DISCUSSION SECTIONS OF SCIENTIFIC RESEARCH ARTICLES: CHALLENGES AND OPPORTUNITIES

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Abstract: Discussion sections are of crucial importance for the acceptance and subsequent dissemination of knowledge claims introduced in scientific research articles. Therefore, this paper aims to summarize the most relevant challenges that academic writers were reported to encounter when writing this section of scientific research articles as well as to highlight the opportunities that successful Discussion sections can provide in today's highly competitive academic environment. The rhetorical strategies most commonly used to interactively introduce and support new claims will be presented alongside the difficulties encountered especially by non-native academics who wish to publish their research results in international English-language journals.

Keywords: *Discussion, scientific research articles, academic writing, knowledge claims, rhetorical strategies, writer-reader interaction.*

The Introduction, Methods, Results and Discussion (IMRAD) structure of research articles has been a uniform technical requirement since the 1978 meeting of the biomedical journal editors who constituted the Vancouver Group that later transformed into the International Committee of Medical Journal Editors (ICMJE). Although the requirements were reviewed several times, this structure continues to be widely used by scientific and medical journals because of its clear formatting that allows modular reading and facilitates a standardized peer review process[1]. Despite being heavily criticized for "providing a totally misleading narrative of the processes of thought that go into the making of scientific discoveries"[2] as well as for intentionally omitting "much of what happened in the laboratory", not respecting the actual sequence of events and using literary strategies for persuading its target readers[3], the scientific research article continues to maintain its current format and to be "the standard product of the knowledge-manufacturing industries"[4]. The popularity of this genre is proven not only by the extremely large number of articles submitted for publication in every scientific field but also by the strong international

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[1] Bollaci and Pereira 2004
[2] Medawar 1964: 42
[3] Knorr-Cetina 1981: 94
[4] Swales 1990: 95

competition that it creates among researchers who wish to have their knowledge claims validated by their respective discourse communities and thus achieve worldwide recognition.

Although theoretically the main role of scientific research articles is to spread knowledge and thus contribute to the progress of science, in today's highly dynamic and competitive academic environment this genre has become a powerful vehicle for establishing individual and institutional hierarchies. Thus, the two-dimensional character of academic writing was highlighted by Askehave and Swales[5], who defined it as a socially constructed rhetorical artefact through which writers not only present new knowledge but also persuade readers of its validity and relevance with the help of interpersonal and evaluative meanings. Persuasion involves writer-reader interaction, whose key role was also pointed out by Myers [6] who stated that "it is important for discourse analysis and for the teaching of writing to show that, while writing does not involve face to face contact, it is a form of interaction".

By gaining personal recognition following the acceptance and subsequent quotation of the knowledge claims introduced in Discussion sections, academic writers also contribute to the validation and prestige of their academic or research institutions whose goal is to achieve high international rankings and consequently attract a high number of students, research opportunities and funding. The interactive character of academic writing, as well as the presence of private goals and intentions that influence the rhetorical strategies selected by scientific writers, were also identified by researchers such as Bhatia[7], Hyland[8], Salager-Meyer[9], Hyland and Tse[10] or Gosden[11].

Discussion sections of scientific research articles represent the main medium for writer-reader interaction in academic writing. Their main rhetorical function is that of summarizing the research results and making claims about the findings, the claim being thus regarded as the core of this section of scientific research articles[12]. The importance of claim acceptance was also stressed by Myers, who viewed the construction of academic texts as relying on a model centered on claims and denials of claims[13].

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[5] Askehave and Swales 2001
[6] Myers 1989: 30
[7] Bhatia 2012
[8] Hyland 2009a
[9] Salager-Meyer 2000
[10] Hyland and Tse 2004
[11] Gosden 1992
[12] Salager Meyer 1994
[13] Myers 1989

In order for successful interaction to occur, the following are required: knowledge of the subject matter, which thus restricts the target audience to the members of a certain discourse community, knowledge of discipline-approved conventions and rhetorical strategies as well as mastery of the language of communication, i.e. mostly English in all scientific areas nowadays. Since Discussion sections are more argumentative than Methods or Results sections, in which the emphasis is on reporting and therefore narration rather than argumentation, they were also found to be more challenging to write in English regardless of the authors' first language[14].

As far as non-native speakers are concerned, a study[15] identified the Discussion section as the most implicated in the increased difficulty perceived by Spanish researchers writing research articles in English as opposed to Spanish regardless of the participants' field or publication experience. This result suggests that an increased level of proficiency writing in English for Academic Purposes reduces the researchers' perception of increased difficulty writing Discussion sections, which highlights the fact that in academic writing English language proficiency outweighs familiarity with disciplinary conventions.

The importance of Discussion sections for the successful acceptance of a submitted research paper is also demonstrated by a study focusing on work presented in abstract form but not subsequently published as full text in a medical peer-review journal[16]. Thus, the editors and reviewers of *Respiratory Care* included in this study ranked getting carried away in the Discussion on the sixth place among the top ten reasons for manuscript rejection. In particular, long Discussion sections containing irrelevant and redundant information were criticized as inappropriate as the authors marketed or trumpeted their results inadequately leading to poorly structured and difficult to follow sections.

The key role of Discussion sections in medical research articles was also highlighted by Trelle[17] who concluded that while Methods sections were rarely read, Abstracts and Discussions were almost always read by the German doctors surveyed in this study. Such a finding is not unusual given the functions of these two vital sections: Abstracts save time by summarizing entire papers so that readers can quickly decide whether the research is of interest to them while Discussions interpret previously presented Results and introduce knowledge claims that may constitute essential breakthroughs in a field or generate opportunities for further investigations.

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[14] Burrough-Boenisch 2005
[15] Moreno *et al* 2012
[16] Pierson 2004
[17] Trelle 2002

As far as the structure and communicative goals of Discussion sections are concerned, a study on move analysis of such sections in dentistry research articles compared to applied linguistics articles revealed broadly similar moves and rhetorical purposes in the two fields, with differences occurring only at step and sub step levels[18]. Thus, the three broad moves occurring in medical Discussions were highlighting the overall research outcome, explaining specific scientific outcomes and stating research conclusions. Knowledge claims are generally introduced in the second move, which aims to explain the results in such a way as to emphasize their novelty, relevance and ultimately value in the field.

While facts can be presented with straightforward confidence in the other sections of research articles or in other genres such as scientific books or textbooks, because they represent commonly accepted knowledge, opinions and interpretations of results must be introduced cautiously, as they are no more than inferred or assumed in Discussion sections[19]. Therefore, since new claims are only regarded as opinions pending the approval of the members of a certain discourse community, they must be introduced with modesty and caution in order to facilitate acceptance following appropriate interaction. Only in this way claims can gain the acceptance of the target readers who have the power to reject them by ignoring the paper or contradicting its results, or, on the contrary, to assign them value through citations thus acknowledging that the respective claims turned into proven scientific knowledge. This process demonstrates that writer-reader interaction is crucial in written academic discourse and ultimately in the creation of scientific knowledge.

The most important characteristics of appropriate knowledge claims, which are most likely to be approved by target readers, were studied by applied linguists. In this respect, Hyland[20] concluded that "reasonable" claims are accepted because they "respond to an existing and finite set of exigencies recognized by the community; maintain or expand the community's understanding of natural phenomena; represent empirical adequacy and accuracy in terms of prescribed methods; correspond to existing assumptions, theories and bodies of knowledge believed to accurately describe nature; adopt the most certain and general position readers are likely to accept; demonstrate a scientific ethos to the discourse community which involvesrecognizing previous work and acknowledging priority, concealing a rhetorical identity behind a pose of objectivity, presenting a modest and collegial persona, demonstrating deference to, and willingness to negotiate with, one's peers."

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[18] Basturkmen 2012
[19] Hyland 2007
[20] Hyland 1998: 252-253

Academic writers must use appropriate rhetorical tools in order for their claims to meet the above-mentioned characteristics of reasonable claims and promote the writer-reader interaction required for the acceptance of claims. Based on the premise that academic writing is not objective and impersonal but persuasive through language that is used "to acknowledge, construct and negotiate social relations", stance and engagement were regarded as the most important resources of academic interaction[21]. According to this view, stance is achieved through the use of hedges (*possible*, *might*, *perhaps*), boosters (*clearly*, *obviously*, *demonstrate*), attitude markers (*unfortunately*, *hopefully*, *remarkable*) and self-mention (first person pronouns, possessive adjectives) while engagement is realized with the help of reader pronouns (*you*, *your*, *we*), directives (*consider*, *note*, *it is important to understand*), questions (mainly rhetorical), appeals to shared knowledge (mainly in soft papers) and personal asides (comments, especially in the soft fields).

In this model of interaction in academic discourse proposed by Hyland, stance reflects the writers' personal authority and attitude towards their opinions and judgments, which they can either strongly convey and support through boosters for instance, or introduce tentatively through hedges, which mitigate the force of statements and withhold full commitment to a proposition. On the other hand, engagement conveys the writers' wish to recognize the presence of the target readers, gain their attention, acknowledge them as discourse participants and stimulate active participation in the reading process. All these resources that are constantly employed in order to create the interpersonal dimension of written academic discourse can often overlap, rendering the task of identifying and establishing their pragmatic function a complicated endeavor.

The identification and classification of rhetorical tools in academic writing greatly depends on the context in which they are used, the readers' familiarity with the conventions of specific discourse communities, their understanding of the different tools employed in soft vs. hard sciences and ultimately their possibly subjective interpretation at the time of reading. In particular, the fundamentally different ways in which knowledge is created in the soft and hard sciences greatly influences the style of written academic discourse.

In the soft fields, deduction, interpretation, evaluation and re-evaluation generally lead to new information that is not necessarily quantifiable, palpable or easy to replicate. Therefore, since claims in these fields cannot be bluntly refuted, writers can safely assume more personal positions and generally seem to be more personally involved in their claims. Personal involvement is also stimulated by the individual character of

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[21] Hyland 2005

research in the humanities, which is usually conducted by individual researchers who thus carry sole responsibility for their statements.

Conversely, in the hard sciences, new information is discovered through experiments that can be replicated by other researchers who could thus refute previous findings. Since scientific data are regarded as being able to speak for themselves, hard science writers generally assume a lesser degree of commitment to the truth of their propositions and seem to downplay their role in the research, in this way creating the impression of objectivity[22]. This reduced level of involvement is also facilitated by the fact that research projects in the hard sciences usually involve teamwork, which leads to multiple authors who had specific roles in the experimental research and are therefore directly responsible for only part of the paper.

These different ways of creating knowledge impact writing styles and conventions. The concept of language as data vs. facts as data is associated with expressing probabilities, hypotheses and interpretation in humanities vs. certainties and descriptions in the hard sciences[23]. Therefore, the explicit involvement of writers in the humanities and social sciences is expressed through interactional markers and overhedging compared to authors in the science and engineering fields, who prefer fewer hedges, weaker claims and directives as the most frequently occurring interactive features[24]. The use of the first pronoun *we* was also found to characterize soft science writing while the possessive adjective *our* (*our data, our results, our findings*) seems to be preferred in the hard sciences for its reduced degree of commitment[25].

Regardless of field, interpersonal discourse strategies were also found to be influenced by a writer's cultural background[26], as well as by individual factors including seniority or language proficiency, which are responsible for different degrees of authorial confidence and directness[27]. Rhetorical strategies are generally used with more confidence and flexibility by non-native academics with a high level of English language proficiency, which allows them to use nuances of meaning in order to convey intended meanings as accurately as possible.

However, interaction in written academic discourse does not solely refer to the target readers' response to published papers but also to the constant interaction among writers, reviewers and editors, which also plays a crucial role in the creation of knowledge. The drafting and redrafting of research articles by teams of writers is then submitted for evaluation to peer-

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[22] Hyland 2002; Millán 2010
[23] Skelton 1988
[24] Hyland 2005
[25] Millán 2010
[26] Salager-Meyer 1998
[27] Burrough-Boenisch 2005; Hyland 2005; Hyland 2011; Millán 2010; Moreno *et al* 2012

reviewers and editors. At this stage, recommended changes, clarifications or improvements lead to further editing and sometimes rewriting of the main rhetorical goals, which has thus turned peer-reviewing into a control mechanism able to transform beliefs into knowledge[28].

Therefore, this continuous interaction facilitated by the use of appropriate rhetorical strategies reflects the social constructivist view according to which a scientific paperis constructed through the interaction of networks and communities[29], which means that it is "a multilayered hybrid co-produced by the authors and by members of the audience to which it is directed"[30].

In conclusion, scientific research articles whose knowledge claims manage to turn into knowledge following their successful acceptance by target readers represent powerful vehicles for obtaining and then consolidating influential positions within specific discourse communities. This is how individual and institutional recognition and prestige are obtained in the context of today's highly competitive academic environment characterized by the need to publish in high-ranking English-language publications.

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[28] Hyland 2009b
[29] Latour and Woolgar 1986
[30] Knorr-Cetina 1981: 106

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