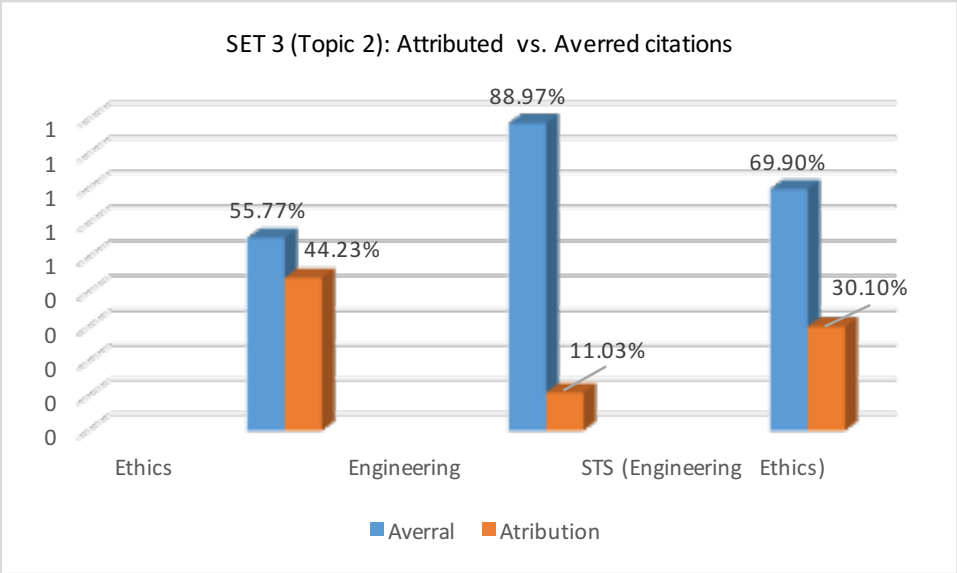


Figure 3.9 Frequency of attributed/averred citations in Set 3 (Topic 2): Ethics, Engineering and Science & Technology Studies

No previous research on the frequency of averred and attributed citations in academic disciplines, to my knowledge, has been carried out in order to provide some parameters of comparison with the frequencies encountered for the single-domain disciplines in this study. Because of that, I will focus on the analysis of the interdisciplines in comparison with them.

Results indicate that, contrary to what the second hypothesis derived from Module 2 suggested, external voices do not seem to be always stronger in interdisciplinary writing, since the percentage of attributed sources was not always higher in the interidisciplines when compared with their related disciplines. Once again, what was found is that in the three disciplinary sets the percentages of attributed and averred sources stand in the middle when compared with the single-domain disciplines. However, those differences are more or less marked depending on the case. As regards Set 1, differences are minimal, although a slightly

closer resemblance between percentages of occurrence in Educational Neuroscience and Education can be perceived, thus showing a greater influence from the latter discipline over the interdiscipline. In the case of Set 2, differences are more marked but it is also clear that the frequency of attributed and averred citations is more similar between Economic History and Economics, which shows a greater influence from the social science than from the humanity contrarily to what had occurred when the visibility of the sources was analysed. As for the analysis of Set 3, although the cases of attributed citations in Science & Technology Studies are more frequent than in Biology and Engineering articles respectively, these are much less frequent than in Ethics articles. This time again a more marked similarity between Science & Technology Studies and Engineering, and Science & Technology Studies and Biomedicine especially, can be acknowledged, thus showing a greater influence from the hard sciences, as occurred when the parameter of visibility was studied.

As a summary, the analysis of the frequency of cases of attribution with citations and averral with citations suggests that when a humanity (Ethics) is combined with a hard science (Biomedicine or Engineering), the interdiscipline is more similar to the hard disciplines. However, when the humanity (History) is combined with a social science (Economics), the resulting interdiscipline resembles the social science more. As stated for the analysis of the degree of visibility of the sources, complementary studies on other interdisciplinary fields in which humanities are combined with other disciplines need to be carried out to explore this interesting interaction.

3.2.5 Credit given to previous research

In Module 2, both averred and attributed citations were analysed so as to find out the amount of credit given to previous research in the Introduction sections of Neuroscience, Education, and Educational Neuroscience articles. In that occasion, when the attributed citations were studied the concept of *writer stance* (Coffin, 2009) towards attributed propositions was applied so as to identify four different types: *endorse*, *acknowledge*, *distance* and *contest*. Then, for instance, it was suggested that an endorse stance gives more credit to the attributed proposition and thus to the external author and his/her research because his/her words, assumptions or views are presented as true and authoritative. On the contrary, it was suggested that a contest stance gives less credit to the external author's words or assumptions because they are negatively critiqued or rejected. When propositions were not attributed but averred, as I have explained in the previous section, several cases might occur: they can be employed to summarise a research processes or procedure carried out by other researchers, to

summarise or interpret other researchers' findings or claims, or just to identify the origin of the source. Then, Hyland's (2002) notion of *communicative risk involvement* was used in order to classify all the averred cases according to the credit given to the previous research they report. It was suggested that, for example, when writers introduce averred sources to summarise other authors' findings or claims they give more credit to what the authors found than to what the authors did because the communicative risk involved is higher. On the other hand, when writers introduce averred sources to explain a research process that other authors carried out, the communicative risk they invest is lower because they give more credit to what the authors did than to what the authors found.

Unfortunately, it is evident that such a detailed and meticulous analysis is not possible to be carried out in this study due to the much bigger size of the corpus and the high number of citations identified. Such analysis would mean to manually scrutinise every single citation in the light of the proposed categories for both, averred and attributed sources. Thereby, the third hypothesis suggesting that in interdisciplinary articles previous research is given more credit than in the single-domain disciplines could not be tested by replicating the same model, what constitutes an interesting avenue for future research.

So far, the relevance of the previously established hypotheses has been explored in each disciplinary set to analyse the possible influence of the single-domain disciplines over the interdisciplines. In the following sections of the chapter, however, only the interdisciplinary fields will be examined through a more detailed study of citations. This analysis aims at addressing the second purpose of this chapter: to compare the use of citations in the three interdisciplinary fields in order to report possible differences between them as well as to describe different types of interdisciplinarity. However, it is important to highlight that due precisely to the nature of this much bigger and varied corpus and the high frequency of citations identified, some methodological decisions had to be made. More specifically, the scope has been reduced to the analysis of the phenomenon of *attribution through citation* only, which is represented by 1,565 citation tokens in the three interdisciplinary fields. Thereby, all the cases of *averred citations* in the same fields, which comprise 6,871 citation tokens, were not included in this analysis.

3.3 Attribution through citations in interdisciplinary writing

As pointed out by Hunston (2011, p. 33) "one of the key modifiers of the status of a proposition is its attribution by the writer to another speaker." However, although attribution always modifies status, this might occur in different ways: it can depend on the grammatical

structure employed, on the verb or noun used, or on the source type (Hunston, 2011). A variety of grammatical structures have been identified as commonly used in attribution, such as *that*-clauses, structures with *as*, reporting phrases like *according to*, etc. (Hunston, 2011). When studying citations, these different grammatical resources help to distinguish "how external authors are referred to syntactically" (Hyland, 2018, p. 25). In addition, the specific noun or verb chosen affects status in the sense that although "attribution itself devolves responsibility for the proposition, the choice of verb or noun allows the writer either to reclaim that responsibility or to distance him/herself still further" (Hunston, 2011, p. 38). This matter of responsibility of the other researcher as source (Hunston, 2000) might be also affected depending on "text integration" (Coffin, 2009) issues, that is, depending on the way in which the attributed proposition is incorporated into the text. Finally, how the attributed source is represented in the text also modifies status.

Based on these considerations, three aspects will be analysed in this study of attribution across the three interdisciplines: the types of grammatical structures, the processes of textual integration, and the choices of reporting verbs. Unfortunately, and due mainly to length restrictions, the types of sources, that is, whether they are human (*Author's last name found that…*), not-human (*Recent studies suggest that…)* etc., will not be considered in the analysis.

It is important to highlight that while for the first two aspects, that is, the type of structure used and the process of textual integration followed, grammar choices are at stake, lexical choices play a role for the selection of reporting verbs. However, it is the interaction between both, grammar and lexis, which demonstrates the contribution of language choices, since both are essential in order to achieve different meanings. For the writer, as pointed out by Hunston (2013, p. 635) "each choice is an independent one, driven by the immediate needs of the text." Triggered by the benefits of a corpus-based approach, the differences in frequency that can be encountered across the three interdisciplinary fields might help to indicate that "some configurations of grammar and lexis are more likely to co-occur than others" (Hunston, 2013, p. 635). This kind of analysis, finally, might turn useful to the interpretation of distinct choices in terms of differences in the epistemological nature of each interdisciplinary field in comparison with the others.

3.3.1 Grammatical structures

Hunston (2011, p. 38) proposes a set of grammatical structures typically occurring in cases of attribution, which have been also investigated by Murphy (2005), among others. Most of

them have been encountered in the present corpus, which I have firstly grouped into three sets:

1) **The '*that*-clause' group**: a verb followed by a *that*-clause (*X states that…*), a noun followed by a *that*-clause (*There is evidence that…*), and introductory *it* passive *that*-clause (*It has been shown that*), or an 'implicit' passive *that*-clause (*… has been shown to…*).
2) **The '*as*' group**: a verb with *as* (*as X suggests* or *as suggested by X*), or a verb followed by a noun phrase and a prepositional phrase with *as* (*X describes something as*).
3) **The 'reporting phrases' group**: typical reporting structures like *according to X*, *for X*, or *in X's words.*

1. The '*that*-clause' group

This type of reporting structure, studied in detail by Charles (2006) and Swales (2014), among others, allows for the presence of three main cases: a reporting verb followed by a *that*-clause, as in example (20); a noun followed by a *that*-clause, as in example (21); and an introductory *it* passive structure followed by a *that*-clause, as in example (22):

(20) Indeed, Walter Scheidel (2012a, p. 11) has argued that "Perhaps the biggest unacknowledged question of Roman economic history is whether population pressure was already mounting before the imperial power structure started to unravel or whether the epidemics of the second and third centuries provided temporary relief." [EH]

(21) There is also evidence that the serotonergic system is also involved in EFs, in part by influencing the activity of the dopaminergic system (Reuter, Ott, Vaitl, & Henning, 2007). [EN]

(22) It has been shown repeatedly that by age 3, children begin to learn as well from video presentations as from live presentations in word learning, action imitation, and object search tasks [9,18,20]. [EN]

Another type of passive structure has been found, also acknowledged by Shaw (1992), whose grammatical meaning might implicitly equal a *that*-clause. In these cases, although no *that*-clause explicitly occurs, its implicit meaning does, as in the following examples:

(23) Number line estimation performance was found to be associated with arithmetic performance and learning repeatedly [16,5]. [EN]

(24) Mind wandering has been shown to reduce after mindfulness practice in adults [15]. [EN]

These examples can be mentally rephrased, without its meaning being changed, into sentences like: (23) *It was found that number line estimation performance is associated with* (…); or (24) *It has been shown that mind wandering reduces after mindfulness practice* (…). When this mental process is possible, it might be stated that we are in the presence of attribution cases.

2. The '*as*' group:

Two different cases are included here. The first case occurs when *as* precedes a finite or non-finite clause, whether in active or passive voice, as in the following examples:

(25) As Hansson (2007, p. 265) states, "There is a risk that users will feel that they are controlled by this technology, rather than using it themselves to control their surroundings." [STS]

(26) However, as suggested by Neville Francis and Valerie Ramey (2005), non-technology stocks such as capital tax changes might be mislabeled as technology shocks under the Galí methodology, because they too could have permanent effects on labor productivity. [EH]

A second case occurs when a verb is followed by a noun phrase indicating the topic and a propositional phrase beginning with *as*:

(27) Engineering educator P. Aarne Vesilind (1998, p. 290) defines ethics as "the study of systematic methodologies which, when guided by individual moral values, can be useful in making value-laden decisions". [STS]

(28) Similarly, Stovall (2011, p. 110) saw reflexivity as a sort of master virtue that fosters the reflective deliberation necessary for a professional to pursue their work in an aspirational frame of mind. [STS]

3. The 'reporting phrases' group:

In this group typical reporting structures like *according to X, for X,* or *in X's words* are encountered. The common feature they share is that although it is clear that they are used to

attribute somebody else's words or thoughts, no verb is used, because the phrases are semantically attributive on their own.

As regards *according to X*, this typical reporting structure has been found throughout the corpus in different cases: as part of an integral citation with a human source, as in example (29) or with an abstract-human source, as in example (30); or as part of a non-integral citation making reference to a non-human source, as in example (31).

(29) According to Harris, "moral paternalism refers to protection of individuals from 'corruption,' moral wickedness, or degradation of a person's character" (1977, 85). [STS]

(30) According to Estes et al.'s review [14], although formal education appears to discourage thematic thinking this relationship may vary across cultures. [EN]

(31) According to recent evidence [29], functional features might even be privileged in biological kind classification. [EH]

The expression *for X* is not a very frequent reporting structure in the corpus. When found, it was part of an integral citation, as in example (32) or a non-integral one, as in example (33):

(32) For Adam Smith and David Ricardo, landownership could be taxed with no effect on productive incentives. [5] [EH]

(33) For authors in these traditions, human relationality is a precondition for subjectivity, not the other way around (Taylor, 1985; Taylor, 1989; Mackenzie and Stoljar, 2000). [STS]

Finally, the expressions *in X's words* or *in the words of X* are not very frequent reporting structures and can be present in two different ways according to the type of possessive construction used: by using a genitive *'s* as in example (34) or by using the preposition *of*, as in example (35). Typically, these structures are commonly used when a direct quotation is introduced.

(34) In Clark's words, "did the institutions create the trade in medieval Europe or did trade possibilities create their own institutions?" [62] [EH]

(35) In the words of Temin (2013, p. 236), "The question therefore is not whether Malthusian constraints were present, but rather what changes in Roman times led to growth within these constraints and how far growth went." [EH]

Although the described three groups count for most of the grammatical structures used for attribution in the corpus, it is important to point out that other cases of attribution, particularly those conveyed by direct quotations, might not always occur as part of the presented types. In other words, if there is a direct quotation, there is always attribution, as pointed out by Thompson (2005, p. 38). Furthermore, direct quotations might be part of *that*-clauses, as in example (20), phrases with *as*, as in examples (25) and (27), or introduced by reporting phrases, as in examples (29, (34) or (35). However, there are still some other cases in which direct quotations do not fit in any of these grammatical resources described. For the purpose of this section, I have included them within a fourth group: the **'direct quotation'** group.

4. The 'direct quotation' group

Three different variants have been identified within this group from the cases encountered in the corpus. The first variant is typical of cases showing what from a SFL perspective might be called "projection" (Halliday 1994, p, 250-272) achieved through a "paratactic clause," in which the level of the proposition is "free-standing" (Hunston, 2013, p. 625). Important for the purpose of this section, there is a clear syntactic role of the cited author as a subject, as these examples show:

(36) Gerald Gaus (2005, p. 33) writes: "although we may be able to obtain knowledge of abstract principles of right, particular judgments and specific issues involve conflicting principles, and [thus] it is exceedingly difficult to provide answers to these questions that have any claim to being clear and definitive." [STS]

(37) Thompson (2013, 64) sums this up: "putting these regulations into action, then, is first and foremost about enabling research in an environment of ethical controversy, and not about ethical inquiry." [STS]

(38) Herlihy further generalizes: "the highly skewed distribution of wealth in the fifteenth-century was a comparatively new development, and (...) wealth had been somewhat more evenly distributed across the population in the thirteenth century, before the onslaught of the great epidemics" (Herlihy 1978, p. 139). [EH]

The second variant is illustrated by cases in which, if it was not for the presence of the quotation marks, averral through citation would be the case. In other words, there is not an attributed proposition; rather, the proposition is averred by the current writer. However, attribution exists because there is a direct quotation:

(39) In a very similar vein, Rhodes (2009, 667) proposed an "ethical response to reflexivity that asks questions rather than provides answers; that refuses the hubris of generalizations; that provokes thinking rather than provides answers; that generates possibilities rather than prescriptions; that seeks openness rather than closure." [STS]

(40) Harris, Pritchard, and Rabins (1995, 68-76) speak about "impediments to responsibility," spending the least amount of discussion on ignorance, which is attributed to either "willful avoidance" or "a lack of persistence." [STS]

(41) One author refers to "possible mating discrimination" (Kavka 1994, 178). [STS]

(42) She uses the term to describe "a massive demand for but selective access to a form of social welfare based on medical, scientific, and legal criteria that both acknowledge biological injury and compensate for it" (Petryna, 2002, p. 6). [STS]

If a name should be given for those cases, I would suggest the label *quoted averral*. In a sense, cases like this would fit into the grey area that Murphy (2005, p. 132) has called "middle ground between averral and attribution." As for the syntactic role of the cited author, it can be explicitly shown as part of an integral citation, as in the first two examples, or of a non-integral one, as in the last two.

The case for the third variant is different. I am specifically referring to cases where direct quotations are part of non-integral citations embedded within the main narrative of the text. The only linguistic resource employed to show attribution is the use of the quotation marks and the cited author is given no syntactic role at all. I have labelled those cases as *plain direct quotations*.

(43) However, some parts of northern Europe were slow in doing so. England, in particular, "was unlike many other European countries in having no public precautions against plague at all before 1518" (Slack 1985, p. 201). [EH]

(44) Domestically, officials saw themselves engaged in an effort to persuade "the masses to internalize appropriate values" (Garon 1997, p. 7). [EH]

(45) This subject is the liberal, rational human at the core of human rights law, the "abstract individual equal to and indistinguishable from other abstract individuals" (Collier, Maure, and Suárez-Navaz, 1995, p. 5). [STS]

It is important to point out that although the three variants have been placed within the same group, because they are all cases in which direct quotations do not fit the main grammatical categories proposed for attribution, they will be reported separately. On the one hand, the *paratactic* and the *quoted averred* citations will be grouped together under the label *author DQ* (abbreviation for author's direct quotation) because the cited author performs an explicit syntactic role within the sentence. The *plain direct quotations* (plain DQ), on the other, will be reported separately, since no syntactic role at all is given to the cited author. To conclude, after each of the 1,565 cases of attribution through citations were classified according to the categories proposed above, their distribution across the interdisciplinary sub-corpora was calculated.

		That clauses	*As* clauses	Reporting phrases	Author DQ	Plain DQ	Total Attribution
Educational Neuroscience	*number of tokens*	413	19	12	2	2	448
	percentage (%)	92.19%	4.25%	2.68%	0.44%	0.44%	100%
Economic History	*number of tokens*	376	60	41	31	28	536
	percentage (%)	70.15%	11.21%	7.64%	5.69%	5.22%	100%
Science & Technology Studies	*number of tokens*	288	84	46	74	89	581
	percentage (%)	49.57%	14.47%	7.91%	12.73%	15.32%	100%

Table 3.13 Frequency of grammatical structures used for attribution in the three interdisciplines

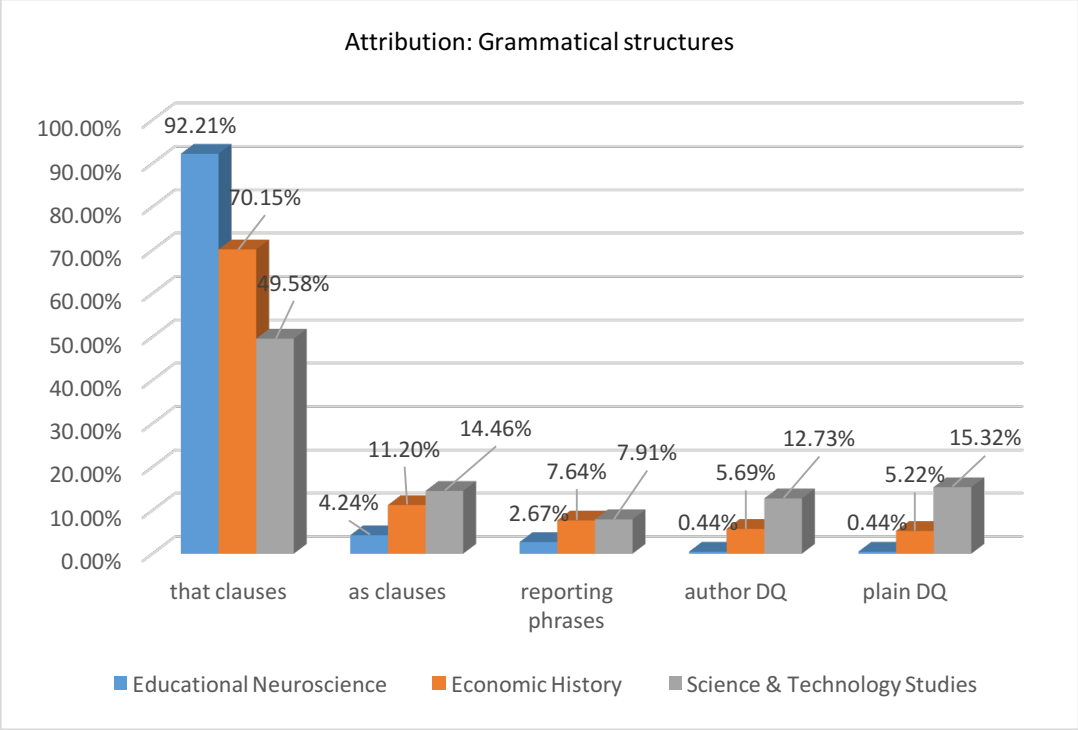


Figure 3.10 Frequency of grammatical structures used for attribution in the three interdisciplines

Findings show that there is a clear preference for the use of *-that* clauses in the three corpora. This is not surprising, since it has been already acknowledged that this is "the most frequent phraseological pattern used in citations" (Charles, 2006, p. 331). However, differences between the disciplines have been found. In Educational Neuroscience, the frequency of use of *that*-clauses (92.19%) is higher than in Economic History (70.15%) and much higher than in Science & Technology Studies (49.57%). According to previous cross-disciplinary research, *that*-clauses are more frequent in the hard sciences than in the social sciences (Charles, 2006; Hyland, 2000). The use of the following structure, i.e., structures with *as*, shows the opposite trend: in Science & Technology Studies, the frequency is higher (14.47%) when compared with Economic History (11.25%) and Educational Neuroscience (4.25%). The difference between both structures and the effects they create on the text can be explained by considering their grammatical status.

(46) Santoni de Sio et al. (2014) claim that the possibility of different descriptions of a given activity may be relevant for understanding the impact of performance-enhancing technologies on the nature of care activities. [STS]

(47) Vallor (2011) describes care activities as a platform for the development of necessary care skills as well as skills for becoming an empathic human being. [STS].

In the first example, what is grammatically the main clause (*Santoni de Sio et el. (2014) claim that*) acts as a modification of the *that*-clause, thus modifying the status of the proposition therein (*the possibility of different descriptions of a given activity…).* As a result, as Hunston (2011, p. 38) explains, the writer's own voice is subordinated to that of *Santoni de Sio* and his colleagues and might be overlooked completely. However, when *as* phrases are used, as in the second example, the writer's voice as an interpreter of Vallor's ideas is much stronger. Here we can go back to the idea that "the writer's voice is stronger where the attribution is not expressed through a *that*-clause" (Hunston, 2011, p. 38). Thus, the findings reported here indicate that in Educational Neuroscience there is a more marked tendency for writers to subordinate their voices to the cited authors when compared with Economic History and even more markedly when compared with Science and Technology Studies given by the higher number of *that*-clauses encountered. Needless to say, this analysis would be richer if treated in complementation with the distinction of different syntactic roles given to the cited authors: whether as syntactic subjects (human or non-human) or as part of passive constructions, depending on decisions about how much prominence is given to them (Thompson & Tribble, 2001), which has not been carried out in this study. Finally, as regards the use of "adjuncts of reporting" (Swales, 1990 p. 148) like *according to* or similar phrases, a similar same trend is observed: these are used almost in the same proportions in Science & Technology Studies (7.91%) and in Economic History (7.64%), but the frequency is lower in Educational Neuroscience (2.68%).

When the cases of direct quotation that do not fit any of the grammatical structures which are commonly used for attribution are analysed, whether the cited author is given a syntactic role or not, the opposite trend is observed. These cases are more frequent in Science & Technology Studies (28.05%) in comparison with Economic History (10.91%), and they even more markedly frequent in comparison with Educational Neuroscience (0.88%). This time, it is not the grammatical status of the proposition what counts but, rather, the "degree of mediation on the part of the writer" (Hunston, 2013, p. 213). Thus, it can be stated that propositions expressed through direct quotations are the least mediated, thus leading to the representation of the cited author's voice as the most explicit (Fløttum et al., 2006):

(48) In reality, Dewey says: "Steam and electricity have done more to alter the conditions under which men associate together than all the agencies which affected human relationships before our time" (Dewey 1954, 323). Dewey argues that these new technologies have contributed more to the establishment of democratic forms of government than the theories of the utilitarians did. [STS]

The mediation of the writer is clearly less in *Dewey says: "Steam and electricity…*" (a case of paratactic construction which usually introduces direct citations) than in *Dewey argues that,* where the writer has decided to subordinate his own voice to that of Dewey. Furthermore, as expressed by Fløttum et al. (2006), when another author is quoted, the writer directly transfers "complete responsibility for the reported sentence," that is responsibility of content but also of form, as in the first sentence. In the second sentence, the writer also transfers responsibility of content to the author; however, responsibility of form is mediated. As a result, the degree of explicitness of the cited author's voice is affected.

The findings obtained in the corpus might count for a tendency in Science &Technology Studies to make the cited author's voices more explicit and their propositions less mediated by the writers when compared with Economic History and in a higher proportion when compared with Educational Neuroscience. As regards giving a prominent syntactic role to the cited author or not, the same trend is observed given by the frequency of plain quotations encountered. In the following section, a complete analysis of the textual integration of sources follows, in which all the cases, regardless of the grammatical structure in which they are embedded, are studied according to the way in which they are incorporated into the text.

3.3.2 Textual integration of sources

This dimension of the study of citations has been investigated by several scholars, who have given different names for more or less similar phenomena. Hyland (2000), for example, explored different ways in which source material could be incorporated into the writer's argument and distinguished between *short quotes* (up to six or eight words) *blocks* (extensive use of original wording as indented blocks), *summary* (from a single source) and *generalizations* (where material is ascribed to two or more authors) (Hyland, 2000, p. 26). Before him, Swales (1986, p. 50) used the terms *short* and *extensive* to describe citations that are at a single sentence level, or those that encompass more than one sentence, although he did not differentiate between quotations and paraphrase or summary. Thus, a long quotation or a long paraphrase would both be considered extensive in Swales' system.

More recently, Coffin (2009), based on White (2003), explored the way in which sources are integrated into the text according to different degrees of *textual integration* to find out whether the original utterance is directly quoted or reworded. Coffin (2009) presented three cases: *insertion*, when the writer directly quotes a source; *assimilation*, when the writer rewords the referenced proposition by paraphrasing and summarising; and *insertion +*

assimilation, which involves a combination of rewording and direct quotation.

For the purpose of this work, however, I prefer to use the framework introduced by Borg (2000), which has been also applied by Petrić (2012). It is important to make clear that especial attention will be placed upon the linguistic mechanisms of direct quotation rather than upon the analysis of summary and paraphrasing cases, mainly due to the fact that for the latter to be complete, a detailed study of the different rhetorical functions they perform in the text should be included.

Borg (2000, p. 8) proposed a taxonomy of four types of citations: *extended*, *brief*, *fragment*, or *paraphrase/summary*. All citations, except paraphrase/summary, are direct quotations. In other words, if a citation contains quotation marks, it is considered a direct quotation, whether extended, brief or fragment; if it is not, it is considered a paraphrased/summary citation.

1. **Extended quotation**: An extended quotation is longer than forty words (Borg, 2000) and is typically formatted as a block quotation (Petrić, 2012), as in the following example:

(49) Finally, even if the IETF were to gain the legitimacy necessary to protect human rights, and decided to enable these through Internet standards and protocols, there is a real risk of (further) Internet fragmentation:

> When governments become sufficiently frustrated with the way standards are being designed, or find that the existing standards process no longer serves their national economic or security interests, then we might see a large country like China, or a coalition of countries, decide to abandon the current standards process, effectively cleaving the Internet at the logical layer. (Hill 2013:36) [STS]

2. **Brief quotation:** A brief quotation is a *t*-unit or more, which is shorter than forty words. A *t*-unit is a single independent clause, including all modifying dependent clauses (Crookes, 1990, p. 184). Lee et al. (2018, p. 6) calls them "whole clauses." These are some examples:

(50) The OECD suggested that "an improvement of one-half standard deviation in mathematics and science performance at the individual level implies, by historical experience, an increase in annual growth rates per capita of GDP of 0.87%" ([38], p. 17) [EN]

(51) The authors conclude: "[…] Media clearly play an important role in the current epidemic of childhood and adolescent obesity. The sheer number of advertisements that children and adolescents see for junk food and fast food have an effect […]" [9]. [EN]

(52) According to ethicist Bruce Jennings (1991), "the concept of consensus is often appealed to in discussions of biomedical ethics and applied ethics, and it plays an important role in many influential ethical theories" (p. 447). [STS]

3. Fragment quotation: A fragment is a direct quote that is less than a *t*-unit. In other words, they are short "stretches of textual borrowing" (Petrić, 2012, p. 106) which are "shorter than a clause such as words and phrases" (Lee et. al, 2018, p. 6) as these examples show:

(53) The task of principlism is, as Albert Jonsen puts it, to create "the common coin of moral discourse" in order, one might add, to help resolve "the cultural tensions" created by medical scientific advance (1998, 333). [STS]

(54) Slave owners, therefore, had "little to gain from improvements in roads," and "no particular desire to attract settlers by building schools and villages and factories" (Wright 1986, p. 18) [EH]

4. Paraphrase/summary quotations: Borg (2000, p. 8) defines those cases as being "another writer's thoughts expressed in the author's own words, and so needing an overt reference." These citations always refer to a specific reference, but one that is restated in the author's own voice, as explained before.

(55) Further, Rinne, Gregory, Yarmolinskaya, and Hardiman (2011) argue that the arts may engage learners in thinking about new information in ways that improve retention. [EN]

(56) As Erik J. Engstrom (2012) has shown, many of these changes affected the turnout of voters, and changes in electoral laws explain much of the decline in voter turnout in the late nineteenth and early twentieth century. [EH]

As done in the previous section, the 1,565 tokens identified as cases of attribution through citation have been classified according to the categories presented and their distribution across the corpus has been calculated. Findings for every interdisciplinary field have been summarised in Table 3.14 and Figures 3.11 and 3.12.

		Summary/ paraphrasing	Fragment DQ	Brief DQ	Extended DQ	Total Attribution
Educational Neuroscience	*number of tokens*	**429**	**7**	**11**	**1**	**448**
	percentage (%)	**95.77%**	**1.56%**	**2.45%**	**0.22%**	**100%**
Economic History	*number of tokens*	**372**	**93**	**65**	**6**	**536**
	percentage (%)	**69.41%**	**17.35%**	**12.12%**	**1,12%**	**100%**
Science & Technology Studies	*number of tokens*	**242**	**242**	**86**	**11**	**581**
	percentage (%)	**41.65%**	**41.65%**	**14.80%**	**1.90%**	**100%**
		Summary/ paraphrasing	**Direct quotation (Total)**			**Total Attribution**
Educational Neuroscience	*number of tokens*	**429**	**19**			**448**
	percentage (%)	**95.77%**	**4.23%**			**100%**
Economic History	*number of tokens*	**372**	**164**			**536**
	percentage (%)	**69.41%**	**30.59%**			**100%**
Science & Technology Studies	*number of tokens*	**242**	**339**			**581**
	percentage (%)	**41.65%**	**58.35%**			**100%**

Table 3.14 Frequency of textual integration processes in the three interdisciplines

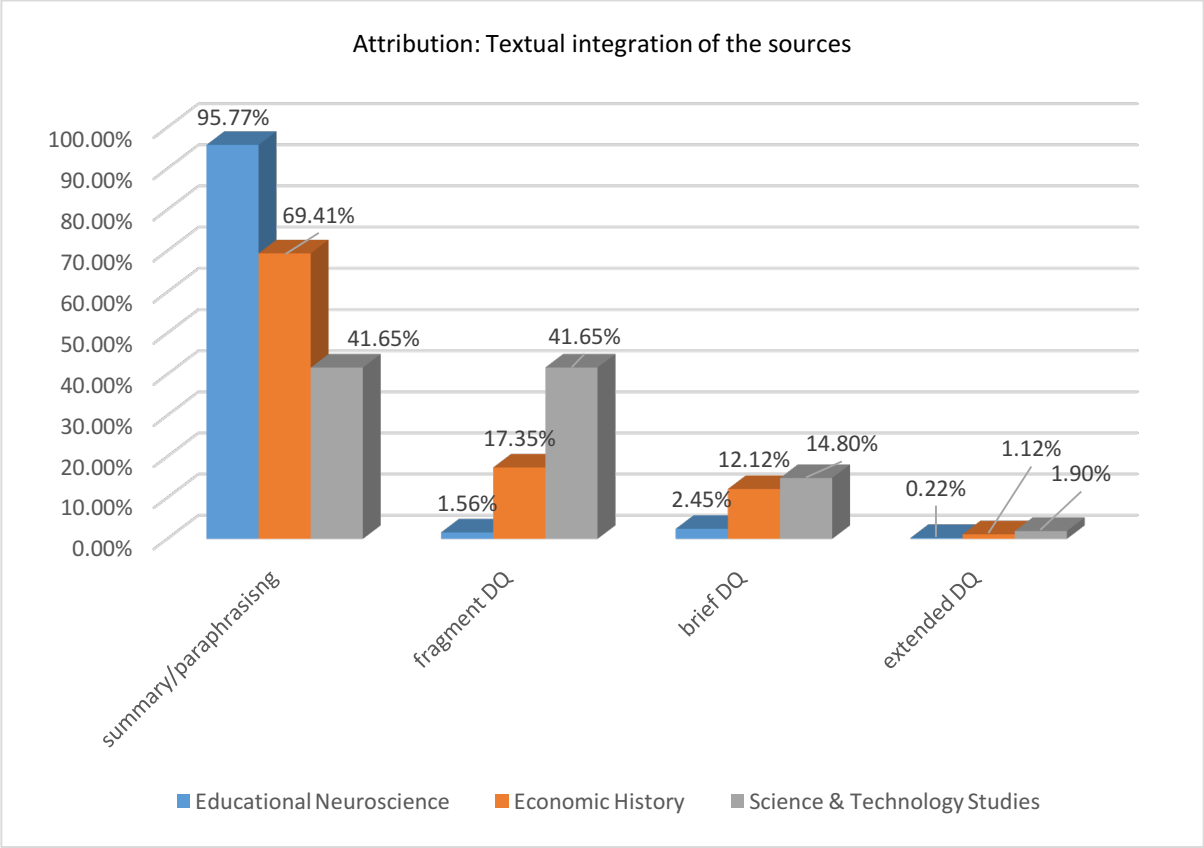


Figure 3.11 Frequency of textual integration processes in the three interdisciplines

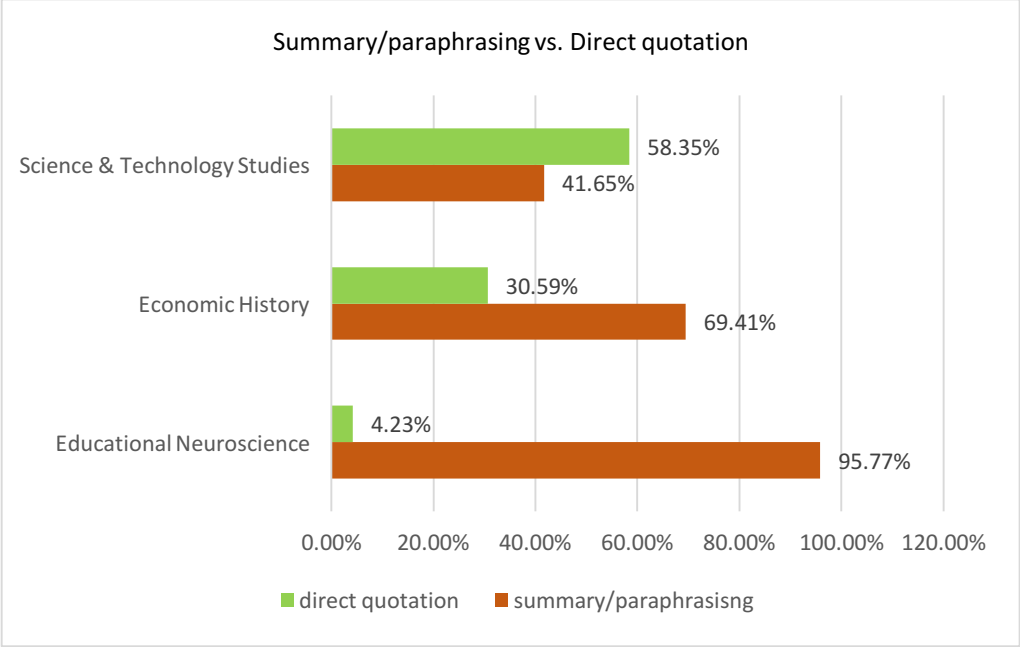


Figure 3.12 Frequency of summary/paraphrasing vs. direct quotation in the three interdisciplines

According to the findings reported, it is clear that there is a preference for integrating sources by means of summary and paraphrasing rather than by direct quotations in Educational Neuroscience (95.77%) when compared with both, Economic History (69.41%) and Science and Technology Studies (41.65%). As for the type of direct quotation, both Science & Technology and Economic History writers rely more on fragment direct quotations, followed by brief direct quotations and extended direct quotations. However, Educational Neuroscience writers prefer brief more than fragment direct quotations, but the frequencies are really low. As regards the preferences between summarising and paraphrasing or direct quoting in different disciplines, previous work has demonstrated that paraphrasing and summarising is most widely employed in all disciplines. However, in the natural sciences the frequency of direct quotations is minimal, or even inexistent, while frequencies of up to a third of the total citations have been encountered in the social sciences (Dubois, 1988; Pickard, 1995; Hyland, 2000; Thompson, 2005). Thus, the most striking finding in the corpus is the fact that the frequency of direct quotations in Science & Technology Studies is higher than the frequency of summary or paraphrasing.

Direct quotation is considered relatively "undemanding" on the side of the writer in comparison to paraphrasing or summarising, since "it does not require any textual modification of the appropriated material," as pointed out by Petrić (2012, p. 102). However, the level of academic literacy required is greater than what it is commonly thought (Petrić, 2012). Jakobs (2003), as cited by Petrić (2012), makes a distinction between two types of

integration processes when incorporating source material into a text: *co-textual* and *contextual*. While co-textual integration refers to "the adaptation of text passages to the linguistic co-text", contextual integration is concerned with "the adaptation of others' formulations to the present communication context" (Jakobs, 2003, p. 898). Direct quotation, thus, requires intervention at these two levels.

At the co-textual or linguistic level, a different vocabulary, syntax, and style are brought into the writer's text. As a result, Petrić (2012) concludes, writers have to carry out different actions in order to successfully incorporate a selected passage into their texts. For example, they need to add transition words, as in examples (57) and (58); omit parts of the quotation to make it fit into their sentences, as in (59); or make different morphological, syntactic, or orthographic changes, as in (60) and (61) (Petrić, 2012).

(57) While one human genetics researcher writes that "selecting for specific traits" is eugenic, another argues that parents are simply "seeking traits to complement their particular family," or "determin[ing] the number, spacing and quality of their children" (Wertz, Fletcher, and Mulvihill 1991, 1210). [STS]

(58) Critics have complained, however, that "consigning consideration of legal, ethical and social issues to special agencies" only "compartmentalizes the problems" rather than "encouraging coordinated ethical and scientific inquiry in which each influences the other's development (Cranor 1994, 4). [STS]

(59) Thus, Rosen (2007, 132) claims that "contemporary biological citizenship, in the advanced-liberal democracies of 'the West' [. . .], does not take this racialized and nationalized form." [STS]

(60) More realistically, the news media can be chastised, according to Dorothy Nelkin (1996), for "underplay[ing] the complexity of genetic and environmental interactions and ignor[ing] the distance between diagnosis and therapy" (p. 30) [STS]

(61) In her study on German modernization, Mary Nolan (1994) notes that American influences on German entrepreneurship were limited before WWI. But "(w)ith the end of Germany's acute postwar dependency and instability, America came to be seen as an economic model" (p. 38). [EH]

At the contextual level, "quotations may reflect a different purpose and intention, level of writer authority, and context of writing than the surrounding text" (Petrić, 2012, p. 103). Thus, writers need to frame the quotation in line with their own intentions. For instance, they may add appropriate introductions or comments about the quoted passage or phrase, as in examples (62), (63) and (64); or they may add words to qualify the quotations and signal their stance towards the ideas expressed in the quotation, as in examples (65), (66) and (67):

(62) Collins (1998) [...] maintained that it is an urgent question: "Will we reach a consensus about the *ethical limits* [emphasis added] of using genetic technology to enhance physical traits?" [STS]

(63) In a recent article, the bioethicist Hank Greely (2013, 44) asks "have ESCROs been worthwhile?" and his answer is "a strong, definite 'probably'" [STS]

(64) The conclusion is that in relations to economics and demography "politics may have played a larger role in determining who might benefit or suffer from a government's particular vision of the rightful order of things and the 'just price'" (Cohn 2007, pp. 475–76). [EH]

(65) Vaisman and other legal scholars such as Nedelsky have taken issue with the narrowness of such readings, arguing that the "legal person is always much more relational and intertwined with others than current legal instruments would have us believe" (Vaisman 2014, 395). [STS]

(66) In the words of another eminent historian, "it was not enough that the polity be centralized, the economy developed, international recognition striven for – the people must also be 'influenced, their hearts and minds made one" (Gluck 1985, p. 1). [EH]

(67) "It is time to take the 'human' out of human rights." This provocative claim was made by John Harris (2011), a renowned professor of bioethics and director of the Institute for Science, Ethics and Innovation at Manchester University, UK. [STS]

Finally, the choice between summarising or paraphrasing the cited author's view or quoting him or her directly creates distinct rhetorical effects in the context of academic writing, as suggested by Coffin (2009). The rhetorical effect of *assimilation*, i.e., when the source material merges into the writer's argument as a summary or paraphrase, is that "the referenced proposition is more likely to be perceived as an established fact, thus creating dialogic contraction," that is, closing down the interchange of alternative views. Quoted wordings or *insertion*, on the other hand, "make a proposition more open to counter argument by being clearly located as the view of but a single source." The effect produced is that the text becomes more dialogically expansive, that is, more room is left for greater degrees of dialogical exchanges (Coffin, 2009, p. 174).

3.3.3 Reporting verbs

As already stated, the specific noun or verb chosen in the construction of attribution affects status (Hunston, 2011). In this last part of the chapter, only the verbs will be analysed, based on the abundant previous research carried out on the topic.

The use of a reporting verb to introduce the work of other researchers is a significant rhetorical choice. As put by Charles, this choice is a key feature which enables writers to "position their work in relation to that of other members of the discipline" (Charles, 2006, p. 318). Hunston (1993) points out that the status of the knowledge depends on the kind of verb chosen. Finally, the importance of these verbs therefore lies in the fact that they allow the writer to clearly convey the kind of activity reported and to distinguish precisely an attitude to that information, signaling whether the claims are to be taken as accepted or not (Hyland, 2000).

Thompson and Ye (1991, pp. 372-3) distinguish three categories of reporting verbs according to the process they perform: *textual* verbs, in which there is an obligatory element of verbal expression (e.g., *state, write*); *mental* verbs, which refer to mental processes (e.g., *think, believe*); and *research* verbs, which refer to processes that are part of research activity (e.g., *find, demonstrate*). Based on those founding categories, Thomas and Hawes (1994, p. 132) employ this three-way distinction to present a different classification referring to the different kinds of activities or processes involved. Thus, they distinguish between *discourse activity* verbs, *cognition activity* verbs, and *real-world* or *experimental activity* verbs. Finally, based on both taxonomies, Hyland (2000, p. 27) developed his own framework and distinguished between three distinguishable processes: *research (real-world) acts,* which might occur in statements of findings or procedures, *cognition acts,* which are concerned with mental processes, and *discourse acts,* which involve verbal expression.

Besides information about the process or activity performed, "writers also exploit the evaluative potential of reporting verbs" (Hyland, 2000, p. 28). Thus, writers can vary their commitment to the message by adopting an explicitly personal stance or by attributing a position to the original author. Based on the complex and detailed taxonomy proposed by Thompson and Ye (1991) to count for evaluation in reporting verbs, Hyland (2000, p. 28) presented his own, proposing three ways in which the writer may represent the reported information: as *true* (*acknowledge, point out, establish*); *false* (*fail, overlook, exaggerate, ignore*); or *non-factively,* giving no clear signal. This last option allows the writer to report the source author as *positive* (*advocate, argue, hold, see*), *neutral* (*address, cite, comment, look at*), *tentative* (*allude to, believe, hypothesise, suggest*) or *critical* (*attack, condemn, object, refute*) (Hyland, 2000).

Several studies have been carried out adopting the models to analyse reporting verbs presented in the previous paragraphs. A slightly different approach, however, was adopted by Charles (2006), who analysed reporting verbs according to *meaning groups* as presented for

verb grammar patterns (Francis et al., 1996). For example, she found four main different meaning groups in her data: *argue* verbs, concerned with writing and other forms of communication (e.g., *argue, suggest, assert, point out*); *think* verbs, which are concerned with processes of thinking, believing, knowing, understanding, hoping, fearing, (e.g., *think, assume, feel*); *show* verbs, concerned with indicating a fact or a situation (e.g., *show, demonstrate, reveal*); and *find* verbs, which are concerned with coming to know or think something (e.g., *find, observe, discover, establish*).

Another still different approach, although based on the same founding categories, was adopted by Fløttum et al. (2006, p. 215), who posed these questions: "What are the other researchers allowed to do? What roles do the authors assign to the other researchers when relating to them?" In order to address these questions, they propose four *author roles* according to four different types of reporting verbs. These are: the *writer* role, which is typically manifested by discourse verbs and denote either processes involving verbal or graphical representation, such as *describe, discuss, illustrate, outline, present, repeat, summarise*, or processes directly related to the text structuring and the guiding of the reader (Dahl, 2004), such as *begin by, focus on, move on, (re)turn to, conclude by*; the *researcher* role, which is typically manifested by research verbs referring to the action or the activities directly related to the research process, such as *analyse, assume, consider, choose, compare, explore, find, follow, limit, study, test, use*; the *arguer* role, which is typically manifested by position verbs denoting processes related to position and stance, explicit argumentation concerning approval, promotion or rejection, such as *argue, claim, dispute, maintain, propose, reject*; and the *evaluator* role, which are typically manifested by evaluation and emotion verbs and verb constructions such as *feel, be content to, be skeptical about, be struck by, find something + evaluative adjective* (Fløttum et al., 2006, p. 216).

Based on this rich but complex set of possible taxonomies and systems, I will adopt a somehow blended approach. On the one hand, the present analysis will be informed by disciplinary preferences for using certain reporting verbs as acknowledged by previous research. On the other hand, verbs will be described according to the different taxonomies reviewed. As regards the cases counted, all verbs occurring in *-that* clauses and in structures with *as*, whether they are part of active or passive constructions, as well as verbs which are part of *paratactic* direct quotations have been analysed. In other words, the only verbs that have not been counted are those verbs which occur in *quoted averral* cases.

A wide variety of reporting verbs are present in the three interdisciplinary corpora. In the case of Educational Neuroscience, thirty-four different verbs (types) were identified, while

fifty-six different verbs (types) were found in Economic History. As for Science and Technology Studies, a total of fifty different verbs (types) were encountered. For the purpose of this section, only verbs occurring ten or more times have been considered for further analysis, since those occurring fewer times did not show representative frequencies. The complete list of all the occurring reporting verbs, however, can be found in the Appendix. In each interdisciplinary field, only eight verbs occurred ten or more times, whose distribution is reported in the following Table and illustrated in the subsequent Figures for each interdiscipline:

Educational Neuroscience			**Economic History**			**Science & Technology Studies**		
verbs	*tokens*	*frequency*	*verbs*	*tokens*	*frequency*	*verbs*	*tokens*	*frequency*
show	109	28.54%	***argue***	72	18.66%	***argue***	72	25.63%
find	61	15.98%	***show***	54	13.98%	***suggest***	33	11.75%
suggest	58	15.18%	***suggest***	49	12.70%	***state***	17	6.05%
demonstrate	41	10.73%	***note***	30	7.77%	***point out***	16	5.70%
report	23	6.02%	***find***	29	7.51%	***claim***	15	5.33%
argue	12	3.14%	***conclude***	14	3.62%	***show***	14	4.98%
propose	11	2.88%	***point out***	12	3.10%	***find***	13	4.62%
reveal	10	2.61%	***estimate***	10	2.60%	***reveal***	11	3.91%
Others	57	14.92%	Others	116	30.06%	Others	90	32.03%
Total	382	100%	Total	386	100%	Total	281	100%

Table 3.15 The most frequent reporting verbs in the three interdisciplines

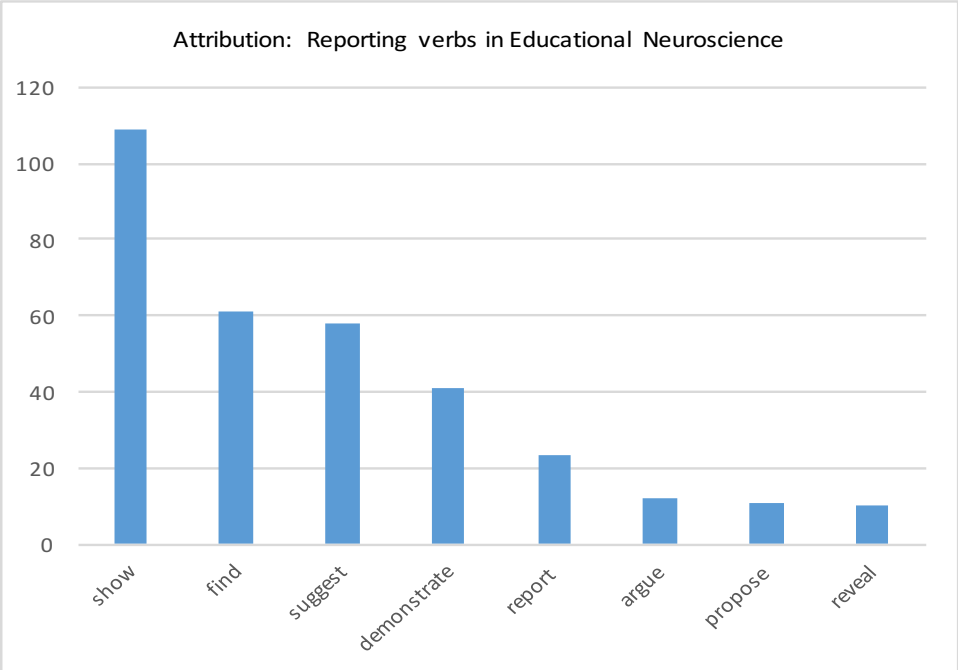


Figure 3.13 The most frequent reporting verbs in Educational Neuroscience

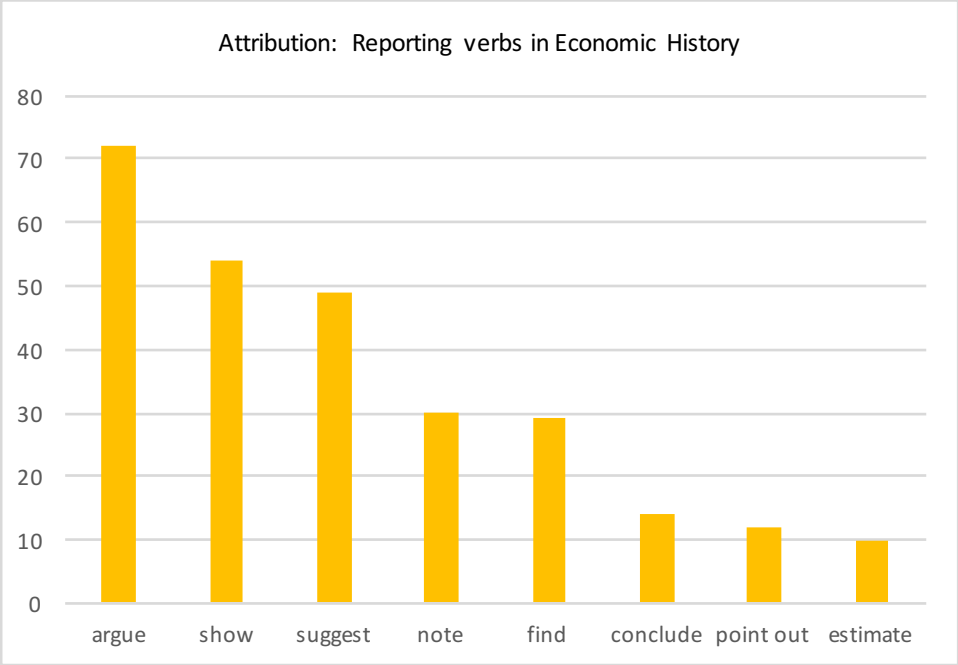


Figure 3.14 The most frequent reporting verbs in Economic History

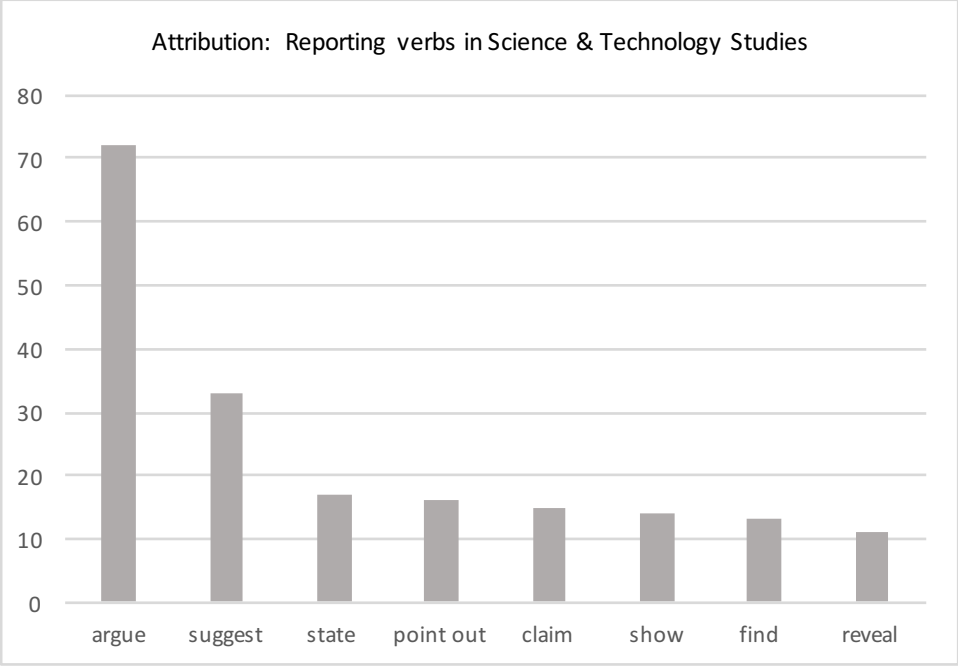


Figure 3.15 The most frequent reporting verbs in Science & Technology Studies

On a first stage, verbs were classified according to the type of activity or process they perform, that is, whether they are *research*, *mental*, or *discourse* verbs (Thompson & Ye, 1991; Thomas & Hawes, 1994; Hyland, 2000). First of all, it is important to highlight that no mental verbs occurred among the most frequent ones in any of the three interdisciplines. Thus, the distinction is to be made between discourse and research verbs only.

In Educational Neuroscience, the two most widely used verbs are *show* (24.58%) and *find* (15.98%), which together with *demonstrate* (10.73%) and *reveal* (2.61%) make up for the group of research verbs. A special case is *report* (6.02%), a verb that Thomas and Hawes (1994) have described as a discourse verb. This verb can also be used as a research verb to communicate findings, as acknowledged by Thompson (2001). Indeed, this is the meaning that *report* conveys in all the cases encountered. Thus, I have counted it as a research verb. Then, the third most frequently used verb is *suggest* (15.18%), which together with *argue* (3.14%) and *propose* (2.88%) represent the discourse verbs. If we consider only the most widely used verbs as a new whole, research verbs represent 75.07% of the total while discourse verbs represent the remaining 24.93% of the total.

In Economic History, the verb *argue*, which is a discourse verb, is the most widely used (18.66%). The verbs *suggest* (12.70%), *note* (7.77%), *conclude* (3.62%), *point out* (3.10%) and *estimate* (2.60%) complete this group. As for research verbs, *show* (13.98%) is the second most widely used verb, and only one more verb with the same meaning, which is *find* (7.51%), completes this group. When considering the most widely used verbs as a new whole, discourse verbs represent 69.26% of the total this time, while research verbs count for the 30.74% remaining.

Finally, in Science & Technology Studies, *argue* (25.66%), followed by *suggest* (11.75%), *state* (6.05%), *point out* (5.70%) and *claim* (5.33%), are the five most widely used verbs, all of them discourse verbs. The other three verbs, which are *show* (4.98%), *find* (4.62%) and *reveal* (3.91%), are examples of research verbs. If the most widely used verbs are considered as a new whole, research verbs represent 19.90% of them while discourse verbs represent the remaining 80.10%.

The classification of the verbs according to the type of process or activity they represent did not present major difficulties, since they are all clear examples of typical verbs for each group and most of them appear as typical cases in the taxonomies provided for Thompson and Ye (1991) and Thomas and Hawes (1994). Only the verbs *reveal*, *claim* and *estimate* do not appear as examples in any of both previous studies. However, Charles (2006, p. 319) classified *claim* and *estimate* within the *argue* group, which she acknowledges “parallels the textual group”, and *reveal* as a *show* verb, which, together with the *find* verbs, parallel the research group as described by Thompson & Ye (1991).

For a clearer understanding of the relationships between *research* and *discourse* verbs in the three interdisciplinary fields, findings have been summarised in Figure 3.15 below:

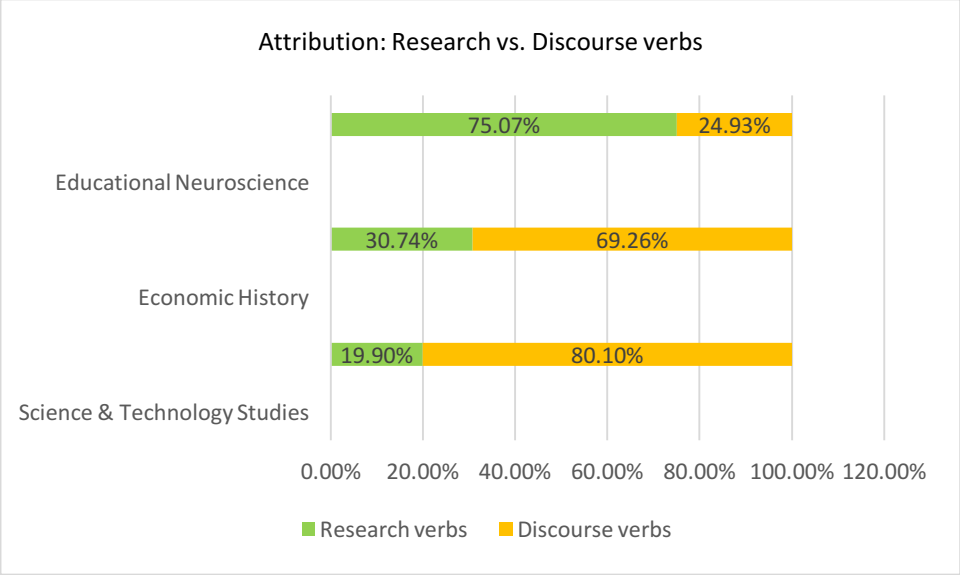


Figure 3.16 Frequency of research vs. discourse verbs in the three interdisciplines

It is widely accepted that there is a preference for hard sciences to use "research type" verbs, while soft sciences largely favour "discourse activity" reporting verbs, as pointed out by Hyland (2000, p. 28). Based on this statement and on the results shown, it can be concluded that researchers in Educational Neuroscience use reporting verbs in similar ways as researchers in the hard sciences do. Then, researchers in Economic History seem to adhere to the norm for soft sciences, which is in fact logical, since Economics is a social science and History is a humanity. Similarly, but in a more marked way, this trend is repeated for reporting verbs in Science & Technology Studies, where researchers use many more discourse than research verbs.

On a second stage of this analysis, verbs have been studied as regards their evaluative potential. As stated before, reporting verbs can be divided into those that are *factive*, when the writer indicates by such a choice that "she or he believes that the reported proposition is correct," and those which are *non-factive*, when the writer "makes no such assumption" (Swales, 2014, p. 125). On the one hand, all the research verbs encountered are factive: *show*, *find*, *demonstrate*, *reveal* and *report*. On the other, all the discourse verbs are non-factive, except, perhaps, *point out*. In addition, *note* and *state* are neutral, *suggest*, *estimate* and *propose* are tentative, and *argue*, *claim* and *conclude* are positive. It is clear that factive verbs predominate in Educational Neuroscience, while non-factive ones predominate in both, Economic History and Science & Technology Studies. However, tentative verbs are more frequent in Economic History while positive verbs are more frequent in Science & Technology Studies.

A last consideration is to be made as regards the kind of *author roles* (Fløttum et al., 2006) these verbs help to perform in each interdiscipline. Because of a higher frequency of research factive verbs, it can be argued that cited authors are given the role of *researchers* in Educational Neuroscience. Those researchers report findings and solutions, show results, find facts and demonstrate effects, as illustrated by the following passages, typically encountered throughout the corpus.

(68) Previous work by Dweck and colleagues has **demonstrated** that students may hold different core beliefs about the nature of intelligence [6,7]. Research has **shown** that students holding such beliefs during the transition to junior high school achieve significantly higher grades [17], and research by Aronson et al. [2] **demonstrated** that it is possible to teach incremental theory to college students, using Gardner's multiple intelligences [12]. [EN]

(69) As Green et al. [18] have **shown**, the rate of temporal discounting is influenced by reward magnitude. […] A recent study by Christakou et al. [5] investigated the neural maturation that accompanies this. They **found** that the previously observed age-related decrease in impulsive choices during adolescence was associated with changes in activation in the limbic corticostriatal network in the brain, including the ventromedial prefrontal cortex. Research by Olson et al. [38] has also **shown** that developing connectivity between networks in the brain is an important influence on discounting behaviour. They **demonstrated** that discounting behaviour was related to the integrity of the white matter pathways that interconnect the lateral prefrontal and temporal/parietal cortices in participants aged 9–23 years. [EN]

As for cited authors in Science & Technology Studies, the higher frequency of position verbs like *argue*, *claim* or *point out* might help to describe them as performing an *arguer* role, which is typically manifested by the presence of explicit argumentation concerning approval, promotion or rejection. Some typical intertextual passages like the following, in which the nature of these verbs is reinforced by the whole context (italised phrases) can serve to illustrate this role:

(70) The ethics of medical mismanagement has captured the attention of many western scholars. Apart from *critics made earlier* by Diamond and Sigmundson (1997) on the John-Joan case, Lev (2006) also **claims** that the outcome of SAS is highly uncertain as no one can determine nor predict what the child would want in his or her life in the future (Lev 2006). In fact, the theory that newborns who are raised with normalized genitalia will accept their assigned gender if the sex of rearing had been consistent, *has remained unclear and unsupported by any studies* (Crouch et al. 2004). There are also claims that despite enhanced surgical techniques, *no decisive evidence has shown this theory to be true* (Creighton and Liao 2004). Chase (1999) **argues** that SAS may negatively affect the sexual function and simultaneously disregard the natural condition of the newborn [...] [STS]

(71) In one of the most cited articles in the sociology of technology, Madeleine Akrich's (1992) describes how designers, when building technologies, also build "scripts" into those technologies. Users, she **argues**, once they take up and use a technology, can then be seen to be enacting a script, though *she is careful* to **point out** that scripts are never enacted straightforwardly, as users will always perform walk-arounds or what she calls "mechanism od adjustments". In contrast, Mike Michael (1996) *makes the appealing argument that* just as we can describe a technology as prescribing one form of use, perhaps the same technology might also incorporate a script that enables its abuse [STS]

Finally, it is not that easy to find a role for the cited authors in Economic History. On the one hand, they report findings and show results as researchers do; in fact, *show* is the second most used verb. On the other, and because the verb *argue* is most widely used, they also participate as arguers in discussions of approval, promotion or rejection of claims and ideas. However, any of those roles seems to be as marked as the researcher role performed by cited authors in Educational Neuroscience or the arguer role they perform in Science & Technology Studies. In fact, arguments, claims and findings are moderate, softened perhaps by the high presence of tentative verbs like *suggest.* This new, blended role, can thus be labelled as *arguer/researcher*. Commonly encountered intertextual passages like the following might help to illustrate this role.

(72) Given the endogenous nature of route allocation, we cannot interpret the OLS estimates as unbiased; previous research **suggests** a downward bias to all of our estimates. Kernell and McDonald (1999) *provide evidence that* Representatives facing competitive elections prior to the establishment of RFD were more motivated to acquire routes for their districts. This echoes *claims* by Fuller (1964), who **argued** that motivated Representatives (especially Republicans) were able to obtain more routes leading up to contested elections. […] There is a potential explanation for RFD to lead to a decrease in turnout. Kernell and McDonald (1999) **point out** that RFD routes eliminated thousands of post office positions. […] As Erik J. Engstrom (2012) has **shown**, many of these changes affected the turnout of voters, and changes in electoral laws explain much of the decline in voter turnout. [EH]

(73) Another example of Germany leading in capital intensity is provided by the metal working and industrial machinery industry. [...] Ralf Ritcher and Jochen Streb (2011) quote contemporary sources **reporting** that American machine tools were copied by German engineers without any modification to the original design. Ritcher (2011) **concludes** that not only thousands of American machine tools were in use in Germany, but also the same amount or even more German copies of these tools. In a more recent article, Cristiano Ristuccia and Adam Tooze (2013) analyze the number of purchased machines in Germany and the United States and **find** that German additions to the machinery stock consisted of new technologies not unlike those in America. On the basis of *this evidence, they reject the notion* of dichotomous technological paths across the Atlantic, at least in this industry. [EH]

So far, the three interdisciplines under study have been described as regards the ways in which the phenomenon of attribution through citations is inscribed according to three main aspects: the grammatical structures employed, the processes of textual integration applied, and the meanings of the reporting verbs used. It is time now to apply the findings obtained into the characterisation of each interdisciplinary field according to different *modes of interdisciplinarity*.

3.4 Modes of interdisciplinarity: Preliminary conclusions

As stated in the introduction of this work, it is possible to identify three modes of interdisciplinarity, i.e., three "ideal-typical arrangements of the interrelations between disciplines" (Barry & Born, 2013, p. 34): the *integrative-synthesis* mode, the *subordination-service* mode, and the *agonistic-antagonistic* mode. I have also made the claim that each of the three cases which have been analysed in this work might correspond to one of these modes.

3.4.1 Educational Neuroscience

It has been shown that Educational Neuroscience writers use *that*-clauses of attribution in a markedly high frequency. In addition, the voices of the cited authors are less explicit because of a low frequency of direct quotations, which indicates that the attributed propositions are more mediated by the writer. When incorporating source material into their texts, writers prefer to paraphrase or summarise rather than to quote other authors, thus creating a rhetorical effect of dialogical contraction, that is, closing down the possibilities for alternative views. Finally, writers use more research than discourse reporting verbs, which are also factive. Because of these choices, cited authors adopt the role of researchers. Most of these features have been acknowledged as typical of the language from the natural sciences. Educational Neuroscience, however, **is not exactly** a natural science; it is an interdisciplinary construction whose scientific knowledge **comes from** a natural science (Neuroscience) but which is also **informed by** a social science (Education). Yet, the relationship between both disciplines is not one of equality. Rather, it is constructed by subordination and service bonds.

In a *subordination-service* mode of interdisciplinarity, as already explained, one discipline occupies a subordinate or service role in relation to the other discipline. This is rooted in the hierarchical division of labour that characterises many forms of interdisciplinarity. According to this mode, the service discipline is typically conceived as

making up for, or filling in for, an absence or lack in the other, which is the master discipline (Barry & Born, 20013). In some cases, the social sciences are understood precisely in such terms. They appear to make it possible for the natural sciences and engineering to engage with social factors that had been excluded from analysis or consideration (Marcus, 2002).

In Educational Neuroscience, then, Education would be the service discipline that makes it possible for Neuroscience, which is the master discipline, to engage with social issues. Thus, the language adopted is more similar to the language of the natural sciences because the natural science is the master science in the relationship. In other words, it is the one that creates knowledge, although this knowledge is informed by the social science. The kind of knowledge that is produced must be useful for a better understanding of learning from a cognitive or neurobiological perspective. Logically, the processes occurring in our brain and nervous system when learning are described in the same way as other biological process: informed by previous research which is reported by using language that is typical of those sciences. Form a more critical perspective, Penny (2006, n.p.) refers to this kind of interdiscipline as made of "practitioners who are firmly rooted in one discipline," and have "a strong internal sense of its authority," that is, who feel that they hold the "master discourse" through which they "exploit or reprocess" some subject matter of the other discipline. Finally, Edelenbosch et al. (2015), argue that if neuroscience really wants to contribute to the complex practice of education, it is necessary to find a middle road between scientific rigour and a more pragmatic approach. This scientific rigour, I claim, has been clearly perceived in the language used, at least when attributing others' propositions, by Educational Neuroscience writers.

3.4.2 Science & Technology Studies

Findings provide evidence that Science & Technology Studies writers use *that*-clauses of attribution most frequently, as writers in all disciplines do, but they also make use of other resources, like quoting averred statements or introducing plain quotations in their arguments. Thus, the cited authors' voices are more explicit and the attributed propositions are less mediated by the writer. As they use more direct quotation than summary or paraphrasing, a rhetorical effect of dialogical expansion is created, thus leading to more spaces for dialogic exchange. Finally, writers use more discourse than research verbs and a high proportion of position verbs and, because of these choices, cited authors adopt the role of arguers. Most of these features have been acknowledged as typical of the discourse from the social sciences. Science & Technology Studies, however, **is not exactly** a social science. Rather, it is an

interdisciplinary construction whose subject matter originates from the **critical reflection** upon the power of science and technology to transform society. Thus, Science and Technology's concepts and theories, which result from that critical reflection, can shed light to different understandings of, for example, bioethics or engineering ethics issues.

An *agonistic-antagonistic* relationship is established, then, between Science & Technology Studies and existing or prior forms of disciplinary knowledge and practice. According to this mode, interdisciplinarity arises from "a dialogue with, criticism of or opposition to the limits of established disciplines, or the status of academic research or instrumental knowledge production in general" (Barry & Born, 2013, p. 25). For Penny (2006), when a new discipline comes in as an outsider to another discipline, with a different set of values, the fundamental assumptions by which that discipline is structured are revealed. This kind of interdisciplinarity, Penny (2006, n. p.) concludes, can be fruitful in "enabling a context for the mutual critique of the fundamental assumptions of the different disciplines." That is why Science & Technology Studies research opens up science, technology, and society to "critical assessment and interrogation" (Felt et al., 2017, p. 1). As a conclusion, then, Science and Technology Studies is framed by an agonistic/antagonistic mode of interdisciplinarity characterised by instances of dialogue, criticism, opposition, assessment and interrogation about the relationships between science, technology and society.

In order to critically reflect upon those relationships, Science & Technology Studies writers need to make use of a language that allows them to criticise, evaluate, question or negotiate with different views, positions, and claims. It has been proved that, when attributing other sources, such a language is similar to the language of the social sciences in general. However, such a language also shows some glimpses of a more critical touch. For example, the fact that Science & Technology Studies writers use more direct quotations than paraphrasing, which is even unusual for the social sciences, and the way in which they do it, that is, by quoting fragments that are adapted according to their own intentions, shows that they use this linguistic resource to bring external voices explicitly into their own arguments and, at the same time, to open up spaces for dialogue and negotiation. This effect is strengthened by giving those cited authors a positional role of arguers. In sum, when Science & Technology Studies writers attribute other sources, they do it by using linguistic resources that continuously enhance critical reflection.

3.4.3 Economic History

According to the findings, Economic History writers also use *that*-clauses of attribution most frequently, as shown for all disciplines. However, they use more *that*-clauses than Science & Technology Studies writers but fewer than Educational Neuroscience writers. In addition, when incorporating source material into their texts, Economic History writers prefer to paraphrase or summarise rather than to quote other authors, as Educational Neuroscience writers do, but they paraphrase or summarise in higher proportions than the latter. Finally, writers use more discourse than research reporting verbs, although the two most widely used verbs correspond to one and another groups. Because of these choices, cited authors adopt a blended role between researchers and arguers, as they combine reports of findings with approval, promotion or rejection of claims and ideas. In general terms, most of these features have been acknowledged as characterizing the language of the social sciences, which is in fact logical, since Economic History **is** an interdisciplinary formation made up of knowledge constructions that come from a social science and a humanity: Economics and History. As for the way in which those disciplines interact, this is another issue.

It has been shown that every time a linguistic aspect of attribution was analysed, i.e., grammatical structures, textual integration, and reporting verbs, Economic History figures stood in the middle between Educational Neuroscience and Science & Technology Studies. This fact might be taken as evidence that the way in which the disciplines involved in Economic History interact is different from both, Educational Neuroscience and Science & Technology Studies. Indeed, no master or service discipline has been encountered, nor a purely critical-reflective one either. What has been described, instead, is a hybrid or "insterticial cross-discipline" which springs from an *integrative-synthesis* mode. According to this mode, interdisciplinary work is defined as "integrating and negotiating knowledge and modes of thinking from two or more disciplines" (Barry & Born, 2013, p. 24). Such work, then, aims at advancing understanding, i.e., explaining phenomena, crafting solutions, or raising new questions, in ways that would have not been possible through single disciplinary means (Boix Mansilla & Gardner, 2003).

This interdisciplinary integration not only occurs between Economics and History, but also across other interdisciplinary connections that are synthesised in the new, hybrid discipline. This is so because disciplines are not monads (Osborne, 2013). Indeed, there is always a certain degree of transparency or porosity. The social sciences, Osborne (2013, p. 134) suggests, "are especially porous in their aptitude for certain kinds of mobility across, and cross-fertilisation with, other areas of inquiry." In the case of Economic History, as it

encourages more rigorous approaches to understanding our economic past, a productive cross-fertilisation process between historical knowledge and quantitative economic theories and methods occurs. Thus, mathematics, statistics or computer studies, for example, are disciplines that cross boundaries across the social sciences to inform computer-based models and methods of statistical projection that economic historians use in their studies. This last fact might serve to understand why Economic History writers make their cited authors *argue* and *suggest* but also *show* and *find*.

To conclude, then, if I have described the language of attribution of Science & Technology Studies as typical of the social sciences but with some glimpses of a more critical touch, I could define the language of attribution of Economic History as typical of the more moderate social sciences with some glimpses of scientific rigour.

Chapter 4: EVALUATIONS OF IMPORTANCE. THE CASE OF *IMPORTANT* IN INTERDISCIPLINARY WRITING

4.1 Academic values and parameters of evaluation

Academic scholars draw on a repertoire of conventional axiological meanings to the production of new knowledge in their field (Giannoni, 2010). Thus, the use of evaluative expressions which encode what is considered to be desirable or undesirable in a given domain is central to the success of academic texts, because it is through language that knowledge claims are constructed and negotiated. In other words, through the study of the language of academic texts the value-system encoded in each discipline might emerge. Furthermore, the values encoded by scholars "share a common concern for the quality, reliability and impact of research in their field" (Giannoni, 2010, p. 14). That is, the value-system which is encoded is also shared by the members of the same disciplinary community. Several studies have been carried out on the mapping of academic values across different disciplines, genres or registers. For example, Giannoni (2010) studied the academic values of *goodness*, *size*, *novelty* and *relevance* across a corpus of Research Articles from several disciplines through the study of language value-markers, such as adjectives, nouns, adverbs and verbs. Likewise, Swales and Burke (2003) explored the evaluation-value interface in spoken academic texts through the study of adjectives. Together with these, Thetela's (1997) small-scale study of *parameters of value* in academic discourse is another interesting example of how the value-systems underlying different academic disciplines can be described through the study of language features.

The existence of different academic values which are encoded in the language of academic discourse can be better understood by means of the concept of *parameters of evaluation*. Hunston and Thompson (2000) refer to these by highlighting the fact that evaluation is always performed along several different parameters or dyads, such as *good-bad* or *positive-negative*. Apart from these, they distinguish three more: *certainty*, *expectedness* and *importance* (also called *relevance*). However, they argue, the most basic parameter to which the others relate is *good-bad*, which is also dependent on the value-system underlying the text (Hunston & Thompson, 2000, p. 22). Thus, for example, words such as *important* or *significant* are commonly considered to reflect good qualities.

It is essential to highlight that different parameters of evaluation play different roles in discourse. For example, evaluations of goodness and certainty are primarily *real-world-oriented*, that is, they express "the writer's view of the status of propositions and entities"

and, because of that, they are typical of genres which build knowledge claims, such as RAs. Evaluations of expectedness and importance also share this role but they add a second function: they are *text-oriented*, since they serve to "guide readers towards the coherence of what they are reading," thus playing a "key role in the organization of texts" (Hunston & Thompson, 2000, p. 22).

4.2 Evaluations of importance and interdisciplinary writing

Bondi (2015, p. 162) points out that evaluations of importance in academic discourse contribute to "positioning research in the context of disciplinary debate." Furthermore, Bondi (2015, p. 163) argues, evaluations of importance also contribute to "highlighting the significance of the data or conclusions produced, thus becoming resources by which the author negotiates the various convergent or conflicting positions with the reader." Hence, due to the additional text-oriented function they carry out, markers of importance also guide the reader to accept the centrality of the topic, the writer's interpretation, or the different "subtopics and sub-claims that contribute to the development of the writer's argument" (Bondi, 2015, p. 163).

As stated in the introduction of this study, articles which are published in interdisciplinary journals need to show they are **relevant** to real-world concerns. Furthermore, as interdisciplinary journals are aimed to a broader audience, more explanatory material needs to be included. For this reason, writers need to **emphasise the relevance** of the proposed methods or the innovation in the theory so as to demonstrate their expertise and, above all, the applicability of their research (CCR, 2017). Clearly, then, it is likely that evaluations of importance or relevance will be frequently encountered and strategically distributed according to the different rhetorical purposes and intentions that interdisciplinary writers choose to convey. In line with this, the aim of this purely exploratory chapter is to describe the ways in which evaluations of importance are inscribed in the three interdisciplines under study.

Evaluations of importance can be shown by the use of different linguistic resources, such as adjectives, adverbs and nouns, which can be grouped according to different lexical sets, for example: significance (*significant, significantly, significance*), importance (*important, importantly, importance*), and so on. As for a higher frequency of one lexical item over the others, it has been pointed out that the most frequent core elements of each category are adjectives, as demonstrated by Bondi (2015) and Giannoni (2010). In fact, I have myself carried out the same search over the corpus and I have arrived at the same conclusion. This

greater frequency of adjectives of importance over nouns and adverbs does not occur by chance: the way in which adjectives behave tells a lot about their preponderance to be used as evaluative markers.

In the following section, I will focus on adjectives and importance and the ways in which they can be identified throughout a corpus as part of grammatical patterns. Then, I will narrow down the scope by studying only the most widely used adjective of importance across the whole corpus: the case of *important*.

4.3 Adjectives of importance and grammar patterns

Soler (2002, p. 149) states that adjectives allow researchers "to describe and qualify phenomena observed during the experimental stage and to anticipate agreements or oppositions to claims with caution and strategic consideration of the opinions and views of peers." This is so because adjectives are "the word class most associated with evaluation," as argued by Hunston (2011, p. 161). Furthermore, Biber et al. (1999) point out that as most adjectives used in academic writing are evaluative, such as *important*, *difficult* or *useful*, they are central to the construction of authorial stance.

Evaluative adjectives commonly occur as part of certain *grammar patterns* (Hunston & Francis, 1999). The patterns of a word can be defined as "all the words and structures which are regularly associated with the word and which contribute to its meaning." Furthermore, a pattern can be identified "if a combination of words occurs relatively frequently, if it is dependent on a particular word choice, and if there is a clear meaning associated with it" (Hunston & Francis, 1999, p. 37). As Groom (2005, p. 258) explains, this theory of language as "phraseology", which Hunston and Francis (1999) have termed *pattern grammar*, rejects "the traditional view of syntax and lexis as separate domains," since a grammar pattern "represents a link between lexis, grammar and meaning" (Hunston, 2002, p. 167).

This interplay between lexis, grammar and meaning that *pattern grammar* offers allows for the use of the model as a suitable methodological framework for the analysis of adjectives of importance in this chapter. The main reason why this model has been chosen for the analysis of adjectives of importance is that the study of grammar patterns (Hunston & Francis, 1999) is the most comprehensive corpus-based research work on adjectives available. Therefore, because of its empirical nature, the model gives us the greatest confidence that all the adjectives of importance or relevance present in the corpus can be identified. In other words, I can be confident as a researcher that the list of adjectives of importance reported is a complete list because it is based on comprehensive and extensive

corpus research. Thus, although some alternative models such as *Construction Grammar* (Goldberg, 1995) or *Appraisal Theory* (Martin & White, 2005), among others, might offer a more theoretically-grounded basis, they might lack reliability because no empirical research has been developed in such a comprehensive way.

Based on these theoretical and methodological considerations, the process of identification of all the adjectives of importance distributed across the corpus has been carried out, as reported in the following section.

4.3.1 Identification of adjectives of importance

As already stated, the aim of this chapter is to explore adjectives of importance in a corpus of RAs from different disciplines and interdisciplines. By focusing first on meaning, I made a list of all the adjectives which have been associated with the meaning of *importan*ce according to Francis et al. (1998) in their study of grammatical patterns. Then, I calculated their frequency in the whole corpus, as shown in Table 4.1 below.

Adjectives	Tokens	Frequency
important	2,115	27.31%
significant	1,849	23.88%
relevant	1,038	13.41%
key	744	9.61%
crucial	305	3.94%
essential	262	3.38%
central	260	3.36%
serious	260	3.36%
fundamental	217	2.80%
prominent	166	2.14%
influential	115	1.49%
notable	84	1.08%
vital	71	0.92%
critical	60	0.77%
decisive	45	0.58%
integral	31	0.40%
pivotal	23	0.30%
urgent	22	0.28%
indispensable	21	0.27%
noticeable	21	0.27%
paramount	18	0.23%
imperative	16	0.21%
TOTAL	7,743	100.00%

Table 4.1 Frequency of adjectives of importance across the whole corpus

This first stage allowed me to know which adjectives from the importance meaning groups were the most frequently used. Results show that *important*, *significant* and *relevant* alone make up for more than 50% of them. As for the most frequent, it is necessary to highlight that the adjective *important* is more frequent than the rest in every sub-corpus. Then, a decision was made so as to explore in detail the linguistic realisations of the most frequent adjective only: the case of *important*.

The study of the adjective *important* across the corpus was divided into three stages. First, a comparison of frequencies was carried out between the single-domain disciplines and the interdisciplines in each disciplinary set. Then, the variation of frequencies in the two different interdisciplinary journals and the variation of frequencies across individual articles in the three interdisciplines was considered. Finally, the process of identification of the grammatical patterns in which the adjective occurs was carried out. These different stages will be described in detail in the following sections.

4.3.2 The adjective important: Its frequency in the interdisciplines in comparison with the single-domain fields

On this first stage I calculated the frequency of *important* in the three interdisciplines in comparison with the single-domain disciplines associated in each case. As the frequency of occurrence of the adjective was not as high as in the case of citations, I calculated normalised frequencies per 10,000 rather than per 1,000 words so as to see the differences in a more visible way. The findings are reported in the Tables that follow.

SET 1	Number of words	*important* tokens	Normalised frequency (per 10,000 words)
Neuroscience	232,092	127	**5.47**
Education	318,513	243	**7.62**
Educational Neuroscience	275,466	226	**8.2**

Table 4.2 Normalised frequencies for the adjective important in Set 1: Neuroscience, Education, and Educational Neuroscience

SET 2	Number of words	*important* tokens	Normalised frequency (per 10,000 words)
Economics	607,852	364	**5.98**
History	462,631	243	**5.25**
Economic History	416,062	316	**7.6**

Table 4.3 Normalised frequencies for the adjective important in Set 2: Economics, History, and Economic History

SET 3	Number of words	*important* tokens	Normalised frequency (per 10,000 words)
Ethics	549,235	360	**6.55**
Biomedicine	48,336	31	6.41
Engineering	59,017	37	6.27
Total (Biomedicine/ Engineering)	107,353	68	**6.34**
STS Topic 1: Bioethics	149,542	158	10.56
STS Topic 2: Engineering Ethics	190,461	172	9.03
Total STS	340,003	330	**9.7**

Table 4.4 Normalised frequencies for the adjective important in Set 3: Ethics, Biomedicine, Engineering, and Science & Technology Studies

Findings indicate that in the three sets there is a higher frequency of *important* tokens in the three interdisciplines when compared with the single-domain fields. This is perhaps one of the most interesting, although general, findings of the study, since it allows to confirm that evaluations of importance are highly visible in interdisciplinary writing. As shown by the results for Set 1, in Educational Neuroscience the normalised frequency of the adjective *important* was 8.2 per 10,000 words, which is slightly higher than in Education (7.62) and more markedly higher than in Neuroscience (5.47). As regards Set 2, the normalised frequency of the adjective *important* in Economic History was 7.6 per 10,000 words, which is

higher than the similar frequencies calculated for Economics (5.98) and History (5.25). Finally, in Set 3, the normalised frequency of the adjective *important* in Science & Technology Studies was 9.7 per 10,000 words, which is higher than the frequency calculated for Ethics (6.55) and for both Biomedicine (6.41) and Engineering (6.27). The comparison with the topical sub-corpora did not show marked differences, although the frequency was higher for the articles dealing with bioethical issues (10.56) in comparison with those referred to engineering ethics issues (9.03).

4.3.3 The adjective important: Variation across interdisciplinary journals

As done in the chapter about citations, a comparison between the two journals from each interdisciplinary field was carried out so as to explore possible journal variation matters. Thus, normalised frequencies of the adjectives *important* per 10,000 words were now calculated for each interdisciplinary journal. According to the findings obtained, which have been summarised in Table 4.5 below, the frequencies of *important* in both journals from each interdisciplinary field are noticeable similar in the three cases. Thereby, possible problems concerned with *local densities* (Moon, 1998) did not have to be taken into account. In fact, the degree of homogeneity between journals is highly visible as regards this specific linguistic feature studied.

Educational Neuroscience Journals	**Number of words**	***important* tokens**	**Normalised frequency (per 10,000 words)**
Trends in Neuroscience and Education	143,995	119	**8.26**
Mind, Brain & Education	131,471	107	**8.13**
Economic History Journals	**Number of words**	***important* tokens**	**Normalised frequency (per 10,000 words)**
The Journal of Economic History	208,415	170	**8.15**
The Economic History Review	207,647	146	**7.03**
Science & Technology Studies Journals	**Number of words**	***important* tokens**	**Normalised frequency (per 10,000 words)**
Science and Engineering Ethics	171,688	162	**9.43**
Science, Technology, & Human Values	168,315	168	**9.98**

Table 4.5 Comparison of normalised frequencies for the adjective important in two journals from the same interdisciplines

4.3.4 The adjective important: Variation across individual articles from interdisciplinary journals

As explained in Chapter 2, the issue of range and dispersion of the linguistic features across individual papers was examined in the interdisciplinary sub-corpora. Thus, the distribution of the adjective *important* across articles for each interdiscipline has been calculated, as shown in Figure 4.2 below.

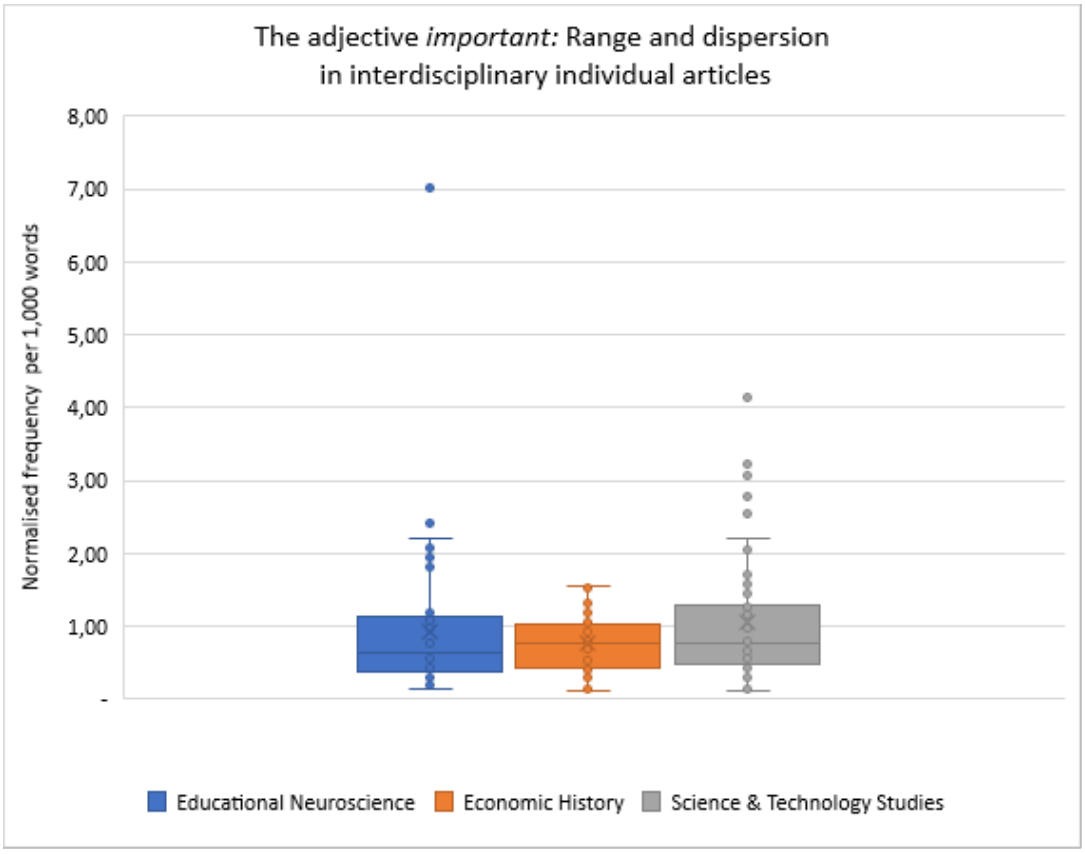


Figure 4.1 Range and dispersion of the adjective important in individual articles from the three interdisciplines

Values indicate that the three sub-corpora are more or less uniform as regards the range and dispersion of the frequencies of the adjective *important* normalised per 1,000 words in each individual article. It is clear that the most uniform set of texts is the Economic History corpus, in which no outliers are present. In the case of the Educational Neuroscience texts, two values stand out from the scope of the maximum values, one much more markedly than the other. As for the Science & Technology Studies corpus, although five values are displayed outside the range, none of them is so extremely distant. The fact that the outliers are represented by only 7 texts out of 150 shows that, as observed when citations were analysed, the findings obtained should not be skewed.

4.3.5 The adjective important: Identification of grammatical patterns

Finally, on the last stage of this preliminary analysis, the focus was shifted towards the grammar of the adjective. Every token for the adjective *important* was explored so as to identify the grammar pattern in which it occurred based on those identified by Francis et al. (1998) for that meaning. Leaving aside the cases in which the adjective *important* occurred in framing phrases like *more important*, in comparative structures, or in some other non-frequent patterns like pseudo-cleft sentences with *what*, I found out that the adjective *important* occurs more frequently in these six patterns (Francis et al., 1998), whose detailed analysis will be presented later on in this chapter.

Pattern 1: 'ADJ + noun': *These are important results.*
Pattern 2: 'v-link + ADJ': *These results are important.*
Pattern 3: 'v-link + ADJ + prep': *These results are important for future research.*
Pattern 4: 'it + v-link + ADJ + *that*': *It is important that these results are taken…*
Pattern 5: 'it + v-link + ADJ + *to-inf*': *It is important to compare these results...*
Pattern 6: 'it + v-link + ADJ + *to-inf* + *that*': *It is important to note that these results…*

So far, I have explained that academic disciplines encode a system of values along different parameters of evaluation that can be explored through the study of evaluative language. More specifically, I have pointed out that the parameter of importance can be examined through the study of adjectives, since they constitute the most widely used lexical items that carry out this meaning. I have also suggested that grammar patterns offer a reliable method for the identification of adjectives of importance. After identifying the most frequent adjectives of importance across the whole corpus, I have decided to study the most frequent one (*important*) in detail. In order to do so, I have calculated and compared its frequency in both, monodisciplinary and interdisciplinary journals, I have examined the variation between the two journals from the same interdisciplinary fields, and I have paid attention to the variation across individual papers in the three interdisciplines. Finally, I have identified the most frequent grammatical patterns in which the adjective occurs.

I will move on now to a more fine-grained study of the adjective *important* in an attempt to explain how evaluations of importance are inscribed in interdisciplinary journals. To carry out this analysis, I will propose an integrative, tripartite model of evaluation in order to find out what evaluations of importance say about disciplinary differences and what they say

about differences between interdisciplinary fields. After this, in the last section of the chapter, I will compare the findings obtained for the interdisciplinary articles with the articles from the single-domain disciplines so as to find out how evaluations of importance are inscribed differently, or not, in interdisciplinary writing.

4.4 Evaluations of importance: Towards an integrative model

Any evaluation of importance minimally involves a *thing evaluated*, which can be a person, utterance, object or situation, as well as an *evaluator* (Hunston & Thompson, 2000) for whom that thing deserves special attention or consideration since it is *important* to his or her interest and, by extension, to the discipline he or she represents (Giannoni, 2010). Furthermore, and particularly in interdisciplinary writing, a reason, a purpose, a process, a place, or an area act sometimes as contextual features that provide information about the *evaluative context* in which the evaluation occurs. As a result of the interaction of these three elements with the *evaluative category*, which is represented by the adjective *important* in this case, three main questions can be addressed, which correspond to three different aspects or dimensions.

1) **What is *important*?**
2) **Who is it *important* to?**
3) **In which context is it *important*?**

4.4.1 What is important? The evaluated thing

Based on the study of the ascribed value given to an evaluated entity, Thetela (1997) coined the term *topic-oriented evaluation* (TOE) to describe evaluations related to the real world, and the term *research-oriented evaluation* (ROE) to describe evaluations directly related to the research discourse and its purpose, as summarised by Xu and Nesi (2017). In Thetela's (1997, p. 105) words, the distinction between TOE and ROE can be expressed simply as the difference between the "writer observing the world" (TOE) and the "writer observing the research" (ROE). In even simpler terms, when entities are directly related to the research article and its purpose, such as *study, evidence, results*, etc., they are seen as research entities and their evaluation is then research-oriented, as in the following examples:

(1) Despite these limitations, we believe our study provides ***important* preliminary evidence** that many students, particularly struggling readers, may retain academic content better when instruction is integrated with the arts. [EN]

(2) The most ***important* result** is that the key variable, *shortage*, is positive and statistically significant at the 1 per cent level in all models. [EH]

When entities refer to things which are related to "the area described in the research paper, but which do not constitute the research itself" (Thetela, 1997, p. 106), that is, when they do not refer to either the process or the outcome of the research investigation itself, they are seen as topic-oriented entities. Topic, then, means aspects of the area under investigation rather than the investigation itself, as the following examples illustrate:

(3) Thus, for adolescents and adults, 3D mental rotation is an ***important* source** of individual differences in a variety of complex tasks. [EN]

(4) Rapid household diffusion of consumer durables in most western nations, together with falling unit costs owing to rapid process innovations and scale economies, made them ***important* growth industries**. [EH]

Furthermore, when ROE is performed, Thetela (1997, p. 106) argues that two different entities can be evaluated: *processes* or *products*. When entities can be seen as part of the methods, that is, of the doing aspect of research (Halliday, 1985), what is evaluated as *important* is part of a process, as *variable* in example (5). However, in example (6), the entity *finding* is not a process. Thus, "the role of the researcher is not that of doing but that of knowing" (Thetela, 1997, p. 106). The term *finding* is related to the outcome of the research investigation and it constitutes a product entity.

(5) If we fail to include an ***important* variable** of the initial problem in our thought experiment, then the elicited intuitions and the corresponding underlying moral principles will not teach us anything about how to regulate problem X. [STS]

(6) The most ***important* finding**, however, is that only in 6.3 per cent of cases were males reclaimed by a family member, usually a parent, compared with 45.8 per cent and 57.1 per cent of females being reclaimed in the two sub-periods. [EH]

There is still another distinction that is important to make. When ROE instances are performed, evaluated entities can refer to the research carried out by the article's current writer, as in all the examples above, or they can refer to the research carried out by another researcher, as in examples (7) and (8).

(7) Martinson et al. **investigations are *important*** because they turn our attention toward the often neglected experiences of scientists regarding common behavior that they see as problematic. [EN]

(8) Lyman's book makes a valuable contribution but it has two ***important* shortcomings**. [EH]

It is interesting to note that ROE of importance might serve to inscribe an overall positive evaluation, as in example (7) or a negative one, as in example (8). Although this last one is more typical of ROE which refers to previous research, which most of the times contributes to indicating a gap in previous research (Swales, 1990), cases are also possible in ROE of importance about the current research, as in example (9):

(9) Our analysis has some ***important* limitations**. First, as it is based on local population registers for the early part of the period analyzed, we cannot completely rule out the existence of selection bias due to migration. [EH]

Finally, there are cases in which the evaluated thing is neither a research-oriented entity nor a topic-oriented one. I am referring here to cases in which the evaluated thing is wider in scope, since aspects related to the discipline/s involved or their interdisciplinary relationships as well as to any of its protagonists constitute the evaluated entity, whether this is a noun, as in examples (10) and (11) or a complete clause, as in example (12):

(10) In my efforts at moral architecture, I do not cast ethicists and scientists either as adversaries or paramours, but rather as differently skilled and critically ***important* participants** in a complex challenge: to understand, elucidate, and articulate the technical, ethical, social, and political aspects of science. [STS]

(11) One critically ***important* institutional strategy** is to embed bioethicists in life sciences units, rather than segregating them in Philosophy departments. [STS]

(12) We argue that **it is *important*** not only **to** focus on the boundary between different scientific disciplines, but to also **to** gain insight into the boundary of science and educational practice, especially considering the developments that have been taking place with regard to brain-based learning in recent years. [EN]

I have labeled these as cases of *disciplinary-oriented* evaluation (DOE), since it is clear that there is not a writer observing the research and there is not a writer observing the real world. Instead, we have a writer observing disciplinary matters.

To sum up, it can be concluded that when we ask what is *important*, the evaluated thing

can be a *topic-oriented* (TOE) entity or a *research-oriented* (ROE) entity. In the case of ROE, it can refer to a *process* or to a *product* of the *current* research or of *previous* research. Finally, the evaluated thing can be *disciplinary-oriented* (DOE). The following diagram represents these possible choices:

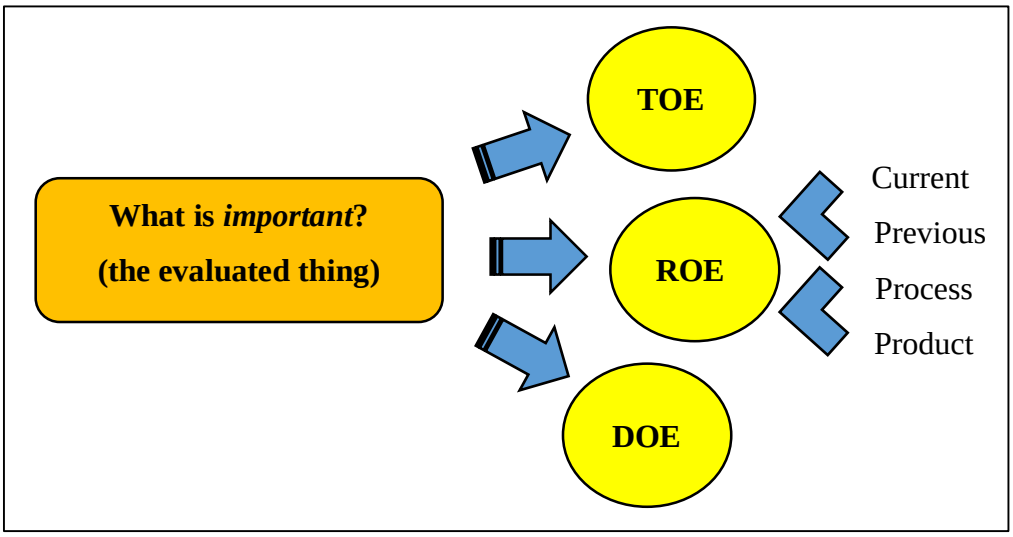


Figure 4.2 What is important?: The evaluated thing

4.4.2 Who is it important to? The evaluator

As noted by Bondi (2015), the notion of importance, like other evaluative notions, implies that there is at least an evaluator, a source of the importance, i.e. someone who takes responsibility for attributing importance to a given entity. Evaluation is thus intertwined with the concepts of averral and attribution (Sinclair, 2004), which have been already discussed in the previous chapter. In general terms, it is accepted that evaluations of importance are normally taken to be averred by the writer unless there are clear contextual clues that attribute them to a different evaluator.

When the evaluator is the *current writer*, his or her presence as evaluator might be more explicitly marked, as in example (13), or less explicitly marked, as in (14). When the act of evaluation is attributed to somebody else, the evaluator can be *another researcher* (or his/her previous study, findings, methods, etc.), as in examples (15) and (16), or a *participant* of the research process, such as interviewed professionals, other members of the research community, etc., for whom a given entity is *important*, as examples (17) and (18) respectively show:

(13) We found several significant, ground breaking findings, that have ***important* education ramifications.** [EN]

(14) Another ***important* factor** for learning with an overall positive effect on neurons is the neurotrophin brain derived neurotrophic factor (BDNF). [EN]

(15) Some of the reviewed studies have proposed that […], while others have suggested that **executive function is *important*** or allows for self-regulation (Bridgett et al., 2012; Clark et al., 2010) [EN]

(16) First, as suggested by many researchers (e.g., Siegler, 1996), **it is *important* to** take into account multiple-strategy use and children's skills at selecting […]

(17) According to one of the neuroscientists interviewed, most schools are happy to participate in research studies because they realize that "they can contribute to ***important* research**." [EN]

(18) Only 18% of teachers reported that they had heard of the term executive functions before completing the survey; however, 72% indicated they had some awareness that **these types of skills were *important***. [EN]

These different choices for types of evaluators when addressing the question: *Who is it important to?* can be represented in the following diagram:

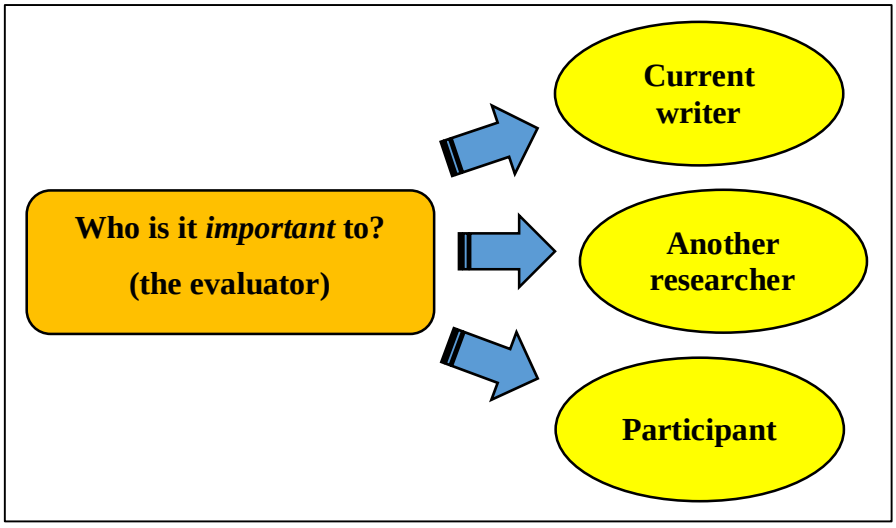


Figure 4.3 Who is it important to?: The evaluator

4.4.3 In which context is it important?

As pointed out by Bondi (2015, p. 168), the "relational nature of the concept of importance implies other significant semantic-pragmatic roles." Thus, evaluations of importance can be qualified by certain elements that delimit their *scope* or explain the *reason* or *purpose* for their importance. There are times when things are not important in themselves: they may be important "to the field, for the analysis, for a particular person, or in a particular process" (Bondi, 2015, p. 168). Most of the times there are no explicit clues in the text about the reason or scope of the evaluation, but the co-textual clues provide further information for their interpretation. If answers to questions like: *Why is it important? What is it important for? Where is it important? When is it important?* etc., can be answered from the information provided, a clearer idea of the evaluative context that surrounds the evaluation act is given. Although no clear-cut taxonomies have been provided due mainly to the ambiguity and variety of possible options, a thorough exploration of the cases in which some kind of additional information is provided has allowed me to identify three possible evaluative contexts.

First, there are times when additional information provides clues for the identification of a *research-related* evaluative context, as in the following examples:

(19) We determined the brain responses in reaction to the mere occurrence of the four types of representation. This is ***important*** **because** the four types differed in number of elements, complexity, colour, and luminance. [EN]

(20) Recently, Arnold and McDermott [2] stressed the importance of distinguishing these direct effects from other indirect, or mediated effects of testing (also see [51]) when research paradigms include restudy opportunities and/or feedback that re-presents the material. This is particularly ***important*** **as** it is under such conditions that the greatest effects of testing on memory performance typically are observed. [EN]

In these cases, the reasons why, purposes for, or processes in which something is important are purely related to the more local research context. However, there are times when the additional information given refers to purely disciplinary (or better said, interdisciplinary) matters, whether this is concerned with disciplinary fields themselves or with any of their protagonists. In those cases, a *disciplinary-related* evaluative context is provided.

(21) Given the role of cotton textiles in nineteenth century industrialization, explaining its location is clearly an ***important*** task for economic history. [EH]

(22) Hence, just when a work-around is a supported form of use, and when it is not, becomes a crucial question that has obvious resource implications, and this in itself makes it an ***important*** topic for the sociology of technology. [STS]

(23) These are all ***important*** strategies in the quest for a better bioethics. [STS]

Finally, there are still other cases in which the additional information given permits to identify an even evaluative wider context, which is more connected with the real world and its problems. In most of these cases, a context of *applicability* is clearly seen. When clues to identify elements of this context are provided, we might be talking about a *real-word-related* context, as in the following examples:

(24) Thus, understanding the mechanisms underlying reading acquisition during development is an ***important*** endeavor for education and public policy. [EN]

(25) If applied ethics wants to generate useful solutions to real world ethical problems, it is ***important*** that the solutions suggested not stray away too far from the normative beliefs held by the people affected by the normative proposal. [STS]

It is important to highlight that sometimes the real-world and disciplinary related contexts cannot be easily separated, since, as stated before, one of the main aims of interdisciplinary knowledge forms is to provide solutions for real-world problems. Furthermore, it is essential to make clear that additional information that helps to identify a more specific evaluative context is not always given. Only in the cases in which those clues are provided, the three mentioned types of contexts can be identified. These choices are represented in the following diagram:

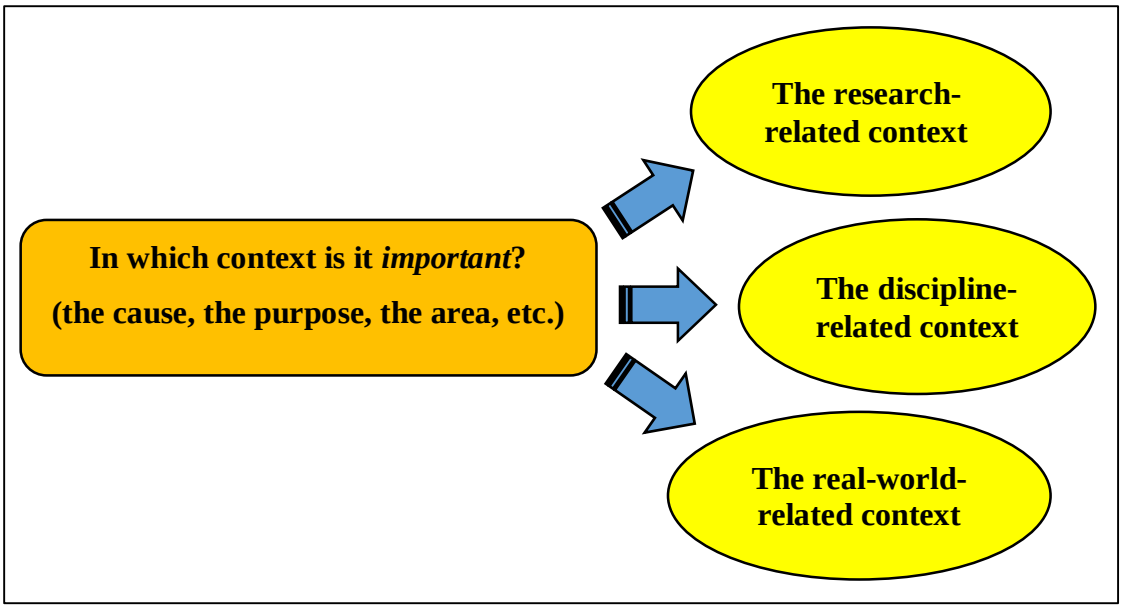


Figure 4.4 In which context is it important?: The evaluative context

To conclude, the development of this tripartite model in which the evaluated thing, the evaluator, and the evaluative context can be examined in detail might prove beneficial in the sense that it is through the interweaving of the choices from each of the three dimensions that different evaluative meanings of importance are created. In order to explore those meanings, each occurrence of the adjective *important* has been scrutinised along the three dimensions. As for the way in which this analysis has been carried out, the grammatical patterns in which the adjective occurs constitute the organisational framework for the analysis. On top of that, it is hypothesised that the use of one pattern over the others can tell something about which evaluative dimension/s is/are more or less highlighted in each case.

4.5 Grammar patterns and evaluative dimensions

In this section, a detailed analysis of the ways in which the adjective *important* occurs along each grammar pattern according to the choices from the three dimensions of the model proposed will be presented. The cases for every choice from each dimension in each pattern have been counted and presented in individual tables for illustrative purposes only. Nevertheless, a general reporting of the findings for each pattern is given. However, it is only at the end of this section, that is, when all the cases for each dimension are counted together, that the useful information for interpretive purposes is obtained.

4.5.1 Pattern 1: ADJ + noun (Attributive use)

When adjectives are followed by a noun, they are usually called *attributive* adjectives. According to Biber et al. (1999, p. 515), adjectives "enhance the information provided by a noun" when used attributively. Thus, studying the nature of the different nouns evaluated, which stand for the evaluated things, might provide useful information to understand what is evaluated, as shown below.

Educational Neuroscience			Economic History			Science & Technology Studies		
Order	**Noun**	**Tokens**	**Order**	**Noun**	**Tokens**	**Order**	**Noun**	**Tokens**
1st	role	19	1st	role	18	1st	aspect	10
2nd	question	4	2nd	factor	9	2nd	role	9
3rd	aspect	3	3rd	source	8	3rd	issue	8
	component	3	4th	issue	7		part	8
	factor	3	5th	determinant	6	4th	implication	7
	implication	3	6th	aspect	5	5th	determinant	6
	issue	3		feature	5		difference	6
	predictor	3	7th	component	4		factor	6
	ways	3		insight	4		point	6
4th	connection	2		part	4	6th	dimension	5
	effect	2		task	4		source	5
	event	2		variable	4	7th	consideration	4
	evidence	2	8th	concern	3	8th	distinction	3
	finding	2		consequence	3		form	3
	information	2		contribution	3		influence	3
Others (1 token)		31		difference	3		insight	3
Total		87		element	3		other	3
				event	3		variable	3
				implication	3		way	3
				limitation	3	9th	area	2
				mechanism	3		construct	2
				merchant	3		contribution	2
				reason	3		discovery	2
			9th	caveat	2		document	2
				center	2		feature	2
				change	2		information	2
				considearti on	2		problem	2
				detail	2		question	2
				effect	2		respect	2
				evidence	2		right	2
				example	2		strategy	2
				gap	2		topic	2
				increase	2	Others (1 token)		53
				input	2	Total		180
				period	2			
				position	2			
				question	2			
				study	2			
				topic	2			
				variation	2			
			Others (1 token)		60			
			Total		205			

Table 4.6 The most common nouns occurring in the 'ADJ + noun' pattern (Attributive use)

Table 4.6 shows the most frequent nouns that are modified by *important* in an attributive way in the three interdisciplines. They have been ranked according to their frequencies from the most to the least frequent and those nouns which occur only once were grouped together under the label of *others*. Findings show that the most frequently encountered nouns which

are preceded by the adjective *important* are all *metacognitive* (Bondi, 2015), general items such as *role*, *part*, *source*, *question*, *feature*, *issue*, *component*, *aspect*, *factor*, etc. In all those cases, the noun that *important* modifies is a general noun that refers to the more specific subject of the clause, which is the actual entity evaluated. These nouns can be used either as "backward-pointing" devices, that is, reinforcing the significance of what has been pointed out before, as in example (26) or as "forward-pointing" devices (Bondi, 2015, p. 173), that is, introducing the reader to something relevant explained in greater depth afterwards, as in example (27):

(26) Withdrawal is another ***important* issue** while exploring biobank consent document policy. [STS]

(27) Another ***important* aspect** of responsibility in care ethics is related to the notion of responsibility ascription, i.e., deciding who is responsible. [STS]

In cases of more concrete nouns such as *findings, evidence, variables, result,* etc., the evaluated entity is the noun that the adjective modifies. This is even more clear when the nouns are typical disciplinary lexical items, like *connection, ramification* and *skill* in Educational Neuroscience, *change, period* and *region* in Economic History, or *genotype, legislation* and *discovery* in Science & Technology Studies, to give some examples.

Whether as metacognitive, general nouns, or as more concrete ones, the evaluative acts performed can be classified as TOE, ROE and DOE, as previously explained, so as to make clear *what* is evaluated. For instance, in examples (26) and (27) above, both evaluated things are topic-oriented (TOE), that is, they refer to the area under investigation rather than to the investigation itself.

However, in example (28) below the evaluated thing is part of the research process or method (*variable*) while in example (29), this is part of the research product (*finding*), although both represent research-oriented (ROE) cases. A further distinction is made between these two examples, since in (28) the reference is made to the current research but in (29) the evaluated thing is part of previous research.

(28) Therefore, even though the children and the teachers at this particular school participated in the observation throughout the intervention period, the most ***important* dependent variable** could not be measured. [EN]

(29) This tendency is plausibly related to ***important* new findings** in the cognitive neuroscience of number processing: Nieder et al. [34,35] observed number-selective neurons in the monkey brain. [EN]

Finally, there are some other cases in which the evaluated thing is not a topic-oriented entity neither a research-oriented one. As explained before, evaluated entities can be more widely connected to disciplinary matters and actors, thus giving rise to disciplinary-oriented evaluations (DOE), such as in examples (30) and (31).

(30) Nevertheless, it is obvious that technological advances in the very field of medicine and health care are an ***important* source** of moral problems and conflicts. [STS]

(31) Ethical concerns play an ***important* role** in public reactions to genetic engineering. [STS]

As for the second question, that is, who the evaluated thing is important to, evaluations are averred by the current writer, whether implicitly as in most cases or more explicitly as in example (32), attributed to other researchers (33), or attributed to participants of the research process (34):

(32) Although many of the main public recommendations of the HERP were not incorporated into the policy, I argue that the committee played an ***important* role** in facilitating resolution of the political problem of […]. [STS]

(33) Gavin Wright (2006, p. 69) notes that "An ***important* component** of planter mobility was the capacity to establish and maintain credit relationships across long distances, arrangements ultimately based on the asset value and liquid character of slave property." [EH]

(34) Thirty-seven respondents (13.3%) affirmed or implied that possession of good interpersonal skills was the most ***important* non-technical aspect** of being a responsible engineering professional in today's society. [STS]

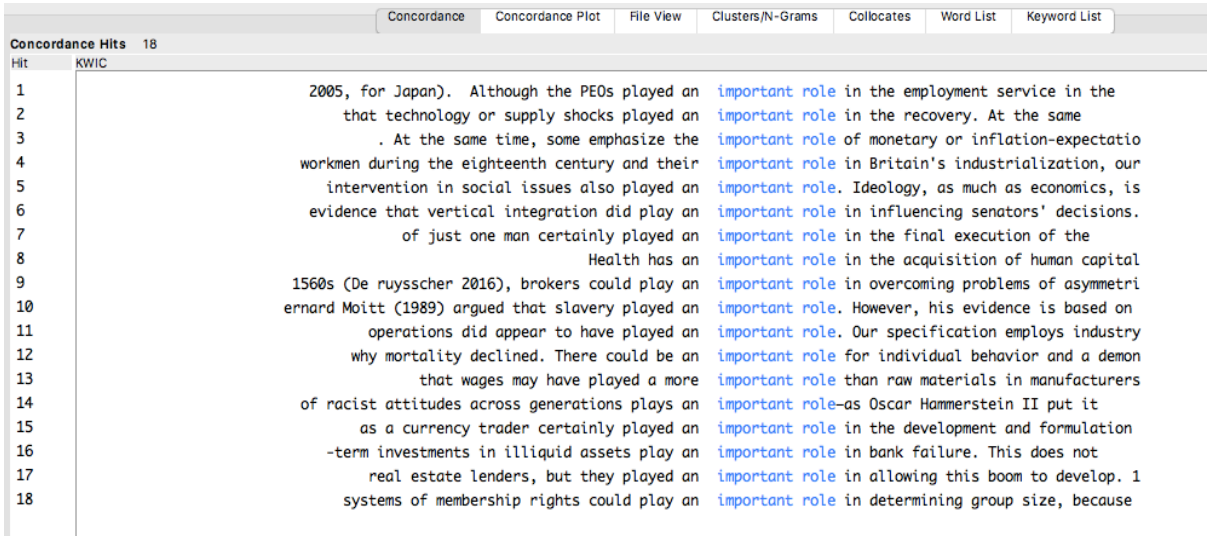
Finally, as regards the context in which the evaluated thing is important, some very interesting insights can be derived from the analysis of the most frequent evaluated noun: *role.* As pointed out before, *role* is a metacognitive, rather general noun which refers to another, more concrete noun that constitutes the evaluated thing in itself. It is usually embedded in the idiomatic expressions *play an important role*, or *have an important role*, as

screenshots from the concordances in Educational Neuroscience, Economic History, and Science & Technology Studies respectively show below:

Concordance | Concordance Plot | File View | Clusters/N-Grams | Collocates | Word List | Keyword List

Concordance Hits 16

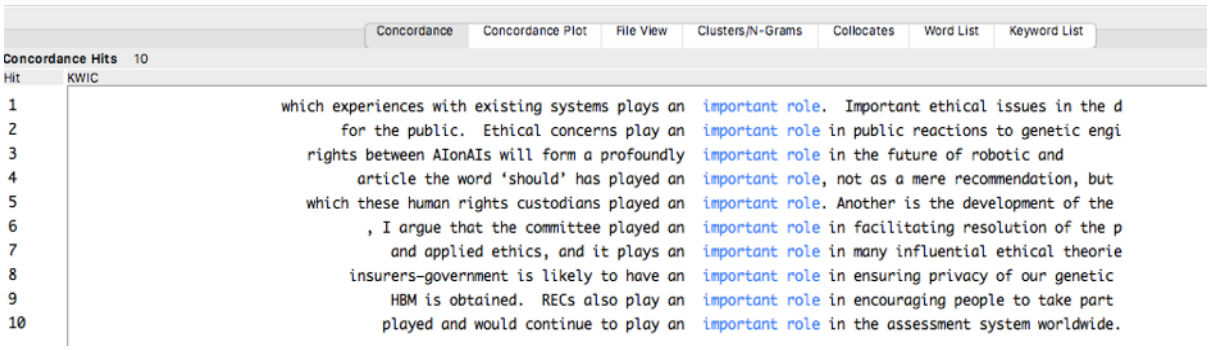
Hit	KWIC		
1	authors conclude: "[…] Media clearly play an	important role	in the current epidemic of
2	general skills (especially EF) play an	important role	in strategy selection. Specifi- call
3	that the ANS still plays an	important role	in adult arithmetical processing in
4	, which is known to play an	important role	in mathematical abilities [11,28,33
5	learn Arabic numbers, which plays an	important role	in acquisition of more sophisticate
6	information in working memory plays an	important role	in the development of numerical
7	below. Research has pointed towards an	important role	of the anterior intraparietal sulcu
8	that experience with numbers plays an	important role	in the development and refinement
9	and semantic memory systems play an	important role	in long-term memory formation
10	from the anterior insula play an	important role	in attention and control during
11	, mental rotation skills also play an	important role	in the learning of and
12	and represent numerical magnitudes, plays an	important role	in mathematical difficulties (e.g.,
13	that the AC had played an	important role	, but it was not clear
14	it is tempting to attribute an	important role	to motivation in learning success,
15	finding of executive function playing an	important role	in risk-taking behavior during
16	that the fusiform area plays an	important role	in visual word recognition (Price



Concordance | Concordance Plot | File View | Clusters/N-Grams | Collocates | Word List | Keyword List

Concordance Hits 18

Hit	KWIC		
1	2005, for Japan). Although the PEOs played an	important role	in the employment service in the
2	that technology or supply shocks played an	important role	in the recovery. At the same
3	. At the same time, some emphasize the	important role	of monetary or inflation-expectatio
4	workmen during the eighteenth century and their	important role	in Britain's industrialization, our
5	intervention in social issues also played an	important role	. Ideology, as much as economics, is
6	evidence that vertical integration did play an	important role	in influencing senators' decisions.
7	of just one man certainly played an	important role	in the final execution of the
8	Health has an	important role	in the acquisition of human capital
9	1560s (De ruysscher 2016), brokers could play an	important role	in overcoming problems of asymmetri
10	ernard Moitt (1989) argued that slavery played an	important role	. However, his evidence is based on
11	operations did appear to have played an	important role	. Our specification employs industry
12	why mortality declined. There could be an	important role	for individual behavior and a demon
13	that wages may have played a more	important role	than raw materials in manufacturers
14	of racist attitudes across generations plays an	important role	–as Oscar Hammerstein II put it
15	as a currency trader certainly played an	important role	in the development and formulation
16	-term investments in illiquid assets play an	important role	in bank failure. This does not
17	real estate lenders, but they played an	important role	in allowing this boom to develop. 1
18	systems of membership rights could play an	important role	in determining group size, because



Concordance | Concordance Plot | File View | Clusters/N-Grams | Collocates | Word List | Keyword List

Concordance Hits 10

Hit	KWIC		
1	which experiences with existing systems plays an	important role	. Important ethical issues in the d
2	for the public. Ethical concerns play an	important role	in public reactions to genetic engi
3	rights between AIonAIs will form a profoundly	important role	in the future of robotic and
4	article the word 'should' has played an	important role	, not as a mere recommendation, but
5	which these human rights custodians played an	important role	. Another is the development of the
6	, I argue that the committee played an	important role	in facilitating resolution of the p
7	and applied ethics, and it plays an	important role	in many influential ethical theorie
8	insurers–government is likely to have an	important role	in ensuring privacy of our genetic
9	HBM is obtained. RECs also play an	important role	in encouraging people to take part
10	played and would continue to play an	important role	in the assessment system worldwide.

In all these cases, the whole sentence is usually made of the concrete evaluated thing followed by the expression *play/have an important role*. After that, it is very common to find additional prepositional phrases which indicate the context *in* or *for* which the evaluated thing is given an *important role*:

(35) Third, episodic and semantic memory systems **play an *important* role in** long-term memory formation and generalization beyond individual problem attributes. [EN]

In example (35), the *episodic and semantic memory systems* are the actual evaluated things, although they act as forward-pointing devices to introduce the reader to the processes in which these entities *play an important role*, which is this case are *long-term memory formation and generalization beyond individual problem attributes.*

In the following sentence, a reversed case is observed:

(36) The design and development of battery cages is an incremental process in which experiences with existing systems **plays an *important* role**.

In this case, the *experiences with existing systems* are the evaluated things, although they act as backward-pointing devices reinforcing the significance of what has been pointed out before, that is, the process itself in which they *play and important role*, which is *the design and development of battery cages.*

In most of the cases in which the expression *play/have and important role* occurs, contextual information about a process in which the evaluated things is important is given, which is usually research-related, as in the examples provided.

However, it is not very frequent to find contextual information when *important* collocates with other nouns apart from *role*. Sometimes, though, additional prepositional clauses are added, especially with *for*, as in the following examples:

(37) The determinants and analysis of the special interest's decision to either side with the colony or ask the empire to repress it is an ***important* topic for** further research. [EH]

(38) How exactly this process goes wrong in dyscalculia and in low-SES populations is an ***important* question for** future research. [EN]

When phrases such as *for future/further research* are added, it is clear that the context is research-related too. However, the information about the context sometimes opens up

towards disciplinary matters, as clearly shown in examples (39) and (40), whose contexts might be labelled as discipline-related:

(39) Given the role of cotton textiles in nineteenth century industrialization, explaining its location is clearly an ***important* task *for economic history***. [EH]

(40) Identifying ethical dilemmas in each sphere and being instructed with strategies to effectively deal with them are ***important* considerations *for engineering ethics***. [STS]

Finally, there are some other cases in which information about the real-world-related context is provided, usually with nouns such as *implications, endeavor, consequences*, etc.

(41) Proficient mathematical learning represents a key aspect of academic achievement and it is also an ***important* skill *for the 21st century competitive workforce***. [EN]

(42) When I am using a normal human-driven car, the choices I will make can have ***important* implications *for other individuals in the car and on the street***. [STS]

(43) The fact that technology allows for such superstar markets has ***important* implications *for what we do outside of work.*** [STS]

(44) Thus, understanding the mechanisms underlying reading acquisition during development is an ***important* endeavour *for educational public policies***. [EN]

To conclude, every instance of the adjective *important* occurring in attributive position has been classified according to the choices provided for each category: the evaluated thing, the evaluator and the evaluative context in the three interdisciplinary sub-corpora. Results have been summarised in the following tables, in which when referring to the evaluated thing *CR* stands for current research while *PR* stands for previous research:

Pattern 1: *ADJ + noun*		"What?" The evaluated thing						TOTAL
		TOE	ROE				DOE	
			Process (CR)	Process (PR)	Product (CR)	Product (PR)		
Educational Neuroscience	tokens	69	4	1	9	1	0	84
	%	82.14%	4.76%	1.19%	10.71%	1.19%	0.00%	100%
Economic History	tokens	172	10	2	6	5	0	195
	%	88.21%	5.13%	1.03%	3.08%	2.56%	0.00%	100%
Science & Technology Studies	tokens	162	5	0	3	3	14	187
	%	86.63%	2.67%	0.00%	1.60%	1.60%	7.49%	100%
TOTAL	tokens	403	19	3	18	9	14	466
	%	86.48%	4.08%	0.64%	3.86%	1.93%	3.00%	100%

Table 4.7 Pattern 1: The evaluated thing in the three interdisciplines

Findings show that when the adjective *important* is placed in an attributive position, the evaluated thing is most of the times an entity which refers to the topic researched (TOE) in the three cases. Then, research-oriented (ROE) evaluated entities follow in frequency in Educational Neuroscience and Economic History. If taking into account the four variables: whether the evaluated entities are processes or products and whether they are part of the current research or of previous research, it is clear that processes that occur in the current research are mostly given importance. In both interdisciplines, no cases of discipline-oriented (DOE) evaluations were encountered. The case for Science & Technology Studies is different, since the percentage of DOE cases is higher than the percentage of ROE ones, which might constitute the most important difference for interpretative purposes.

Pattern 1: *ADJ + noun*		"Who?" The evaluator			TOTAL
		Current writer	Others		
			Researcher	Participant	
Educational Neuroscience	tokens	63	18	3	84
	%	75.00%	21.43%	3.57%	100%
Economic History	tokens	175	20	0	195
	%	89.74%	10.26%	0.00%	100%
Science & Technology Studies	tokens	163	14	10	187
	%	87.17%	7.49%	5.35%	100%
TOTAL	tokens	401	52	13	466
	%	86.05%	11.16%	2.79%	100%

Table 4.8 Pattern 1: The evaluator in the three interdisciplines

As regards who the evaluated thing is important to, a much higher frequency of cases in which the current writer is the evaluator is clearly observed in the three fields. However, other researchers are also visible in Educational Neuroscience, while they are less visible in

Economic History and Science & Technology Studies respectively. Another important difference is given by the fact that in both, Educational Neuroscience and Science & Technology Studies, participants of the research process have a role as evaluators sometimes, while this does not occur in Economic History.

Pattern 1: ***ADJ + noun***		**"Why? What for? Where? When?" The context**				**TOTAL**
		Research-related	**Discpline-related**	**Real world-related**	**No context given**	
Educational Neuroscience	**tokens**	20	2	7	55	**84**
	%	23.81%	2.38%	8.33%	65.48%	**100%**
Economic History	**tokens**	10	2	2	181	**195**
	%	5.13%	1.03%	1.03%	92.82%	**100%**
Science & Technology Studies	**tokens**	9	4	6	168	**187**
	%	4.81%	2.14%	3.21%	89.84%	**100%**
TOTAL	**tokens**	**39**	**8**	**15**	**404**	**466**
	%	**8.37%**	**1.72%**	**3.22%**	**86.70%**	**100%**

Table 4.9 Pattern 1: The evaluative context in the three interdisciplines

Finally, no additional clues are given that help to describe a more specific evaluative context most of the times in the three cases, although a higher percentage of instances in which additional information serves to describe a research-related context or a real-world-related context is seen in Educational Neuroscience in comparison with the other two interdisciplines.

4.5.2 Pattern 2: v-link + ADJ (Predicative use)

When adjectives follow a link verb, they are usually called predicative adjectives. When in predicative position, the presence of the writer is more evident since he or she is "more openly visualized as the source of the qualifying statement" (Soler, 2002, p. 153). Predicative uses, in general, also "foreground the value claim" by placing the evaluative category, *important* in this case, "in rhematic position" (Giannoni, 2010, p. 106). Predicative adjectives are often followed by a complementation pattern, that is: a prepositional phrase, a finite, or a non-finite clause. These cases will be analysed as part of separate patterns in the sections that follow. In this section, the focus will be placed upon predicative cases without complementation, as in the following examples:

(45) There is also some similarity with the situation among Venetian glass-manufacturing artisans examined by Trivellato where, she noted, 'a very flexible economic stratification was able to coexist with a rigid hierarchy', and in which **individual negotiation was very *important.*** [EH]

(46) Overall, the association is stronger for the paternal grandfather than for the maternal grandfather, even though **they are both *important***. [EH]

A common feature in this pattern is the use of the demonstrative pronoun *this* as a cohesive device that encapsulates a whole previous statement, which is indeed the evaluated thing:

(47) We determined the brain responses in reaction to the mere occurrence of the four types of representation. ***This* is *important*** because the four types differed in number of elements, complexity, colour, and luminance. [EN]

(48) Recently, Arnold and McDermott [2] stressed the importance of distinguishing these direct effects from other indirect, or mediated effects of testing (also see [51]) when research paradigms include restudy opportunities and/or feedback that re-presents the material. ***This* is** particularly **important** as it is under such conditions that the greatest effects of testing on memory performance typically are observed. [EN]

Furthermore, as observed in examples (47) and (48), a reason clause might follow after the adjective. This clause usually starts with *because*, *as*, and *since*, or expressions like *given that*. It is clear that in these cases contextual information about the reason/s why the evaluated entity is *important* are given. While in examples (47) and (48) the contextual information is research-related, in examples (49) and (50) the information provided is related with the real-world context and in example (51) this information is related with disciplinary matters.

(49) In this article, we shall discuss the 'tussle theory' suggested by Clark et al. (2005) and add further complexity to the 'baking-in theory' supported by Brown et al. (2010). These previous theories **are *important*** because they pinpoint the tension in the debate, namely whether protocols and standards made by SDOs should be used to enable the actualisation of human rights in current times. [STS]

(50) Filling this knowledge gap **is *important*** not only because protocols and standards shape the Internet, but also because the software and hardware that define the infrastructure of cyberspace are increasingly perceived to have the same power in society as law (Lessig 2006). [STS]

(51) Such involvement may also reveal where communities place large-scale genetic databases in their moral, spiritual or religious frameworks, as well as the ways in which the public is grouped. This **is *important*** because this information might be decisive for framing the future of genetics**.** [STS]

As regards the question about what is important, it must be acknowledged that in this pattern most of the the evaluated entities are topic-oriented (TOE). Although no cases of disciplinary-oriented evaluations (DOE) were encountered, some cases in which research-oriented evaluation (ROE) takes place occur, as in examples (49) and (50) above where *previous theories* and *knowledge gaps* are the evaluated things, or as in example (52) referred to *experiments.*

(52) Such experiments **are *important*** because schools and/or teachers generally self-select AI instruction, raising the possibility that differences in student outcomes may be the result of selection bias. [EN]

Finally, the current writer is the evaluator most of the times. However, other researchers, as in examples (53) and (54), as well as participants of the research process, as in examples (55) and (56) can occupy that role:

(53) Martinson et al. (2006) investigations **are *important*** because they turn our attention toward the often neglected experiences of scientists regarding common behaviour that they see as problematic. [STS]

(54) As the Internet becomes more globalised, and increasingly impacts all aspects of society, understanding who has the power to decide how the Internet's architecture is managed **becomes** evermore ***important***, as suggested by previous literature (Lessig 2006; Mueller 2004, 2010; Zittrain 2008). [STS]

(55) Only 18% of teachers reported that they had heard of the term 'executive functions' before completing the survey; however, 72% indicated they had some awareness that these types of skills **were *important***. [EN]

(56) Some of these respondents also believe that attending to the consequences of one's engineering work **is *important***, but they apparently believe that […]. [STS]

As previously done, all the instances where the adjective *important* was found in this pattern were classified according to the categories provided, as shown in the following tables:

Pattern 2: *v-link + ADJ*		"What?" The evaluated thing						TOTAL
		TOE	ROE				DOE	
			Process (CR)	Process (PR)	Product (CR)	Product (PR)		
Educational Neuroscience	**tokens**	14	1	0	0	0	0	**15**
	%	93.33%	6.67%	0.00%	0.00%	0.00%	0.00%	**100%**
Economic History	**tokens**	34	0	0	0	0	0	**34**
	%	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%	**100%**
Science & Technology Studies	**tokens**	34	0	2	0	0	0	**36**
	%	94.44%	0.00%	5.56%	0.00%	0.00%	0.00%	**100%**
TOTAL	**tokens**	**82**	**1**	**2**	**0**	**0**	**0**	**85**
	%	**96.47%**	**1.18%**	**2.35%**	**0.00%**	**0.00%**	**0.00%**	**100%**

Table 4.10 Pattern 2: The evaluated thing in the three interdisciplines

As stated before, it is evident that this pattern is widely used in cases in which the evaluated entity refers to the research topic. Only very occasionally a few cases in which research processes which are part of the current or previous research have been encountered in Educational Neuroscience and Science & Technology Studies articles, while no cases of DOE occur in any of the sub-corpora.

Pattern 2: *v-link + ADJ*		"Who?" The evaluator			TOTAL
		Writer	Others		
			Researcher	Participant	
Educational Neuroscience	**tokens**	10	1	4	**15**
	%	66.67%	6.67%	26.67%	**100%**
Economic History	**tokens**	32	2	0	**34**
	%	94.12%	5.88%	0.00%	**100%**
Science & Technology Studies	**tokens**	32	2	2	**36**
	%	88.89%	5.56%	5.56%	**100%**
TOTAL	**tokens**	**74**	**5**	**6**	**85**
	%	**87.06%**	**5.88%**	**7.06%**	**100%**

Table 4.11 Pattern 2: The evaluator in the three interdisciplines

This time again the evaluators are most of the times the writers of the articles in the three cases. However, evaluated things are important for participants of the research process at times, a trend which is more marked in Educational Neuroscience in comparison with Science & Technology Studies but which does not occur in Economic History at all. The frequency of other researchers as evaluators is similar in the three fields.

Pattern 2: *v-link + ADJ*		"Why? What for? Where? When?" The context				TOTAL
		Research-related	Discpline-related	Real world-related	No context given	
Educational Neuroscience	**tokens**	3	0	2	10	**15**
	%	20.00%	0.00%	13.33%	66.67%	**100%**
Economic History	**tokens**	11	0	0	23	**34**
	%	32.35%	0.00%	0.00%	67.65%	**100%**
Science & Technology Studies	**tokens**	8	0	3	25	**36**
	%	22.22%	0.00%	8.33%	69.44%	**100%**
TOTAL	**tokens**	**22**	**0**	**5**	**58**	**85**
	%	**25.88%**	**0.00%**	**5.88%**	**68.24%**	**100%**

Table 4.12 Pattern 2: The evaluative context in the three interdisciplines

As for the third question, no additional evaluative context is given most of the times in the three interdisciplines. However, clues that reveal a research-related context are present at times in Economic History, followed by Science & Technology Studies and Educational Neuroscience in similar proportions. In these two last interdisciplines, cases in which additional information from the real-world context is given also appear, which does not occur in Economic History.

4.5.3 Pattern 3: v-link + ADJ + PREP

As stated before, when evaluative adjectives like *important* are used in predicative positions, they can be followed by a prepositional phrase. The prepositional phrase might consist of the propositions *for* or *in* and a noun group, as in example (57) or an *–ing* clause, as in (58):

(57) Accessing a stored motor program of a letter-form may also be ***important* for** the process of letter identification. [EN]

(58) In analogy with the CPI, the information for Hamburg appears ***important* in** causing heteroscedasticity. [EH]

When exploring the evaluated thing, topic-oriented evaluations (TOE) mostly occur, as examples (57) and (58) show. In fact, only one case of research-oriented (ROE) evaluation was found, which is shown in example (59), and no cases of discipline-oriented (DOE) evaluations were encountered.

(59) This result may be ***important* for** the early detection of neurodevelopment disorders such as DD because this dyslexion alters the VWFA's activation (e.g., Hoeft et al., 2007). [EN]

As for who the evaluator is, the three cases proposed are present: the evaluator is the current writer, as in all previous examples, or the evaluator is another researcher, as in example (60) or a participant of the research process, as in (61):

(60) For example, Neuenschwander and colleagues [23] found effortful control and EF to be independently ***important* in** improving early learning success and good classroom adjustment in children making the transition to school life. [EN]

(61) Results show that 94% of respondents considered the CARTaGENE Project ***important* for** the Quebec population. [STS]

Finally, it is clear that the sole presence of a prepositional phrase adds information about a process, a person or group of people, a particular time or period of time, a place, or a situation most of the times. However, this does not mean that this information always provides additional clues to locate the evaluation of importance within specific research-related, discipline-related, or real-world-related contexts. For instance, in most of the cases in which a prepositional phrase starting with *in* is used in Economic History articles, the information added is a place, a particular date or a period of time which does not add anything about the evaluative context of importance; rather, it shows complementary information about the evaluated thing, as in these examples:

(62) A second main finding is that government wealth has always been ***important* in** Sweden. [EH]

(63) However, the role of public employment offices was ***important* in** the early twentieth century. [EH]

There are other cases in which the information provided by the prepositional phrase does add additional clues of more specific contexts of evaluation. For instance, examples (64) and (65) give information about a research-related context:

(64) Trust is also assumed to be ***important* in** the research setting of the investigator-subject relationship (Kass & Sugarman, 1996). [EN]

(65) Individuals often have multiple observations on occupation (average about 3) and earnings (average about 13) in the registers. Having these multiple observations is especially ***important* for** the study of income mobility because single measures of income tend to exaggerate measurements of mobility (Solon 1992). [EH]

Furthermore, additional information about a discipline-related context is given in example (66):

(66) Technological mediation is ***important* for** the ethics of engineering design since it concerns human actions, whereas ethics is about the moral question of how to act. [STS]

Finally, a real-word-related evaluative context is provided in the examples that follow, in which a clear sense of applicability is perceived:

(67) Both factors are crucial for learning and memory, activities that are vitally ***important* in** schools, where students have to focus on tasks, pay attention, think critically and acquire new knowledge and skills. [EN]

(68) The ability to delay gratification is particularly ***important* in** educational contexts, as education is by nature a future-oriented investment. [EN]

(69) The Internet is becoming increasingly ***important* for** enabling and inhibiting human rights, most obviously for rights like freedom of expression, access to information and freedom of assembly (Dutton 2011; UNESCO, 2015). [STS]

(70) Results indicate that the CARTaGENE Project is perceived to hold promise for all of society; to represent an important event with concrete spin-offs for society; and to be ***important* for** the future in terms of prevention and treatment of disease, and, therefore to have a positive impact on the healthcare system. [STS]

(71) The existence of an independent ethics committee ensures that the interests and concerns of the community are represented, and the participation of laypersons is ***important* in** ensuring that the public can have confidence in the system for oversight of biomedical research. [STS]

It has also been observed that, in some occasions, additional information about the context is not only given by the prepositional phrase itself but it is also reinforced by a following reason clause starting with *because, since, as,* etc. as in examples (59), (65), (66) and (68) above.

As done before, every case of *important* as occurring in this pattern has been classified and results are presented as follows:

Pattern 3: *ADJ + prep*		"What?" The evaluated thing						TOTAL
		TOE	ROE				DOE	
			Process (CR)	Process (PR)	Product (CR)	Product (PR)		
Educational Neuroscience	**tokens**	47	1	0	0	0	0	**48**
	%	97.92%	2.08%	0.00%	0.00%	0.00%	0.00%	**100%**
Economic History	**tokens**	32	0	0	0	0	0	**32**
	%	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%	**100%**
Science & Technology Studies	**tokens**	16	0	0	0	0	0	**16**
	%	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%	**100%**
TOTAL	**tokens**	**95**	**1**	**0**	**0**	**0**	**0**	**96**
	%	**98.96%**	**1.04%**	**0.00%**	**0.00%**	**0.00%**	**0.00%**	**100%**

Table 4.13 Pattern 3: The evaluated thing in the three interdisciplines

As observed, nothing else can be added about the nature of the evaluated thing, since all cases except one in Educational Neuroscience are part of topic-oriented evaluations (TOE).

Pattern 3: *ADJ + prep*		"Who?" The evaluator			TOTAL
		Writer	Others		
			Researcher	Participant	
Educational Neuroscience	**tokens**	40	8	0	**48**
	%	83.33%	16.67%	0.00%	**100%**
Economic History	**tokens**	30	2	0	**32**
	%	93.75%	6.25%	0.00%	**100%**
Science & Technology Studies	**tokens**	15	0	1	**16**
	%	93.75%	0.00%	6.25%	**100%**
TOTAL	**tokens**	**85**	**10**	**1**	**96**
	%	**88.54%**	**10.42%**	**1.04%**	**100%**

Table 4.14 Pattern 3: The evaluator in the three interdisciplines

As regards the evaluator, the current writer performs this role most of the times in the three cases, while other researchers are given the responsibility sometimes in Educational Neuroscience and fewer times in Economic History. As for Science & Technology Studies, the role of evaluator is never performed by another researcher, but there is a case in which a participant of the research process takes this role.

Pattern 3: *ADJ + prep*		"Why? What for? Where?" etc. The context				TOTAL
		Research-related	Discpline-related	Real world-related	No context given	
Educational Neuroscience	**tokens**	15	0	11	22	**48**
	%	31.25%	0.00%	22.92%	45.83%	**100%**
Economic History	**tokens**	8	0	0	24	**32**
	%	25.00%	0.00%	0.00%	75.00%	**100%**
Science & Technology Studies	**tokens**	2	1	3	10	**16**
	%	12.50%	6.25%	18.75%	62.50%	**100%**
TOTAL	**tokens**	**25**	**1**	**14**	**56**	**96**
	%	**26.04%**	**1.04%**	**14.58%**	**58.33%**	**100%**

Table 4.15 Pattern 3: The evaluative context in the three interdisciplines

Finally, when additional information about the evaluative context was given, the most important finding is the fact that research-oriented and real-world-oriented contexts were provided in Educational Neuroscience articles more frequently than in the other interdisciplines.

4.5.4 Pattern 4: It + v-link + ADJ + that

This is one type of *introductory-it* patterns (Francis, 1993). These patterns begin with an introductory or anticipatory *it*, followed by a verb link, an adjective group and a finite or non-finite clause: a *-that* clause or a *to-infinitive* clause as for the cases encountered in the corpus. In both cases, the thing that is evaluated is realised by the clause following the adjective group (Hunston & Thompson, 2000). According to Francis et al. (1999, p. 518) introductory-*it* patterns "are the default option in stretches of text where there are two pieces of new information, but no old or given information with which to introduce them."

This type of introductory-*it* pattern which is followed by a *that*-clause is the least frequent in the whole corpus. From the cases encountered, the evaluated thing, which actually is the whole *that*-clause, has been mostly found as part of research-oriented evaluations (ROE), specially in the case of evaluating a process or methodological aspect, as in the examples that follow. In fact, this pattern has been acknowledged to "facilitate comment on research procedure and experimental actions" (Groom, 2005, p. 259).

(72) With respect to the current study, **it is *important* that** the afore-mentioned impressive numbers are suggested to be dealt with by means of numeracy interventions. [EN]

(73) Each 45 min session was held by an experienced neuropsychologist and a psychology trainee. Particular emphasis was placed on the proximal zone of development: **it was *important* that** the games were neither too easy, such as would risk causing boredom in the children, nor too difficult, such as would risk causing discouragement or dropping out. [EN]

(74) In creating a model, **it is *important* that** we are able to identify the relevant variables at work in a certain situation. [EH]

Only a few cases of topic-oriented (TOE) evaluations were found, as illustrated by this example:

(75) **It is *important* that** this argument is not misunderstood. The claim is that the kinds of machines that make widespread technological unemployment possible are also likely to be better (more accurate, more efficient, less prone to distortion or bias) at attaining the True and the Good. [STS]

Finally, some cases of discipline-oriented evaluations (DOE) have been also encountered, as in these examples:

(76) Given the pluralist base of many governments, **it is important that** bioethics presents itself and its methods as inclusive. [STS]

(77) With respect to the crossing of the boundary, some education professionals spoke about "a bridge to be built" and argued that **it was *important* that** the "two perspectives" [the neuroscience insights and their translation to daily activities of teachers in educational practice] are made clear. [EN]

As regards the possible evaluators, the current writer took that role most of the times, as in the previous examples, although participants were often encountered, as in the previous example and the one which follows:

(78) Several neuroscientists mentioned that they thought **it was *important* that** the public at large, but especially education professionals, should learn to be more critical toward media reporting of neuroscientific insights and toward commercial brain-based training methods. [EN]

The fact that in most cases in which an introductory-*it* pattern the evaluator is the current writer has been explained by Hunston (2011, p. 139), who points out that those patterns are typically used to express "performed" rather than "reported" evaluation, i.e. cases where "it is the writer/speaker who is the source of the evaluation."

Finally, information about the evaluative context was embedded within the content of the *that*- clause sometimes. A research-related context is perceived in example (79), while the context of (80) is more real-world-related. The case for example (81) is rather ambiguous, since disciplinary (*applied ethics*) but also real-world matters (*real-world ethical problems*) are present. However, the content of the *that*-clause is more related to the real world (*the normative beliefs held by people*).

(79) **It is *important* that** further work is done on the terms of research contracts. [STS]

(80) But **it is very *important* that** governments, universities, and industry itself realise that problems are arising due to the extremely rapid expansion of the partnership between universities and industry. [STS]

(81) If applied ethics wants to generate useful solutions to real world ethical problems, **it is *important* that** the solutions suggested not stray away too far from the normative beliefs held by the people affected by the normative proposal. [STS]

A summary of the results for the occurrence of *important* in this particular pattern are illustrated in the following tables. As the occurrences for this pattern are not abundant, a general comment is given for the three dimensions.

Pattern 4: ***it + ADJ + that***		**"What?" The evaluated thing**						**TOTAL**
		TOE	**ROE**				**DOE**	
			Process (CR)	**Process (PR)**	**Product (CR)**	**Product (PR)**		
Educational Neuroscience	**tokens**	0	2	0	0	0	3	**5**
	%	0.00%	40.00%	0.00%	0.00%	0.00%	60.00%	**100%**
Economic History	**tokens**	0	1	0	0	0	0	**1**
	%	0.00%	100.00%	0.00%	0.00%	0.00%	0.00%	**100%**
Science & Technology Studies	**tokens**	2	6	0	0	0	2	**10**
	%	20.00%	60.00%	0.00%	0.00%	0.00%	20.00%	**100%**
TOTAL	**tokens**	**2**	**9**	**0**	**0**	**0**	**5**	**16**
	%	**12.50%**	**56.25%**	**0.00%**	**0.00%**	**0.00%**	**31.25%**	**100%**

Table 4.16 Pattern 4: The evaluated thing in the three interdisciplines

Pattern 4: *it + ADJ + that*		"Who?" The evaluator			TOTAL
		Writer	Others		
			Researcher	Participant	
Educational Neuroscience	tokens	2	0	3	5
	%	40.00%	0.00%	60.00%	100%
Economic History	tokens	1	0	0	1
	%	100.00%	0.00%	0.00%	100%
Science & Technology Studies	tokens	10	0	0	10
	%	100.00%	0.00%	0.00%	100%
TOTAL	tokens	13	0	3	16
	%	81.25%	0.00%	18.75%	100%

Table 4.17 Pattern 4: The evaluator in the three interdisciplines

Pattern 4: *it + ADJ + that*		"Why? What for? Where?" etc. The context				TOTAL
		Research-related	Discpline-related	Real world-related	No context given	
Educational Neuroscience	tokens	0	3	0	2	5
	%	0.00%	60.00%	0.00%	40.00%	100%
Economic History	tokens	0	0	0	1	1
	%	0.00%	0.00%	0.00%	100.00%	100%
Science & Technology Studies	tokens	2	1	3	4	10
	%	20.00%	10.00%	30.00%	40.00%	100%
TOTAL	tokens	2	4	3	7	16
	%	12.50%	25.00%	18.75%	43.75%	100%

Table 4.18 Pattern 4: The evaluative context in the three interdisciplines

Findings show that this pattern is used in the three interdisciplines to express evaluations of importance of entities that are part of the current research (ROE), especially when referring to research processes or methods. Discipline-oriented evaluations (DOE) are also present in Educational Neuroscience and Science & Technology Studies. Most generally, the current writer is the evaluator, although participants are visible in Educational Neurosience. Finally, when evaluative contexts are more explicitly given, discipline-related information is present in Educational Neuroscience. In the case of Science & Technology Studies, information about the research, discipline and real-world contexts is given sometimes.

4.5.5 Pattern 5: it + v-link + ADJ + to-inf

According to Charles (2006), while the *it* v-link ADJ *that* is a pattern that evaluates propositions, as previously seen, the *it* v-link ADJ *to-inf* is a pattern that evaluates processes,

and by extension the agents of these processes. Furthermore, these patterns indicate that some action is important (Francis et al., 1998) and, by communicating to readers what is important to do, "the researcher signals procedural decisions recommended to the disciplinary community as advisable" (Giannoni, 2009, p. 206). Several cases occur in the corpus, for which different evaluated entities, evaluators and evaluative contexts can be identified.

As regards the evaluated thing, examples (82), (83) and (84) make reference to topic-oriented entities (TOE):

(82) Because mathematical abilities are crucial in modern Western societies (Chiswick, Lee, & Miller, 2003**), it is *important* to** gain insight into the cognitive processes underlying these difficulties. [EN]

(83) What are the neural correlates of human arithmetic proficiency? First, **it is *important* to** emphasize that arithmetic proficiency is not one single concept. [EN]

(84) Therefore**, it is *important* to** know more about the role of emotional factors in students' academic success. [EN]

Research-oriented evaluations (ROE) can be observed in the following examples, specifically referred to the research processes or methods rather than the products:

(85) Additionally, as in the present study only two classes were compared, we were unable to control for a number of variables that could have influenced results (e.g., teacher's personal and pedagogical styles). In this sense, **it would be *important* to** include more schools and classes in future studies to arrive to broader conclusions. [EN]

(86) Without a doubt, this study has opened new perspectives toward a practical application of enactment in foreign language teaching and learning. However, **it is *important* to** address some issues that might have influenced the results and therefore could be improved. [EN]

(87) Also, if we are to develop more complex statistical tests, for example, of coherence pattern analysis or complementary strategies of micro–macro developmental mapping, **it will be *important* to** increase the sample size of future studies.

Finally, cases of discipline-oriented evaluation (DOE) were also found, as in these examples:

(88) We argue that **it is *important* not only to** focus on the boundary between different scientific disciplines, **but to** also gain insight into the boundary of science and educational practice. [EN]

(89) If technologies are not moralized explicitly, after all, the responsibility for technological mediation is left to the designers only. Precisely, this would amount to a form of technocracy. A better conclusion would be that **it is *important* to** find a democratic way to moralize technology. [STS]

(90) Medical ethics is often thought to be in the vanguard of research in applied ethics; thus, **it is** particularly ***important*** in assessing the products of research in medical ethics **to** have a clear picture of the "applied" component of such research. [STS]

As regards who the evaluator is, the same cases were present again: the current writer, as in example (91), an external source, as in example (92), or a participant of the research process, as in example (93):

(91) We argue that **it is *important* to** view boundary work also in light of opportunities for bridging the gap, thereby […] [EN]

(92) First, as suggested by many researchers (e.g., Siegler, 1996), **it is *important* to** take into account multiple-strategy use and children's skills at selecting […] [EN]

(93) Many of the neuroscientists interviewed argued that **it was *important* to** invest more in training researchers to be able to […] [EN]

Finally, as regards the evaluative context provided, a reason was sometimes present through clauses beginning with phrases like *given that*, as in the following examples, which are both research-related:

(94) Therefore**, it seems *important* to** investigate how mindfulness practice improves attention in young people, given that this mechanism might have primary (attention) and secondary (emotion processing) outcomes. [EN]

(95) Given the risks associated with low number sense, **it is *important* to** find out what are the best methods to increase it, particularly in the preschool or kindergarten years. [EN]

In some other cases, information about the evaluative context is given by the preceding clause, which is connected with the purely evaluative one. As the examples show, the context of (96) is disciplinary-related while (97) refers to more real-world concerns. Example (98) is

an ambiguous one because of the reference to *engineers*, which is more disciplinary-related. However, this has to do more with details about the evaluator, while the previous clause starting with *it is clear that* and the reference to *problems* that *can be solved* reinforce a real-world-oriented context.

(96) If professionalization requires more than establishing professional organizations, then, in judging the development of STS activities**, it is *important* to** ask whether there are fundamental ingredients that bind this area of study together as a field of research. [STS]

(97) Therefore, while encouraging people to participate in biobanks, **it is also *important* to** inform them about the biobank's need to access their medical data. [STS]

(98) Overall it is clear that waste electronic recycling can greatly affect human life in areas contaminated by the products of recycling and, as engineers, **it is *important* to** consider how these problems can be solved. [STS]

Once again, the results obtained have been summarised, as Table 4.19 shows:

Pattern 5: ***it + ADJ + to-inf***		**"What?" The evaluated thing**						**TOTAL**
		TOE	**ROE**				**DOE**	
			Process (CR)	**Process (PR)**	**Product (CR)**	**Product (PR)**		
Educational Neuroscience	**tokens**	25	6	0	0	0	5	**36**
	%	69.44%	16.67%	0.00%	0.00%	0.00%	13.89%	**100%**
Economic History	**tokens**	10	2	0	2	0	0	**14**
	%	71.43%	14.29%	0.00%	14.29%	0.00%	0.00%	**100%**
Science & Technology Studies	**tokens**	27	0	0	0	0	2	**29**
	%	93.10%	0.00%	0.00%	0.00%	0.00%	6.90%	**100%**
TOTAL	**tokens**	**62**	**8**	**0**	**2**	**0**	**7**	**79**
	%	**78.48%**	**10.13%**	**0.00%**	**2.53%**	**0.00%**	**8.86%**	**100%**

Table 4.19 Pattern 5: The evaluated thing in the three interdisciplines

Findings show that topic-oriented evaluations (TOE) occur most of the times in the three sub-corpora. In Educational Neuroscience, however, cases of research-oriented (ROE) evaluations and disciplinary-oriented (DOE) ones are more frequent than in the other fields.

Pattern 5: *it + ADJ + to-inf*		"Who?" The evaluator			TOTAL
		Writer	Others		
			Researcher	Participant	
Educational Neuroscience	**tokens**	32	0	4	**36**
	%	88.89%	0.00%	11.11%	**100%**
Economic History	**tokens**	12	2	0	**14**
	%	85.71%	14.29%	0.00%	**100%**
Science & Technology Studies	**tokens**	29	0	0	**29**
	%	100.00%	0.00%	0.00%	**100%**
TOTAL	**tokens**	**73**	**2**	**4**	**79**
	%	**92.41%**	**2.53%**	**5.06%**	**100%**

Table 4.20 Pattern 5: The evaluator in the three interdisciplines

As regards who performs the evaluator role, a higher frequency of current writers is made visible in the three cases. The only noticeable feature is that participants as evaluators are only present in Educational Neuroscience.

Pattern 5: *it + ADJ + to-inf*		"Why? What for? Where?" etc. The context				TOTAL
		Research-related	Discpline-related	Real world-related	No context given	
Educational Neuroscience	**tokens**	10	0	0	26	**36**
	%	27.78%	0.00%	0.00%	72.22%	**100%**
Economic History	**tokens**	0	0	0	14	**14**
	%	0.00%	0.00%	0.00%	100.00%	**100%**
Science & Technology Studies	**tokens**	4	2	5	18	**29**
	%	13.79%	6.90%	17.24%	62.07%	**100%**
TOTAL	**tokens**	**14**	**2**	**5**	**58**	**79**
	%	**17.72%**	**2.53%**	**6.33%**	**73.42%**	**100%**

Table 4.21 Pattern 5: The evaluative context in the three interdisciplines

Finally, no additional context is given most of the times in the three fields. In Educational Neuroscience, however, a context related to the research has been provided in several cases, while this never occurs in Economic History and occasionally does in Science & Technology Studies. Information about a discipline or real-world oriented contexts is given only in a few cases in Science & Technology Studies.

4.5.6 Pattern 6: v-link + ADJ + to-inf + that

This last pattern, which is also introduced by an introductory-*it* clause, "enables writers to highlight the importance of a proposition for the development of their own argument," since

it has “an interpersonal use,” as pointed out by Charles (2004, p. 89). At the same time, the pattern functions as a discourse organiser to mark the introduction of a new piece of information. Hewings and Hewings (2002) refer to these cases as *emphatics*, since their use allows to “emphasise the force or the writer’s certainty.” In this way, the reader is told that he or she, too, must reach the same conclusion from the evidence provided. Furthermore, “the reader’s attention is forcefully drawn to some point” (Hewings & Hewings, 2002, p. 372). Finally, the use of this emphatic pattern helps to confer what Charles (2004, p. 75) calls an “appropriate academic persona” on the voice of the writer, since this involves a well-documented strategy of preserving credibility.

As far as the evaluated thing is concerned, cases of TOE are mostly encountered, as in examples (99), (100) and (101):

(99) **It is also *important* to note that** rural communities had recognized neighborhoods. [EH]

(100) **It is *important* to note that** cohabiting couples were generally considered “married” for the purposes of pension eligibility, so the pension is unlikely to have encouraged women to substitute cohabitation for marriage. [EH]

(101) When looking at the development of numerical competencies **it is *important* to note that** more advanced arithmetical skills in school-age children seem to develop on the basis of more basic numerical representations. [EN]

In some other cases, the evaluation is research-oriented (ROE), as in (102), (103), (104) and (105). However, no cases of discipline-oriented evaluation (DOE) were encountered.

(102) **It is *important* to emphasise that** this was not an empirical piece of research to characterise the nature and variety of public expectations.

(103) However, while this is consistent with previous findings [26,41,30] **it is *important* to point out that** investigating general performance enhancement was not at the heart of the current study.

(104) However, **it is *important* to note that** we did not control explicitly for the motivational appeal of our training conditions.

(105) To add arguments in favour of the educational effect of an MRI protocol, **it is *important* to emphasize that** our study was conducted without making a connection with the previous MRI experiment.

When analysing who the evaluator is, all the cases report the current writer as the one that has carried the evaluative action, except for one rather strange case in which there are external, although not referenced, evaluators:

(106) My doctor friends feel **it *important* to point out that** talk of autonomy is problematic because personhood, for them and their patients, is also relational and distributed in ways that are markedly "other-directed" to use Prainsack's term. [STS]

As for additional information about the evaluative context, a case of real-world-oriented context is shown in example (107). In the rest of the cases, no additional information about causes, purposes, areas, places, etc. are given:

(107) Considering the impact of the Internet's architecture on society, **it is *important* to ensure that** human rights as outlined in the UDHR are represented at the IETF.

Findings obtained have been summarised in Tables 4.22, 4.23, and 4.24 as follows and some general comments have been provided after them.

Pattern 6: ***it + ADJ + to-inf + that***		**"What?" The evaluated thing**						**TOTAL**
		TOE	**ROE**				**DOE**	
			Process (CR)	**Process (PR)**	**Product (CR)**	**Product (PR)**		
Educational Neuroscience	**tokens**	6	7	0	2	3	0	**18**
	%	33.33%	38.89%	0.00%	11.11%	16.67%	0.00%	**100%**
Economic History	**tokens**	6	7	0	4	0	0	**17**
	%	35.29%	41.18%	0.00%	23.53%	0.00%	0.00%	**100%**
Science & Technology Studies	**tokens**	16	2	0	0	0	0	**18**
	%	88.89%	11.11%	0.00%	0.00%	0.00%	0.00%	**100%**
TOTAL	**tokens**	**28**	**16**	**0**	**6**	**3**	**0**	**53**
	%	**52.83%**	**30.19%**	**0.00%**	**11.32%**	**5.66%**	**0.00%**	**100%**

Table 4.22 Pattern 6: The evaluated thing in the three interdisciplines

Pattern 6: *it + ADJ + to-inf + that*		"Who?" The evaluator			TOTAL
		Writer	Others		
			Researcher	Participant	
Educational Neuroscience	**tokens**	18	0	0	**18**
	%	100.00%	0.00%	0.00%	**100%**
Economic History	**tokens**	17	0	0	**17**
	%	100.00%	0.00%	0.00%	**100%**
Science & Technology Studies	**tokens**	17	1	0	**18**
	%	94.44%	5.56%	0.00%	**100%**
TOTAL	**tokens**	**52**	**1**	**0**	**53**
	%	**98.11%**	**1.89%**	**0.00%**	**100%**

Table 4.23 Pattern 6: The evaluator in the three interdisciplines

Pattern 6: *it + ADJ + to-inf + that*		"Why? What for? Where?" etc. The context				TOTAL
		Research-related	Discpline-related	Real world-related	No context given	
Educational Neuroscience	**tokens**	0	0	0	18	**18**
	%	0.00%	0.00%	0.00%	100.00%	**100%**
Economic History	**tokens**	0	0	0	17	**17**
	%	0.00%	0.00%	0.00%	100.00%	**100%**
Science & Technology Studies	**tokens**	0	0	1	17	**18**
	%	0.00%	0.00%	5.56%	94.44%	**100%**
TOTAL	**tokens**	**0**	**0**	**1**	**52**	**53**
	%	**0.00%**	**0.00%**	**1.89%**	**98.11%**	**100%**

Table 4.24 Pattern 6: The evaluative context in the three interdisciplines

When the adjective *important* occurs in this last pattern, research-oriented evaluations (ROE) are more frequent in Educational Neuroscience and Economic History, while topic-oriented (TOE) are more frequent in Science & Technology Studies. No cases of discipline-oriented (DOE) evaluations have been encountered in any of the sub-corpora. As regards who the evaluator is, current writers perform this role almost always in the three cases. Furthermore, no additional information about a more specific evaluative context was provided either.

So far, a detailed account of the ways in which the adjective *important* occurs in the three fields across the six patterns has been provided. This has been mainly done to test the applicability of the proposed evaluation model on every single case as well as to provide illustrative examples that help to visualise different choices for each dimension. Although a few ambiguous cases occurred and their placing into one or another category was not a completely easy task, no major inconveniences existed in most of the cases. Furthermore, it is

likely that if the approach is applied on any other adjective of importance, such as *relevant, significant, crucial, vital,* etc., more well-grounded evidence might be surely found. Testing this model against other adjectives of importance is then an interesting goal for future research. As a general conclusion, it might be stated that the question about how evaluations of importance can be inscribed in texts has been, at least, partially answered.

As previously explained, after this fine-grained analysis of each individual case of *important* across the three dimensions according to the pattern in which the occur, the comparison between interdisciplines will follow. In the section below (4.6) the use of the different grammar patterns across the three interdisciplines will be examined. After that, in the following section (4.7) the interdisciplines will be compared across the three evaluative dimensions.

4.6 Description of grammar patterns across interdisciplines

This section is concerned with the analysis of the usefulness of one or another pattern to highlight one or another evaluative dimensions. This can be addressed by calculating which patterns are more or less used in each interdiscipline to create different meanings according to the writers' purposes, as shown in Table 4.25 below.

		Pattern 1 ***ADJ + noun***	**Pattern 2** ***v-link + ADJ***	**Pattern 3** ***ADJ + prep***	**Pattern 4** ***it + ADJ + that***	**Pattern 5** ***it + ADJ + to-inf***	**Pattern 6** ***it + ADJ + to-inf + that***	**TOTAL**
Educational Neuroscience	**tokens**	84	15	48	5	36	18	**206**
	%	40.78%	7.28%	23.30%	2.43%	17.48%	8.74%	**100.00%**
Economic History	**tokens**	195	34	32	1	14	17	**293**
	%	66.55%	11.60%	10.92%	0.34%	4.78%	5.80%	**100%**
Science & Technology Studies	**tokens**	187	36	16	10	29	18	**296**
	%	63.18%	12.16%	5.41%	3.38%	9.80%	6.08%	**100%**

Table 4.25 Frequency of grammar patterns for the adjective important across the interdisciplines

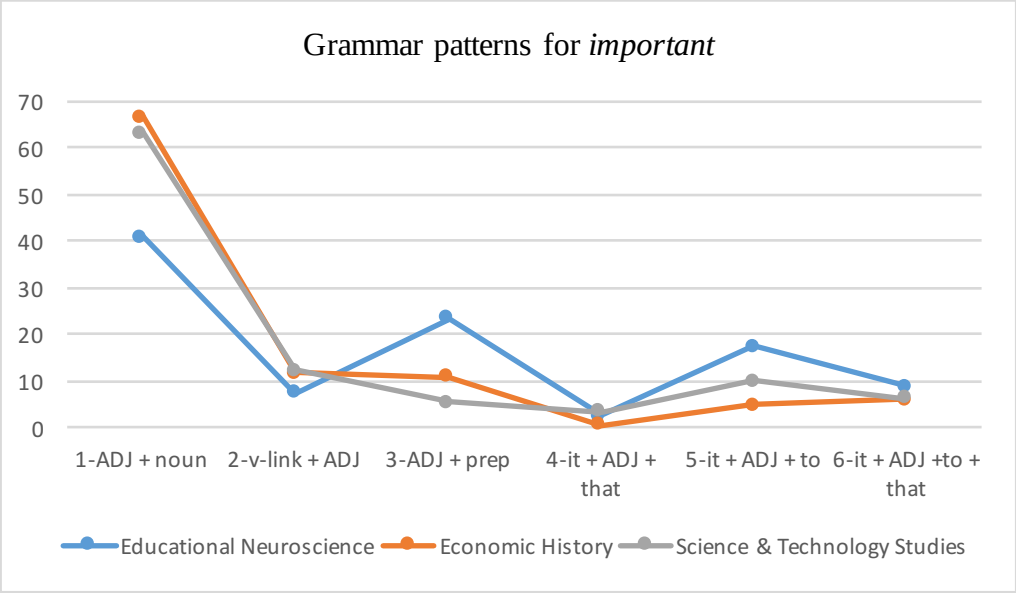


Figure 4.5 Frequency of grammar patterns for the adjective important across the interdisciplines

The most noticeable difference as regards the use of different grammar patterns for the adjective *important* is a higher frequency of attributive uses (Pattern 1: ADJ + noun) in Economic History and Science & Technology Studies over Educational Neuroscience. The same trend is observed for the use of *important* in predicative cases without complementation (Pattern 2: v-link + ADJ), although the difference is much lower. As a result, a higher frequency of predicative uses with complementation, especially when followed by a prepositional phrase (Pattern 3: v-link + ADJ + prep) and a to-*inf* clause (Pattern 5: it + ADJ + to-*inf*) is observed for Educational Neuroscience in comparison with both, Economic History and Science & Technology Studies. As for the use of *important* with *-that* clauses (Pattern 4: it + ADJ + *that*) and to-*inf* clauses followed by *that* (Pattern 6: it + ADJ + to-*inf* + *that*), similar frequencies were encountered for the three cases. A last difference is that Economic History registers a slightly higher presence of prepositional phrases (Pattern 3) than Science & Technology Studies, but this trend is reversed when *important* is used in to-*inf* clauses (Pattern 5).

In an attempt to find some possible explanations for the differences in uses of one or the other pattern in the three interdisciplines, the different effects that these patterns produce in the text have been explored, paying particular attention to the creation of a writer stance. In general terms, when in predicative position, the presence of the writer is more evident since he or she is "more openly visualized as the source of the qualifying statement" (Soler, 2002, p. 153). Furthermore, predicative uses tend to "foreground the value claim" by placing the evaluative category, *important* in this case, "in rhematic position" (Giannoni, 2010, p. 106),

as already stated. According to Biber et al. (1999, p. 515), adjectives "enhance the information provided by a noun" when used attributively, and "express evaluations of things" when used predicatively.

So far, it might be argued that because of a considerably higher frequency of the attributive pattern (ADJ + noun), Economic History and Science & Technology Studies writers place a major emphasis on highlighting the evaluated thing, since this is always the modified noun. Furthermore, although in both disciplines the frequency of the predicative pattern without complementation (v-link + ADJ) is higher than in Educational Neuroscience, the different is not as marked, for which the effect described before is the most noticeable.

As regards the higher frequency of predicative uses with complementation in Educational Neuroscience, especially when what follows is a prepositional phrase or a to-*ing* clause, two different effects might be observed. On the one hand, it is generally known that when an adjective is complemented, the grammatical pattern that follows it "completes the specification of the meaning relationship which that word implies" (Greenbaum & Quirk, 1990, p. 336), which is a meaning of importance in this case. Thus, for example, when followed by a prepositional phrase, further information about the adjective and its evaluative context is provided, as I have already shown.

The case for the complementation with a to-*inf* clause is different, not because of the complementation itself but because of the pattern in which it occurs, which is an introductory-*it* one. One of the effects those patterns create in academic writing is that the use of *it* as a grammatical subject "disguises the highly personal and subjective nature of such evaluations," (Groom, 2005, p. 261) thus "adding to the impression of the presentation of objective, impersonal knowledge" (Hewings & Hewings, 2002, p. 368), which is specially valued as a typical feature of academic discourse. Furthermore, Charles (2002), as cited by Groom (2005, p. 262), suggests that this pattern is frequently used to construct a "positive aura around the figure of the writer-as-researcher," since "the adjective evaluates a to-infinitive clause, and thus by implication evaluates the performer of the action indexed by the to-infinitive verb itself." As a preliminary conclusion, it might be inferred that by using both patterns more frequently, Educational Neuroscience writers seek to provide additional information that accentuates or intensifies the meaning of importance by providing some additional contextual clues and, at the same time, they do it by constructing an objective, impersonal research-like stance.

Finally, the two introductory-*it* patterns in which a *-that* clause is present did not show

important differences and, as I stated before, their frequency of use was similarly low in the three cases. In fact, the very low frequency of the 'it + ADJ + *that*' pattern in the three cases seems to be a common feature in academic writing since Biber et al. (1999, p. 675) have noted that this pattern is mainly associated with meanings of validity rather than with meanings of importance. As for the effects both patterns create, some differences have been spotted mainly due to the fact that in the 'it + ADJ + *to-inf* + *that*' pattern the adjective acts not only as an attitude marker but also as an emphatic (Hewings & Hewings, 2002). This latter function of adjectives of importance used in this pattern also "contributes to the reader's engagement with the text by focusing their attention on particular points" (Bondi, 2015, p. 166), which is a resource that writers from the three fields have shown to use in similar ways.

As a final thought, it can be concluded that as well as attributive adjectival patterns seem to be more useful to emphasise the quality of the evaluated thing, it might be suggested that predicative patterns with complementation through a prepositional phrase or as part of an introductory-*it* pattern followed by a to-*inf* clause seem to be more useful to provide additional clues that help to distinguish a more specific evaluative context. So far, it might be argued that because of a considerably higher frequency of the attributive pattern (ADJ + noun), Economic History and Science & Technology Studies writers place a greater emphasis on highlighting the evaluated thing. In the case of Educational Neuroscience writers, however, the emphasis is placed on highlighting the evaluative context due to the higher frequency of the adjective followed by a complementation pattern.

4.7 Comparison of interdisciplines across evaluative dimensions

It is clear that the analysis presented in the previous sections has been mainly descriptive, since the aim was to identify different ways in which choices from the three dimensions interact in each grammar pattern as well as to describe how the choice for one pattern or the other helps to highlight different dimensions. It is time now to provide some plausible interpretations that might help to find out what evaluations of importance say about disciplinary differences and how they are different in interdisciplinary writing when compared with single-domain disciplines. While the first question will be addressed in this section, the second one will be treated in the following one.

Based on the reported findings, it might be possible to compare and describe the differences between the three interdisciplines by exploring the ways in which the different types of evaluated things, the different types of evaluators, and the different types of

evaluative contexts as wholes interact across them, regardless of the patterns in which they occur. In other words, it is possible to explore how the answers to the three questions are distributed across Educational Neuroscience, Economic History, and Science & Technology Studies. The results obtained have been reported in Tables 4.26, 4.27, and 4.28, and they have been illustrated in Figures 4.5, 4.6, and 4.7 below.

All patterns		"What?" The evaluated thing						TOTAL
		TOE	ROE				DOE	
			Process (CR)	Process (PR)	Product (CR)	Product (PR)		
Educational Neuroscience	tokens	161	21	1	11	4	8	206
	%	78.16%	10.19%	0.49%	5.34%	1.94%	3.88%	100%
Economic History	tokens	254	20	2	12	5	0	293
	%	86.69%	6.83%	0.68%	4.10%	1.71%	0.00%	100%
Science & Technology Studies	tokens	257	13	2	3	3	18	296
	%	86.82%	4.39%	0.68%	1.01%	1.01%	6.08%	100%
TOTAL	tokens	672	54	5	26	12	26	795
	%	84.53%	6.79%	0.63%	3.27%	1.51%	3.27%	100%

Table 4.26 What is important? Comparison of frequencies across interdisciplines

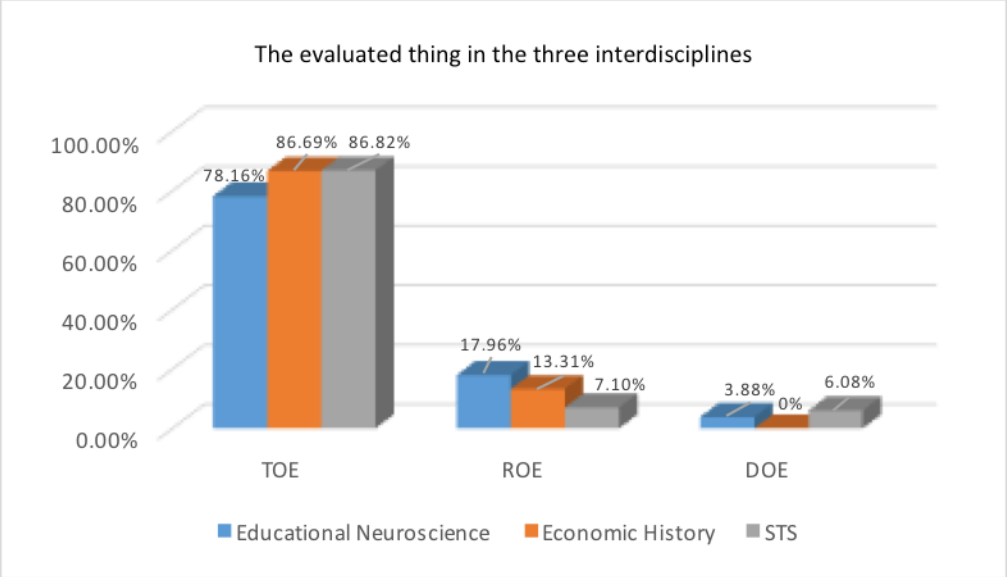


Figure 4.6 What is important? Comparison of frequencies across interdisciplines

In the three cases there is a notably higher presence of topic-oriented (TOE) entities as evaluated things. The main difference is the case of Educational Neuroscience, where the frequency is slightly lower when compared with the other two fields. This is so because research-oriented evaluations (ROE) are more frequent in Educational Neuroscience than in the other two cases. While Economic History and Science & Technology Studies share the

same percentage of TOE cases, in Economic History ROE cases are more frequent than in Science & Technology Studies. Finally, no cases of disciplinary-oriented (DOE) evaluations occur in Economic History but they are present in the other two sub-corpora, showing a higher frequency in Science & Technology Studies.

All patterns		"Who?" The evaluator			TOTAL
		Writer	Others		
			Researcher	Participant	
Educational Neuroscience	**tokens**	165	27	14	**206**
	%	80.10%	13.11%	6.80%	**100%**
Economic History	**tokens**	267	26	0	**293**
	%	91.13%	8.87%	0.00%	**100%**
Science & Technology Studies	**tokens**	266	17	13	**296**
	%	89.86%	5.74%	4.39%	**100%**
TOTAL	**tokens**	**698**	**70**	**27**	**795**
	%	**87.80%**	**8.81%**	**3.40%**	**100%**

Table 4.27 Who is it important to? Comparison of frequencies across interdisciplines

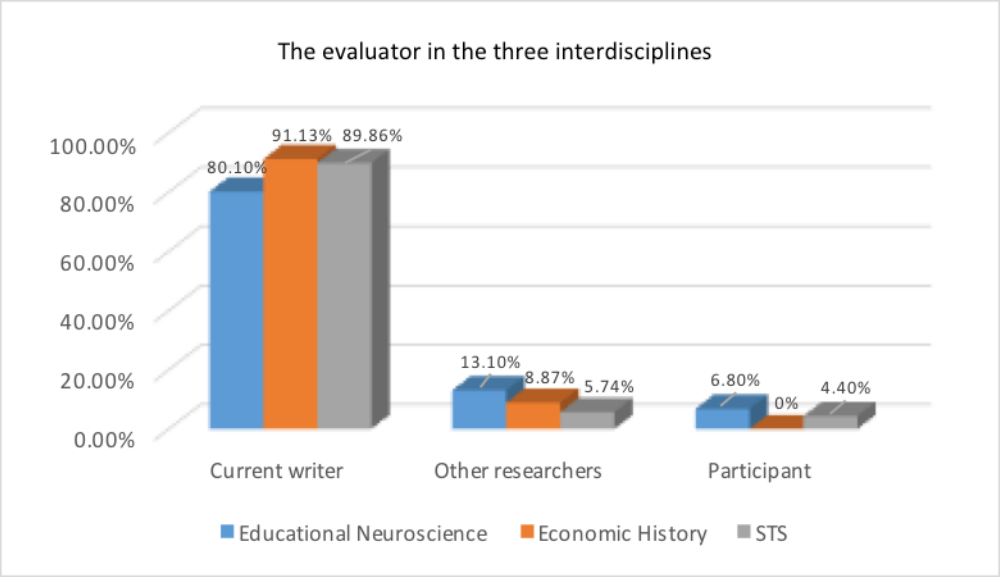


Figure 4.7 Who is it important to? Comparison of frequencies across interdisciplines

In the case of the type of evaluator, it is clear that a much higher frequency of current writers as the responsible for the evaluative act is observed in the three cases. The main difference, again, is the case of Educational Neuroscience, where the frequency is slightly lower when compared with the other two sub-corpora. This might be so because the presences of both, other researchers and participants of the research process are more frequent in Educational Neuroscience than in the other two cases. While Economic History and Science & Technology Studies share a similar percentage of cases in which the current

writer is the evaluator, in Economic History other researchers as evaluators are more frequent than in Science & Technology Studies but no cases of participants of the research process as evaluators occur in Economic History, though this does occur in Science & Technology Studies.

All patterns		"Why? What for? Where?" etc. The context				TOTAL
		Research-related	Discpline-related	Real world-related	No context given	
Educational Neuroscience	tokens	48	5	20	133	206
	%	23.30%	2.43%	9.71%	64.56%	100%
Economic History	tokens	29	2	2	260	293
	%	9.90%	0.68%	0.68%	88.74%	100%
Science & Technology Studies	tokens	25	8	21	242	296
	%	8.45%	2.70%	7.09%	81.76%	100%
TOTAL	tokens	102	15	43	635	795
	%	12.83%	1.89%	5.41%	79.87%	100%

Table 4.28 In which context is it important? Comparison of frequencies across interdisciplines

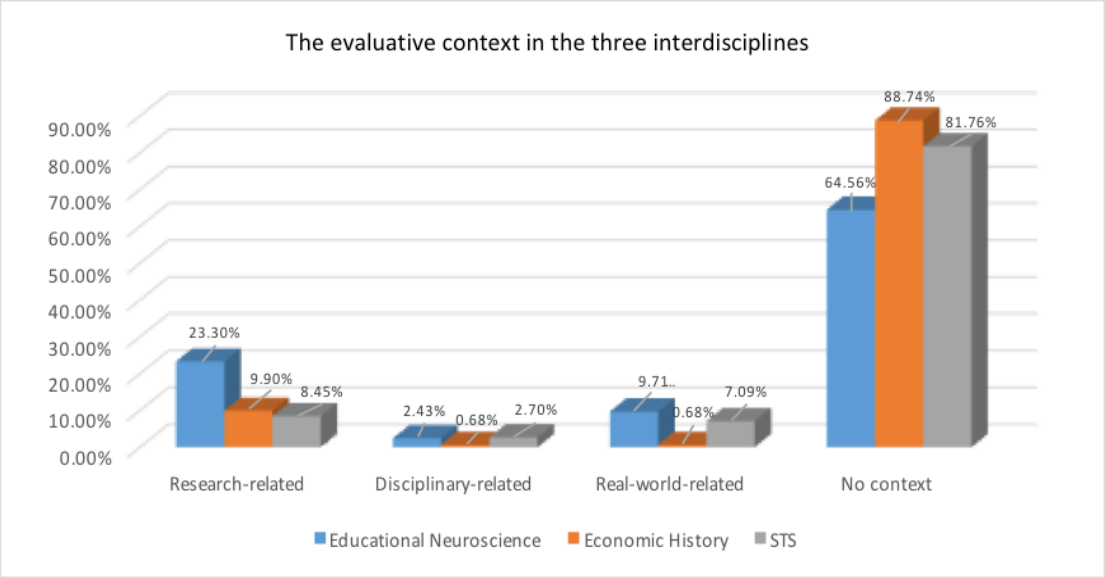


Figure 4.8 In which context is it important? Comparison of frequencies across interdisciplines

As regards the presence of additional clues that help to describe a more specific evaluative context, it is evident that this does not occur most of the times in any of the fields. However, this is more marked in Economic History, since the presence of clues that give account of a disciplinary or real-world context rarely happen. In fact, when some additional information is given, it is mostly related to the research context. The other two interdisciplines are different. In Science & Technology Studies, when additional information about the context is given, this is about the research context most of the times although a

similar frequency has been found for the presence of a real-world related context. The most noticeable differences are observed, once again, in Educational Neuroscience, where a higher frequency of both, research and real-world related contexts is found. As for clues about a disciplinary related context, the frequency is similarly low in both cases.

The interpretation of the interaction of all those features as a whole in each of the interdisciplines might shed some light as regards similarities and differences between them, which are rooted in what is already known about typical features of interdisciplinary articles as well as in the different ways in which the disciplines involved interact in each case. In the sections that follow I will start by analyzing the Educational Neuroscience case, since it is where the most outstanding differences were observed. This is followed by Science & Technology Studies and Economic History at the end. Finally, some preliminary conclusions about the identification and description of different modes of interdisciplinarity will be presented.

4.7.1 Educational Neuroscience

As observed, when the adjective *important* is used in Educational Neuroscience articles, higher frequencies of evaluated things as research entities (ROE), other researchers and participants as evaluators, and research-related and real-world-related contexts are found in comparison with the other interdisciplines. As for the first issue, when the evaluated thing is part of the investigation itself, the products (*findings, evidence, results*, etc.) but also the processes (*methods, variables, procedures*, etc.) can be given relevance. In fact, in the three interdisciplines, but more markedly in Educational Neuroscience, elements of the research methods or the methods themselves have been evaluated as *important*. This finding is in line with the idea that, as interdisciplinary writing is aimed at a broader audience, more explanatory material and a focus on "emphasising the relevance of the proposed method" (CCR, 2017, p. 17) are necessary. This focus on showing the relevance of the research approach adopted is reinforced by the higher frequency of additional information that helps to describe a research-related evaluative context.

The higher frequency of other researchers and participants acting as evaluators as well as the higher frequency of real-world related contexts can be treated together, since both contribute to provide evidence that, in interdisciplinary articles, the focus is likely to be "on the relevance of the proposed study to 'real-world' concerns and on its applicability" (CCR, 2017, p. 4). In the previous chapter about attribution and citations it was already

acknowledged that a broad range of literature (CCR, 2017), which is shown by the high citation density rates encountered, was drawn on by interdisciplinary writers. Here, it has been also acknowledged that some of these external voices are made visible in the text as evaluators of importance, that is, as explicitly manifesting that a particular thing is *important.* What is more, evaluations of importance are not only attributed to other researchers but also to participants of the research processes, who, most of the times, are interviewed or surveyed professionals or actors from any of the two disciplines involved: teachers and educators as well as neuroscientists. Thus, Educational Neuroscience writers strongly rely on other sources by attributing claims of importance to them, which help to support their own interpretations and findings. When these sources are participants of the research process, the focus on applicability emerges, since, as stated before, whether they are teachers or neuroscientists expressing that something is *important*, they are doing so with the final outcome of improving education through a better understanding of the nervous system and its 'importance' for learning. This focus on applicability is reinforced by the higher frequency of information given about a real-world related context, most of the times schools or other educational institutions, in which different problems to solve and questions to address are presented as *important*.

4.7.2 Science & Technology Studies

Some differences are encountered when Science & Technology Studies articles are analysed. It is clear that the emphasis on the relevance of the study and its methods is not as marked as in Educational Neuroscience, since research-oriented (ROE) evaluations are less frequent. Instead, there seems to be a greater emphasis on showing the relevance of the disciplines and their relationships in solving the problems of the real world. Evidence for this is the higher frequency of discipline-oriented (DOE) evaluations of importance, which is reinforced by more cases in which additional information about a disciplinary-related context is provided. On top of that, although not as frequent as in Educational Neuroscience, real-world-related contexts are identified because of the presence of additional information, what helps to reinforce the emphasis on the applicability of the research outcomes. The fact that the evaluators are not only the writers but also other researchers and participants, also adds to this sense of applicability. It is interesting to mention that those participants are members of the disciplinary communities at play, i.e., engineering students, practicing engineers as well as religious leaders or ethicists. In all cases, the aspects or entities they evaluate as *important*

are related to the applicability of research findings to the solving of real world problems, as most of the examples above have shown.

4.7.3 Economic History

The case for Economic History is a different one, as already pointed out. In these articles, the adjective *important* is mainly used to evaluate topic-oriented (TOE) entities and, to some extent, research-oriented (ROE) ones, whether they are processes or products. However, discipline-oriented (DOE) evaluations are non-existent. Furthermore, current writers and other researchers act as evaluators, but participants as evaluators are not present at all. Finally, no additional context is given most of the times and, when it is provided, it gives account of a research-related context. In fact, clues that help to describe discipline-oriented or real-world oriented contexts are extremely rare. As a conclusion, the fact that in interdisciplinary writing there is a focus on "emphasising the relevance of the proposed study and its methods to real-world concerns" as well as a focus on "demonstrating applicability" rather than expertise (CCR, 2017, p. 17) can be only partially probed. It is clear that relevance is given to the research itself and to the methods proposed, which provides evidence for the first part of the previous statement. What is missing is then, is evidence of importance given to a context of applicability in which real-world problems need to be solved.

It is necessary to make clear that I am not affirming that this typical feature of interdisciplinary writing is not seen in Economic History articles. I am only suggesting that this is not shown by the use of the adjective *important*. This might be explained, in part, by considering some issues of the epistemic nature of the interdiscipline as a whole as well as of the disciplines involved. Although Economics is itself an applied science, its applicability to solve real-world problems is not as strengthened as in the other two interdisciplines because the main aim of Economic History is to understand the economic phenomena of the past, not to provide solutions for the economic future. In other words, its merging with History is what makes Economics lose a little bit of its applied nature. In fact, although the more quantitative economic theories (econometrics, cliometrics) stand for the possible replication of statistical, computer-based economic models on different contexts and societies, their reliability has been neglected by economists and historians alike.

4.7.4 Modes of interdisciplinarity: Preliminary conclusions

As already reported, in Educational Neuroscience the adjective *important* is used to highlight the relevance of the methods proposed and of the research as a whole. Besides, relevance is also given to the solving of real world problems. In a certain way, it might be hypothesised that these two conclusions could add to the description of the *service-subordination* relationship between Neuroscience and Education. Importance is given to the research products and processes, which are more similar to those from Neuroscience, because the main subject matter of the field comes from the natural science and that is why this is the master discipline. However, importance is also given to the applicability of the findings in educational contexts. Although Education is indeed an applied science, this applicability is even reinforced by the fact that Education informs (or serves) Neuroscience by signaling the importance of the problems that need to be solved. An additional and perhaps interesting issue for further research is the fact that, as I pointed out in the Introduction of this work, Educational Neuroscience has been described as fostering activities to the development of *translational research*, which is the "a systematic effort to convert basic research knowledge into practical applications to enhance human health and well-being and must include some action steps," as defined by Wethington (2016, n.p.). Thereby, the fact that translational research is broader in scope than just applied research is useful in this case. Indeed, this fact can help to understand why a higher frequency of cases which emphasise the applicability of the research and its methods to solve real-world problems has been encountered in Educational Neuroscience in comparison with the other two interdisciplines.

In Science & Technology Studies, the adjective *important* is also used to highlight the relevance of the methods proposed and of the research as a whole but, more importantly, it is used to highlight the relevance of (inter)disciplinary issues. Furthermore, as in Educational Neuroscience, there is also an emphasis on highlighting the applicability of the findings to the real world. This time, it might be hypothesised that these two conclusions could add to the description of the *agonistic-antagonistic* relationship between Biomedicine and Engineering with Ethics. By using evaluations of importance to refer to the disciplines involved in a meta-discursive way, as many of the given examples have shown, a disciplinary fight is perceived within the emerging disciplinary boundaries and in relation to the intellectual domains of the disciplines involved. The applied sciences by nature are Biomedicine and Engineering, and, although the applicability of their findings to solve real world problems is emphasised, it is at the same time measured, evaluated and criticised in the light of ethical issues. That is why

more emphasis is given to highlighting the importance of the interdisciplinary relationships to solve problems than to highlighting the importance of the research itself, since one of the main aims of Science & Technology Studies is precisely to evaluate the risks that science and technology pose to human values as well as to control their impact on human life. In this way, Ethics exerts the control over the two hard disciplines and the emphasis is given to highlighting the importance of this disciplinary interplay for the benefit of the whole society.

As for Economic History, the *integrative-synthesis* mode of interdisciplinarity is observed since there is a synthesis of both disciplinary approaches through a process of integration or negotiation. More specifically, the emphasis on highlighting the relevance of the research findings and methods comes from the scientific rigour of Economics, mostly when quantitative economic schools of thought are involved. However, the emphasis on highlighting the applicability of the findings might be weakened because of a major influence of the explanatory and interpretative power of History. As a final thought, it is necessary to acknowledge that Economic History is the most well-established field of the three, since it emerged in the late nineteenth century as an academic field on its own, while both Educational Neuroscience and Science & Technology Studies emerged as independent fields in the last half of the twentieth century. Thus, there is not such an urgent need for economic historians to claim importance for their findings or to position their research in the context of disciplinary debate, since it might seem that Economic History has become more of a discipline in its own right that the other to interdisciplinary fields.

As previously stated, in the last section of this chapter the findings obtained for the interdisciplinary articles will be compared with the articles from the single-domain disciplines so as to find out if evaluations of importance are inscribed differently.

4.8 Comparison of interdisciplinary writing and single-domain disciplinary journals

In this final stage, the features that stood out as being more useful to describe interdisciplinary writing presented above are explored in the single-domain disciplinary journals to compare the extent to which their frequencies are similar or different. As those hypothetically typical interdisciplinary features were much less frequent than the *default* uses, they were grouped together for a clearer visualisation. In this stage, then, when the evaluated thing was explored, cases were divided into *topic-oriented evaluations* (more commonly frequent) and *research/disciplinary-oriented* evaluations (less commonly frequent). As for the cases of different types of evaluators, they were divided into *current*

writer (more commonly frequent) and other *researchers/participants* (less commonly frequent). Finally, when the evaluative context was explored cases were classified into *not context given* (more commonly frequent) and *research/disciplinary/real-word-related* contexts given (less commonly frequent). The findings from the three interdisciplinary sets have been summarised in Table 4.29, in which the frequencies that are of a greater interest for comparative purposes have been highlighted.

"What" is important?	NEUROSCIENCE	EDUCATION	EDUC. NEURO.
Topic-oriented entities	88.80%	90.98%	78.16%
Research/Discipline-oriented entities	11.20%	9.02%	21.84%
"What" is important?	ECONOMICS	HISTORY	ECON. HIST.
Topic-oriented entities	90.65%	93.42%	86.69%
Research/Discipline-oriented entities	9.35%	6.58%	13.31%
"What" is important?	BIO/ENGI	ETHICS	S&TS
Topic-oriented entities	91.18%	92.70%	86.82%
Research/Discipline-oriented entities	8.82%	7.30%	13.18%
"Who" is it important to?	NEUROSCIENCE	EDUCATION	EDUC. NEURO.
Current writer	95.20%	97.95%	80.10%
External source/Participant	4.80%	2.05%	19.90%
"Who" is it important to?	ECONOMICS	HISTORY	ECON. HIST.
Current writer	97.14%	96.30%	91.13%
External source/Participant	2.86%	3.70%	8.87%
"Who" is it important to?	BIO/ENGI	ETHICS	S&TS
Current writer	98.53%	96.91%	89.86%
External source/Participant	1.47%	3.09%	10.14%
"In which context" is it important?	NEUROSCIENCE	EDUCATION	EDUC. NEURO.
No additional clues given	90.40%	86.17%	64.56%
Research/Disciplinary/Real-world-oriented	9.60%	13.83%	35.44%
"In which context" is it important?	ECONOMICS	HISTORY	ECON. HIST.
No additional clues given	91.27%	99.19%	88.74%
Research/Disciplinary/Real-world-oriented	8.73%	7.40%	11.26%
"In which context" is it important?	BIO/ENGI	ETHICS	S&TS
No additional clues given	88.24%	91.30%	81.76%
Research/Disciplinary/Real-world-oriented	11.76%	8.70%	18.24%

Table 4.29 Comparison of frequencies for the evaluative dimensions of the adjective important in the interdisciplines and the single-domain disciplines

Findings show that in every single-domain discipline even higher frequencies of the more commonly frequent uses for each dimension were encountered when compared with the interdisciplines. In simpler words, even more cases of topic-oriented evaluations, current writers as evaluators and no additional clues that describe an evaluative context were encountered in the single-domain disciplines. As a consequence, even lower frequencies of research and disciplinary-oriented evaluations, other researchers or participants as evaluators and research, disciplinary, or real-word-related evaluative contexts were calculated. It might seem as if the more frequent uses would mark the *rules* in both, monodisciplinary and interdisciplinary articles, while the less frequent ones would mark the *exceptions*. However, the exceptions represent precisely the cases that were found more useful to describe distinguishing features of interdisciplinarity. In other words, as the highlighted percentages in Table 4.29 show, the exceptions are more frequent in the interdisciplines than in the single-domain disciplines and, although they are not significantly frequent, they do mark an area of potentially significant difference for comparative purposes in future studies.

As a conclusion, these findings have helped to probe that when the adjective *important* is used in interdisciplinary articles in comparison with monodisciplinary ones, the different choices for the type of evaluated thing, the type of evaluator, and the type of evaluative contexts which are evaluated as *important* occur differently as regards frequency. Thus, it might be hypothesised that those less frequent uses encountered might mark specific features of interdisciplinary. Needless to say, these hypotheses need to be tested first on a bigger corpus of articles form the same interdisciplines as well as in other corpora from similar or different interdisciplinary fields.

Chapter 5: CONCLUSIONS

The main aim of this exploratory, corpus-based case study has been to compare three different interdisciplinary fields in the light of two different linguistic aspects: the study of citations and the study of evaluations of importance. As stated before, this research is based on the premise that disciplinary differences can be reflected by linguistic differences and, by the same token, linguistic differences can signify disciplinary differences. However, the interesting question emerges when the aim is to describe linguistic differences across interdisciplinary fields, that is, when two different disciplines merge or interact to create a still different interdisciplinary knowledge form. Such an aim is a challenging one, since from the very beginning it is needed to knock down theoretical preconceptions in order to understand a different way of conceptualising academic knowledge. From the simple definition of what a discipline is to the complex interweaving of academic cultures, epistemic natures and disciplinary subject matters, everything needs to be scrutinised under a different lens. What is needed, indeed, when language is the focus, is a magnifying glass: interdisciplinary footprints are spread all around. They only need to be found. How? Some possible paths have been proposed in this work.

Following this idea of finding different paths to look for linguistic evidence that might serve to describe interdisciplinary writing and, above all, the possible relationships between disciplines when building up interdisciplinary fields, the decision to focus on citations and evaluations of importance has been based on two main facts. In general terms, they are both central aspects of academic writing, as has been pointed out in the previous chapters. More specifically, they are both linguistic resources used to convey typical features of what the intended readerships of interdisciplinary articles expect to encounter, as already highlighted. Inspired by the theoretical considerations introduced as regards interdisciplinarity in general and interdisciplinary writing in particular, a corpus was designed for the analysis of the chosen linguistic features. The aim of compiling such corpus was to represent a variety of interdisciplines not only as regards the nature of the disciplines that interact in each of them but also as regards the nature of such interdisciplinary relationships. Finally, once compiled, RAs from Educational Neuroscience, Economic History, and Science & Technology Studies journals were described and compared as regards the ways in which attribution through citations on the one hand and the adjective *important* on the other occur across each sub-corpus. When necessary, and because of different reasons, a comparison between the interdisciplinary articles and those from the single-domain disciplines involved was included.

A summary of the main findings and the answers to the proposed research questions will be presented in the following section. Then, some considerations as regards the usefulness of this work for the study of interdisciplinary writing will be introduced. After that, I will propose some suggestions for further research and I will acknowledge the most important limitations of the study. Some final thoughts are provided as a conclusion.

5.1 Summary of the main findings and answers to the Research Questions

In Chapter 3, which is rooted in my preliminary findings from previous research, I first tested those previous hypotheses that had been encountered on a corpus of RA Introductions in Educational Neuroscience and its constituent disciplines, i.e., Education and Neuroscience, on the new corpus, which includes whole RAs rather than Introduction sections, as well as two new sets of disciplines/interdisciplines. Thus, RQ 3, which aimed at finding out whether there was some evidence that practices in the interdisciplines (more specifically the use of citations in this case) are drawn from those in the single-domain disciplines, was addressed in the first place, since it is the continuation of previous work.

Firstly, when the degree of visibility of the projecting sources was analysed, my previous belief that interdisciplines stand in the middle between the single-domain disciplines was restated, since in the three cases the frequencies of integral vs. non-integral citations were mid-way between the two. It is important to acknowledge, however, that a greater influence from one discipline or the other was observed in each case. Secondly, when the distinction between averred and attributed sources was studied, my preliminary hypothesis that a higher frequency of attributed sources (understood as the strengthening of the external researchers' voices) might constitute a feature of interdisciplinary writing was revised, since this was shown to be true for Educational Neuroscience texts but not for the other two fields. In fact, frequencies stood in the middle in both cases and, again, a more or less marked influence from the single-domain disciplines was observed. Finally, the third previous hypothesis that attributed sources were given more credit in interdisciplinary writing could not be tested because the model I had proposed included all, attributed and averred propositions along a continuum of different degrees of credit towards them. Because of the size of the new corpus and the complexity of the categories proposed, this analysis is still pending, which might constitute an interesting avenue for future research.

In the second part of Chapter 3, the scope was narrowed down to the study of cases of attribution through citation only so as to address RQ 1: How does the use of citations differ across the three interdisciplines? In doing so, I proposed a thorough exploration of three

aspects: the grammatical structures used to convey attribution, the different forms of textual integration, and the nature of the diverse reporting verbs used. After a meticulous analysis of each of the 1,565 instances of attribution through citations encountered, the quantitative findings from each of the studied dimensions helped to provide a more qualitative description of each interdiscipline. Then, taking into account previous research on citations in academic writing which gives account of disciplinary differences, the findings obtained made it possible to describe the three interdisciplinary fields as representing three different modes of interdisciplinary relationships, as hypothesised in the Introduction: a *subordination-service* mode was observed in Educational Neuroscience articles, an *integrative-synthesis* one in Economic History, and an *agonistic-antagonistic* one in Science & Technology Studies. It is very important to make clear that those modes of interdiscipinarity describe ways in which interdisciplinary work, research projects and practices are carried out, but they do not describe the way in which language is inscribed in them. They are rooted in epistemic notions, not in linguistic ones. Then, what I have tried to do is to look for linguistic evidence, footprints, or *traces*, as some researchers have called them, of these interdisciplinary practices in the texts, not the practices themselves.

In Chapter 4, whose content stems from the concepts of academic values and parameters of evaluation, I analysed the occurrence of the adjective *important* in the articles from each interdisciplinary sub-corpus in order to address RQ 2: How does the use of adjectives of importance differ across the three interdisciplines? In order to do so, the adjective *important* was analysed according to the six most frequent grammar patterns in which it was encountered. Furthermore, I developed an integrative model of evaluation that aimed at answering three basic questions: What is *important*? Who is it *important* to? In which context is it *important*? Thereby, every instance was classified according to different categories for the three dimensions: the evaluated thing, the evaluator, and the evaluative contexts. Some of the categories proposed were based on previous research, such as the concepts of topic-oriented evaluation (TOE) and research-oriented evaluation (ROE) (Thetela, 1997), or the notions of attribution and averral (Sinclair, 1988) to identify different evaluators. However, some others were intuitively coined based on the linguistic cases encountered, such as the concept of disciplinary-oriented evaluations (DOE) or the several types of clues that help to identify more specific evaluative contexts: research, disciplinary or real-world related contexts.

Once each of the 795 cases was analysed across the three dimensions and the six patterns to test the reliability of the model and provide examples, the cases for each interdisciplinary

field were grouped according to two different criteria: according to the type of grammar pattern in which they occur on the one hand, and according to the type of choice for the evaluated thing, the evaluator, and the evaluative context, regardless of the patterns in which they occur on the other. As for the first criterion, the cases were grouped according to the pattern in which they occurred because the choice of one pattern over the other was thought to say something else about the type of meaning achieved as well as the writer's intentions. Based on the findings reported, it was hypothesised that because of a considerably higher frequency of attributive patterns, Economic History and Science & Technology Studies writers place a major emphasis on highlighting the evaluated thing, while Educational Neuroscience writers are more prone to providing additional clues that help to distinguish a more specific evaluative context due to a higher frequency of predicative patterns with complementation, especially with a prepositional phrase or as part of an introductory *it* pattern followed by a to-*inf* clause.

As regards the second criterion, that is, the comparison of the interdisciplines according to the frequency of the categories proposed for each dimension regardless of the patterns in which they occur, findings were evaluated according to their alignment with or departure from two typical features of interdisciplinary articles: a focus on highlighting the relevance of the proposed method or study to real-world concerns, and an emphasis on demonstrating applicability to solve those problems (CCR, 2017). From the three fields, Educational Neuroscience was found to be the one which is mostly aligned with both principles. As for Science & Technology Studies, although it was also shown that the methods and the research are given relevance to real-world matters, a new flavor was encountered: relevance is also given to interdisciplinary matters, and it is the emphasis given to this disciplinary interplay which has implications for applicability in the real word. Finally, Economic History was found to be less aligned with the principles stated: although the research methods and products were given importance, their relevance to real world concerns as well as the applicability of the findings to solve those problems was not markedly acknowledged. No signals of importance given to (inter)disciplinary matters were frequent either. These preliminary conclusions helped to describe each interdisciplinary field according to the three modes of interdisciplinarity already discussed.

Finally, in the last section of Chapter 4, RQ 3 was addressed again, this time to find out whether the ways in which the adjective *important* is used in the interdisciplines is different from or similar to the ways in which it is used in the single-domain disciplines. Preliminary

findings show that when the adjective *important* occurs in interdisciplinary articles, the choices writers make from the three evaluative dimensions differ as regards frequency. Thus, more research and discipline-oriented entities constitute the evaluated thing, more external sources or participants act as evaluators, and more clues showing a research, disciplinary or real-world related evaluative contexts are observed. It has to be pointed out, however, that these differences in frequencies are not very large and that this is a hypothesis that needs future testing.

5.2 Concluding remarks on the usefulness of the methodological approach

Some final considerations about the methodological steps followed in this study will be presented in this section aiming at highlighting the usefulness of combining quantitative and qualitative methods. As perhaps noticed, the analysis of the comparisons between the interdisciplinary fields and the single-domain disciplines across Chapters 3 and 4 has taken an *hourglass* shape. While Chapter 3 goes from general to specific, Chapter 4 moves from specific to general. In other words, Chapter 3 about citations starts by testing previous hypothesis on the visibility and strength of external voices as well as on the credit given by previous research in every disciplinary set, thus providing comparisons between each interdiscipline with the respective monodisciplinary fields involved. In contrast, Chapter 4 starts by providing a detailed analysis of the occurrence of the adjective *important* in the three interdisciplines and then opens up to the testing of the main findings on the single-domain disciplines. However, in both cases, the calculating of normalised frequencies for both linguistic features in the disciplines in comparison with the interdisciplines was the starting point. And it was a very important one, because it was the basic quantitative diagnostic tool that served to decide whether the whole study was worth being done or not. In the case of Chapter 3, it was found that the citation density rate was higher in the three interdisciplines when compared with every single-domain discipline, albeit the slight discrepancy with the rate for Biomedicine articles, which in fact was acknowledged as a special case by previous research. Similarly, in Chapter 4, not only was *important* the most widely used adjective of importance in all the corpora but its normalised frequency was higher in the three interdisciplines when compared with every monodisciplinary field. Thereby, this starting point from the comparison between the interdisciplinary articles with the monodisciplinary ones provided a first clue that *something interesting* or, at least, *something different* might be found through a deeper, more throughout analysis of the interdisciplinary texts.

Another relevant aspect that needs to be highlighted is the fact that by providing frequencies only, as I have done in the first part of Chapter 3, no grounded conclusions can be achieved nor can they be generalised. In other words, by counting how many times a certain feature occurs in one of the disciplines and how many times it occurs in the other, and then comparing these with the times it occurs in the interdiscipline, I am only saying that such a feature is present in different (or not) proportions in each field and, because of that, a more or less marked influence from one or the other discipline might be exerted over the interdiscipline. However, those findings are only quantitatively interesting for diagnostic or hypotheses-testing purposes. In fact, the conclusions I arrived at in Module 2 became general hypotheses I tested at the beginning of Chapter 3. By the same token, the conclusions I reached at the end of Chapter 4 about higher frequencies of ROE and DOE evaluated things, other researchers and participants as evaluators, and more specific evaluative contexts in the interdisciplines when compared with the single-domain disciplines might only serve as general hypotheses to be tested in future research. In other words, those findings are only indicative of possible disciplinary influences from the **outside**, whether from one, the other, or both sides. However, I claim, such an analysis must be always complemented by a more specific, qualitatively interesting exploration of the presence of the single-domain disciplines **within** the interdiscipline, as part of a single matrix. This is what I have tried to do in the last sections of Chapter 3 when I examined each individual case of attribution through citation, and in the first sections of Chapter 4 when I examined every occurrence of the adjective *important* framed by the tripartite model. These types of more fine-grained analyses make up the *narrow neck* of the hourglass.

5.3 Concluding remarks on the usefulness of the findings for the study of interdisciplinary writing

I have tried to make it clear throughout this work that citations and evaluations of importance are only two aspects from the multiple ones that can be studied as part of academic discourse in general and of interdisciplinary writing in particular. Thus, none of those aspects can represent the whole of what is going on in interdisciplinary texts. Rather, the findings reported only represent starting points and the aspects studied only represent diagnostic tools. Just as Teich and Holtz (2009) studied the lexico-grammatical contexts of selected nouns (*algorithm* and *model*) in the interdisciplinary field of Computational Linguistics to assess their contribution to register formation, or Thompson et al. (2017) explored register variation through the study of text constellations in the interdisciplinary field of Environmental

Studies, I have studied citations and evaluations of importance in my three interdisciplinary fields to evaluate their usefulness as linguistic parameters of comparison across interdisciplines. What I have found is that they are common linguistic resources that are used in different ways and that they can serve to provide linguistic evidence for the relationships between disciplines when interacting in the matrix of interdisciplinary fields. Viewed in this way, the study of citations and the study of adjectives of importance are both possible paths to look for interdisciplinary *footprints* in texts.

The findings reported have allowed for the description of three distinct interdisciplinary fields which represent three different modes of interdisciplinarity. As I pointed out in the Introduction of this work, those fields were chosen *a priori* because they were very different from an epistemological point of view. After the analysis was carried out, and as suggested by the findings reported, they were also found different *a posteriori* from a linguistic point of view. As a final thought, it is important to highlight that the conclusions arrived at are not to be taken as reliable parameters for generalisation. These conclusions only open up an interesting debate about which linguistic resources are more prone to show those disciplinary differences when the object of study is interdisciplinary writing.

5.4 Suggestions for further research and limitations

First of all, as the study of interdisciplinary academic writing is rather recent as compared with research of cross-disciplinary differences in academic discourse, the topic offers, in itself, a plethora of exciting avenues for further research. Perhaps the two more interesting ones have to do with a change of focus. This study can be described as *text-centred,* since the focus is placed on the study of linguistic features as encountered in the texts, which indeed have helped to describe some of the typical features that are commonly encountered in interdisciplinary articles. In other words, citations were primarily studied because a "broader range of literature" is commonly drawn on in interdisciplinary articles and the adjective *important* was studied because "a greater emphasis on the relevance of the research contribution to issues in the 'real' world and its application" (CCR, 2017) is commonly given in interdisciplinary articles and so on. However, what cannot be forgotten is that those features are typical of these kind of articles because they respond to the specific needs of a broader, interdisciplinary audience. Thus, when the focus is changed towards this intended readership, more *reader-centred* studies must surely provide a complementary angle of interpretation, which is the kind of work started up by the IDRD team headed by Hunston and Thompson (Thompson et al., 2017; Murakami et al., 2017). Similarly, when changing the

focus to the other extreme of the communicative continuum, more *writer-centred* studies can provide an equally important complementary perspective, especially as regards the study of the relationship between interdisciplinarity and writer identity. An example of such studies is the pioneer work by Petrić (2006) on disciplinary affiliations in interdisciplinary fields.

From a narrower perspective now, the preliminary conclusions presented in this work can be starting points to the application of the models proposed on other interdisciplinary fields as well as to the enhancing of these models to cope with other dimensions and categories. For instance, the model proposed to study citations can be applied to explore more and more interdisciplinary fields, which can be similar or different as regards the epistemic nature of the disciplines involved as well as similar or different as regards the nature of the interdisciplinary relationships. Thus, the extent to which research on citations can stand as a proxy for the relationships between disciplines might be evaluated.

Another possible option is to apply the evaluation model proposed to the study of other adjectives of importance, such as *relevant*, *crucial*, *vital*, etc., as I have already stated. On top of that, similar models can be proposed to study adjectives which occur within other parameters of evaluation, such as *certainty* or *expectedness*, or which are concerned with other values, like *size*, *novelty*, and so on. In this way, it would be possible to find out how academic values are mapped in interdisciplinary writing.

A last suggestion for further research might be to focus on the grammar patterns in which the adjectives occur and explore the possible presence of *semantic sequences* (Hunston, 2008), understood as "recurring sequences of words and phrases that may be very diverse in form and which are therefore more usefully characterised as sequences of meaning elements rather than as formal sequences" (p. 271). To give just one example, while exploring the corpus of Educational Neuroscience articles I found out that in most cases in which the predicative case with complementation by means of a prepositional phrase with *for* (Patter 3: 'v-link + ADJ + prep') occurred, a repeating meaning was conveyed, as in cases like these: [*One part of the brain, the prefrontal cortex (PFC)*] [*is often discussed as* ***being important for***] [*the ability to learn*]; [*One challenge for cognitive psychology research is to reveal the processes and mechanisms*] [*that* ***are important for***] [*successful learning*]; [*The executive function*] [***seems to be*** *particularly* ***important for***][*academic achievement and readiness*]; [*An area in the dorsal lateral premotor cortex, termed Exner's area,*] [*is well known to* ***be important for***] [*writing*], among many others, in which the semantic sequence encountered might be represented as something like ['mental process'] + ['*is important for'*] + ['learning outcome']. It might be interesting to investigate, for example, whether sequences like these

can be taken as additional *footprints* that signal interdisciplinarity and, furthermore, if they might serve to illustrate different relationships between the disciplines involved. In this specific example, a hint that shows the *subordination-service* mode is the fact that, in all the cases, a biological process is given importance as promoting an enhancement in learning and not the other way round.

As well as many avenues for future research are open, several important limitations need to be acknowledged. Most of them stem from the fact that this is an exploratory study and, due to this nature, I did not know what was going to be found until I found it. Because of that, then, I realised that some decisions I had taken could have been different. Perhaps the most noticeable limitation of this work is concerned with the interplay between the narrowing of the scope and the enlarging of the corpus. More specifically, the fact that only in the interdisciplinary fields more than 6,000 citations were encountered made it necessary to reduce the scope of analysis to the cases of attribution only, due to the impossibility to apply the kind of model I had in mind on such a high number of cases. However, it is clear that the study of the phenomenon of academic citation was incomplete, because a great number of citations, the averred ones, were left aside without interpretation. Then, the opposite effect was encountered in the study of evaluations of importance. As a high frequency of adjectives with that meaning were found, I decided to focus only on one of them, the most frequent. However, it turned out to be that the most useful findings for the study of interdisciplinarity were not given by the most frequent uses of the adjective. In this case, a bigger corpus of interdisciplinary articles would have been needed so as to make it possible to analyse more cases and thus provide more well-grounded evidence for the preliminary conclusions reached.

A second major limitation is rooted in the fact that in both analyses I tried to be as inclusive as possible; that is, I analysed every occurring citation that conveyed attribution and every case of *important* which occurred in the patterns selected across all the dimensions. Because of this, I had to create new categories or coin new names to encompass cases that, to my knowledge, had not been taken into account from a similar perspective in previous research. I am referring specifically to those cases in which attribution through citation was present but the grammatical category used did not fit any of the commonly acknowledged ones, the cases in which additional information was given to describe a more specific evaluative context of importance, and the cases in which the evaluated thing was neither purely research-oriented nor purely topic-oriented. Needless to say, when new categories are proposed within taxonomies or systems, they need to be treated and tested several times

before being taken for granted for future research. On top of that, it is possible that for certain ambiguous or blurred cases, I might have taken the wrong decision to place them as belonging to one or the other category. However, I was careful about always applying the same pre-established criteria for the classification of the difficult cases.

Finally, a third major limitation is the fact that the interpretation of the findings was based solely on my own judgment. Without any doubt, the inclusion of the opinion of specialist informants from the different interdisciplinary fields could have made an important contribution to the reliability of the research contribution, since as members of the disciplinarily communities they are who know and are informed about the specific disciplinary norms and practices and their implications for writing. Needless to say, the inclusion of interviews with the authors of the articles would have been ideal, as they could have provided more well-grounded reasons for their purposes and choices as well as useful contextual information for the interpretation of the quantitative data. Unfortunately, those methodological resources were not adopted due mainly to space, time and access restrictions.

5.5 Final thoughts: On metaphors and interdisciplinarity

Metaphors are often said to be useful to explain complex topics. Interdisciplinarity is indeed such a topic. As metaphors create a vivid image in the reader's head, understanding the message they convey is thought to be made easier. That is perhaps why several metaphors, borrowed and owned, have been used in this work. *Bowls of fruit* and *smoothies*, and *pidgins* and *creoles* have been used to represent differences between multi-, inter-, and transdisciplinarity. Furthermore, a progress from *tribes* and *territories* to *flowing oceans* and *troubled waters* was described when the concept of discipline was introduced. Finally, I have referred to the possibility of finding different *paths* in the search of interdisciplinary *footprints*. In a certain way, it seems as if complex concepts, processes or phenomena are better understood when described in ways that are not literally true.

While describing the current tensions between "the three cultures", that is, the culture of the natural sciences, the culture of the social sciences and the culture of the humanities, Kagan (2009, p. 266) acknowledges an obvious need for "a greater mutuality of understanding among the members of the three cultures," and he suggests that this might be partially met through "collaborations, both in and out of the academy, college courses co-taught and books co-authored by representatives from two or all three groups." In other terms, he is asking for more interdisciplinary work based on the premise that "scholars

working in all domains of inquiry have something to contribute to a deeper understanding of the human condition" (Kagan, 2009, p. 275). To finish his argument, the author argues that it is time for the members of the three cultures "to adopt a posture of greater humility for, like tigers, sharks, and hawks, each group is potent in its own territory but impotent in the territory of the other" (Kagan, 2009, p. 275).

And this is how, once again, a new metaphor has been introduced. I argue, however, that an important element is missing in it: when interdisciplinarity occurs, that is, when unknown areas are trespassed, how potent one or the other groups are is not what matters. What is really important is how one group communicates, negotiates and interacts with the other/s. And here is where the complexity of interdisciplinarity emerges. As Bernstein argues, "interdisciplinarity is a contradiction in terms, since disciplinary specialisation means that we shouldn't be able to talk to one another. But we do. And from the tension of the contradiction, knowledge grows" (cited in Martin, 2011, p. 57). I claim, to conclude, that although contradictory at times and always complex, interdisciplinarity does enhance disciplinary dialogue and understanding. Finally, throughout the development of this work I hope to have humbly contributed to the implicit endeavour of comprehending the language of different academic cultures when they interact to make interdisciplinary meanings.

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APPENDIX

Educational Neuroscience			Economic History			Science & Technology Studies		
verbs	*tokens*	*frequency*	*verbs*	*tokens*	*frequency*	*verbs*	*tokens*	*frequency*
show	109	28.53%	***argue***	72	18.65%	***argue***	72	25.62%
find	61	15.97%	***show***	54	13.99%	***suggest***	33	11.74%
suggest	58	15.18%	***suggest***	49	12.69%	***state***	17	6.05%
demonstrate	41	10.73%	***note***	30	7.77%	***point out***	16	5.69%
report	23	6.02%	***find***	29	7.51%	***claim***	15	5.34%
argue	12	3.14%	***conclude***	14	3.63%	***show***	14	4.98%
propose	11	2.88%	***point out***	12	3.11%	***find***	13	4.63%
reveal	10	2.62%	***estimate***	10	2.59%	***reveal***	11	3.91%
observe	8	2.09%	***indicate***	8	2.07%	***observe***	8	2.85%
state	6	1.57%	***claim***	8	2.07%	***indicate***	7	2.49%
point out	5	1.31%	***state***	7	1.81%	***write***	6	2.14%
conclude	4	1.05%	***report***	7	1.81%	***propose***	5	1.78%
claim	3	0.79%	***demonstrate***	7	1.81%	***explain***	5	1.78%
establish	3	0.79%	***emphasise***	6	1.55%	***remark***	4	1.42%
assert	3	0.79%	***believe***	5	1.30%	***put***	4	1.42%
confirm	2	0.52%	***stress***	5	1.30%	***stress***	3	1.07%
assume	2	0.52%	***observe***	5	1.30%	***believe***	3	1.07%
consider	2	0.52%	***assume***	3	0.78%	***assume***	3	1.07%
maintain	2	0.52%	***put***	3	0.78%	***report***	3	1.07%
highligth	2	0.52%	***acknolwedge***	3	0.78%	***emphasise***	2	0.71%
think	2	0.52%	***reveal***	3	0.78%	***mention***	2	0.71%
explian	2	0.52%	***write***	3	0.78%	***contend***	2	0.71%
prove	2	0.52%	***predict***	2	0.52%	***detail***	2	0.71%
note	1	0.26%	***propose***	2	0.52%	***describe***	2	0.71%
comment	1	0.26%	***posit***	2	0.52%	***conclude***	2	0.71%
accept	1	0.26%	***discuss***	2	0.52%	***acknowledge***	2	0.71%
postulate	1	0.26%	***know***	2	0.52%	***opine***	2	0.71%
posit	1	0.26%	***contend***	2	0.52%	***recommend***	2	0.71%
mention	1	0.26%	***mention***	2	0.52%	***comment***	1	0.36%
express	1	0.26%	***confirm***	2	0.52%	***notice***	1	0.36%
discover	1	0.26%	***hypothesise***	2	0.52%	***see***	1	0.36%
emphasise	1	0.26%	***calculate***	2	0.52%	***discuss***	1	0.36%
			remember	1	0.26%	***advice***	1	0.36%
			insist	1	0.26%	***illustrate***	1	0.36%
			recognise	1	0.26%	***lay out***	1	0.36%
			hint	1	0.26%	***like***	1	0.36%
			underline	1	0.26%	***insist***	1	0.36%
			admit	1	0.26%	***coin***	1	0.36%
			add	1	0.26%	***maintain***	1	0.36%
			hold	1	0.26%	***complain***	1	0.36%
			warn	1	0.26%	***express***	1	0.36%
			express	1	0.26%	***demonstrate***	1	0.36%
			maintain	1	0.26%	***hypothesise***	1	0.36%
			complain	1	0.26%	***know***	1	0.36%
			depose	1	0.26%	***note***	1	0.36%
			allege	1	0.26%	***say***	1	0.36%
			feel	1	0.26%	***reflect***	1	0.36%
			inform	1	0.26%	***surmise***	1	0.36%
			outline	1	0.26%	***admit***	1	0.36%
			specify	1	0.26%			
			say	1	0.26%			
			consider	1	0.26%			
			remark	1	0.26%			
			think	1	0.26%			
			agree	1	0.26%			
others	57	14.92%	others	116	30.06%	others	90	32.03%
Total	382	100.00%	Total	386	100.00%	Total	281	100.00%

Table A.1 List of reporting verbs in the three interdisciplinary fields