



Critical Issues in the Teaching of Responsible Writing

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In this paper I identify some of the more common, problematic writing practices (e.g., plagiarism, selective reporting of literature, and/or results, 'spin') found in traditional journal articles, along with associated variables, and suggest ways to correct them. The primary aim of the discussion is to emphasize the cultivation of transparency, excellence in scholarship, and a 'best practices' approach to disseminating the results of our research.

THE NEED FOR INSTRUCTION IN RESPONSIBLE WRITING

Competency in English, the *de facto* language of science, is associated with higher levels of scientific output in that language (33). But, at the same time, it seems that an increasing number of publications are being authored and/or co-authored by researchers with inadequate writing skills in English and limited experience with Western traditions of intellectual property (10, 18). In the U.S. alone, about 35% of doctoral degrees in the sciences are awarded to foreign students (19), many of whom are not native English speakers. Others, who are native-born or who are assumed to have had the proper training in the use of standard scholarship, seem to have adopted writing practices that differ from established norms (16, 24). Even some who rise to become journal editors do not always agree on some of the key issues of scholarship (35, 29) nor on their importance in scientific writing (2, 15).

TEACHING RESPONSIBLE WRITING: THE READER-WRITER CONTRACT

Instruction in responsible writing should be grounded on the 'reader-writer contract,' a notion with origins in the humanities and which has been described as an implicit understanding that exists between authors and readers. When readers approach a written work, they do so with the understanding that the ideas, facts, and figures presented by the author are accurately represented. In addition, the ideas (data, etc.) being described are assumed to be the authors' own

and, if not, credit is given to the rightful owners. Moreover, readers also assume that the work is new and, if it is not, they are informed about any partial or full prior disseminations of that work. In sum, the principles of accuracy and originality, which are also at the core of all scientific work, underlie all facets of responsible writing.

PLAGIARISM, CITATION, AND QUOTATIONS

Perhaps the most common violation of the reader-writer contract occurs when we present some aspect of others' work as our own. For example, one may plagiarize ideas, data, figures, text, processes, and even portions of research methodologies, such as experimental procedures, variable manipulations, etc. It does not matter whether the source from which the material has been plagiarized is published or not. Even an idea that has only been verbally disclosed informally must be credited to its rightful owner. In sum, when discussing others' ideas, theories, previous findings, etc., we are obligated to identify their source unless the material constitutes common knowledge (I discuss this notion at some length in Roig [25], p 14–15). Proper attribution serves two primary purposes: to credit those who did the work and to allow readers to verify any claims made about such work.

Credit where credit is due

Some inexperienced authors have difficulties with the mechanics of citation placement. For example, they may provide the same citation repeatedly throughout a section of their paper leading to what might be called 'citation clutter.' More commonly, perhaps, is the situation where a series of citations are added at the end of a very long paragraph that outlines work from various sources (improper citation placement). Other instances of inappropriate citation are more challenging, such as when an

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author provides a citation to someone's work when the work is first cited, but continues to discuss that individual's work later in the paper in such a way that the reader cannot determine which ideas/data are the author's own and which belong to others (insufficient citation). The latter situation is perhaps the most problematic because it can conceivably lead readers to misattribute others' ideas as the author's own, thereby risking a charge of plagiarism for the inexperienced author.

Plagiarism of text

The most common form of plagiarism is thought to be the misappropriation of portions of others' text that are passed off as one's own writing. To avoid it, authors must become mindful of two simple rules of scholarship. When we wish to convey others' ideas and do so by using an author's verbatim (i.e., word-for-word) text from the original source, we must enclose that text in quotation marks (or block-indent it if the borrowed material is long) and provide a citation to identify its source. Note that some style manuals will also require the page number to be listed to identify the exact location from which the material was obtained. Alternatively, we paraphrase and/or summarize the material and provide a citation as to its source.

Unfortunately, enclosing others' text in quotation marks is not commonly done in IMRAD-type (introduction, methods, results, and discussion) journal articles. Perhaps this is because the scientific community has long been operating under the increasingly unfounded assumption that contributors to the scientific literature either are sufficiently English-writing proficient to be able to describe their own research and to summarize others' work, or have access to technical writing assistance to help them do so competently. As noted earlier, the reality is that an increasing proportion of the scientific literature is now generated by scientists whose primary language is not English and/or who lack adequate resources to function in the now largely global context of publish-or-perish. Given the decades-old scholarly traditions used in scientific writing, authors are left with no other option but to produce original writing. Compounding the problem is the fact that good scientific prose is often difficult to generate, even for those who are native English speakers. Consequently, some authors may feel that because their primary mission is to discover and disseminate their findings, they should be able to do so without sacrificing quality and accuracy even if it means misappropriating small portions of others' language (34, 12).

Whatever the causes, some authors engage in writing practices that, at best, fall short of the high scholarly excellence expected in scientific writing. For example, some authors have been known to engage in mosaic plagiarism, or patch-writing, which occurs when they construct a paragraph by stitching together smaller portions of verbatim text from several sources and present the resulting writing

as their own. Another way in which readers are misled about the authorship of text occurs when authors rely on 'light' paraphrasing of others' work. A proper paraphrase requires that the textual material be thoroughly modified, and failure to do so can lead to a charge of plagiarism. (Elsewhere, I have provided additional discussion on the distinction between paraphrasing and summarizing see Roig [25] or Roig [28]). Of course, the ability to thoroughly modify text depends on 1) the extent to which the textual material is composed of technical terms and expressions for which there are acceptable equivalents and 2) the writing skill and technical knowledge of the paraphrasing author. Thus, most skillful writers would not have much difficulty providing an adequate paraphrase of material that appears in, say, a popular magazine article. However, paraphrasing material from a technically complex methods section may be a different matter, even for seasoned authors, if they are not intimately acquainted with the relevant area of research being described. Given these considerations, it is important that those teaching responsible writing be mindful of their students' current fluency in English and be able to adjust their instructional materials to meet the needs of the growing number of scientists who are not fluent in English. Furthermore, evidence suggests that such instruction is best when carried out face-to-face as opposed to the more practical online approach (13). Certainly, acquiring good paraphrasing and summarizing skills demands a more hands-on practice-and-feedback style (21) that current automated online approaches are simply unable to provide.

Self-plagiarism

Although a number of writers have objected to the use of the term 'self-plagiarism' (e.g., Bird [3] and Callahan [6]), it has been adopted by others to describe a variety of malpractices in which authors reuse their own material without informing the reader of its prior dissemination. As such, self-plagiarism violates the assumption of novelty embodied in the reader-writer contract, and it is particularly problematic as it applies to the reuse of data that have already been published, but are presented again as new. Still, some consider the notion of self-plagiarism as a non-problem (1, 6, 9), but others (4, 5), including myself (26, 27), disagree, arguing that recycling substantial amounts of text does not represent a best-practices approach to responsible writing and falls short of scholarly excellence, the types of qualities that we want to model for aspiring scientists. In addition to ethical concerns, there may be legal implications to recycling our previously published work. For example, an author who recycles in a new publication material from their own previous publications that are owned by different publishers may be engaging in copyright infringement. Nonetheless, the recycling of small portions of one's own text, even if it is done within the confines of copyright law, may be deemed as ethically problematic (5).

OTHER PITFALLS IN SCIENTIFIC WRITING

Literature reviews

“A paper that conforms to the norms of scholarly perfection would explicitly cite every past publication to which it owes an intellectual debt” (17). Alas, in some areas of science, such perfection may be impractical or even impossible, given the growing volume of relevant literature published each year. In addition, limits on the number of citations some journals impose on authors may also affect such noble aspirations. But evidence does indicate that, too often, authors fail to cite previous relevant literature in critical areas of research (e.g., Robison and Goodman [23]). As Ginsburg explains (11), the reasons for this so-called “citation amnesia” can range from unintentional oversight that may occur as a result of, say, a change in terminology that prevents the identification of older literature to intentionally ignoring relevant literature (e.g., Ravnskov [22], Schmidt and Gotzsche [31]) because it does not conform to the author’s point of view. Memory probably plays a role also, particularly in situations where there is extensive literature on a subject. Whatever the causes, ignoring relevant literature denies deserving authors exposure to their work. More importantly, cherry-picked (i.e., biased) literature reviews are undesirable because they provide readers with a distorted view of the status of the phenomena being studied.

Another deceptive writing malpractice typically associated with literature reviews occurs when authors rely on secondary sources to compose their own review. There may be several reasons for taking this short-cut and these can range from an inability to access one or more key primary sources to pure intellectual laziness on the author’s part. Relying on a secondary source is seldom advisable mainly because there is an expectation that authors have access to, and are able to process, the primary literature, but also because sometimes those secondary sources can contain subtle errors of fact or interpretation which are then unintentionally propagated by the authors who relied on the flawed presentations. One particularly deceptive malpractice observed with some students, and thought to occur with professionals as well, occurs when authors summarize the contents of the secondary source adopting the citations contained therein, which are then listed in the offending author’s reference list. In this situation, the reader is additionally misled into believing that the author has read the cited literature when, in fact, that is not the case.

Methods sections

We have all been taught that, in the methods section, a most important part of an empirical paper, we must provide a concise, but clear, description of the actual experiment. All relevant details about the study’s subjects, materials, equipment, procedure, etc. must be conveyed in an accurate and

coherent way to allow others to independently reproduce the investigation and verify the original results. We must also be precise in our language. Thus, for example, if we write that ‘animals were randomly assigned to experimental and control conditions’ we should mean that we used an acceptable procedure involving a true set of random numbers to ensure that, in fact, animals were randomly assigned to conditions. As Lisa Bero explains, reaching into a cage and selecting the first animal we can grab (7) is not random assignment. Precision and clarity are requirements of scientific writing. However, as the complexity of our materials and procedures increases, so too do the chances of omitting a crucial detail or of introducing ambiguity in our descriptions (see McNutt [20]). It should come as no surprise, then, that even with the introduction of online supplementary materials sections, which allow authors to provide more complete descriptions, incomplete methods sections are thought to be one of the factors associated with the lack of reproducibility in science. The reality is that balancing conciseness, clarity, and completeness, especially in methods sections, is no easy task in highly complex experiments, even for experienced authors. The introduction of subtle ambiguities in a phrase or sentence may be sufficient to prevent reproducibility of that work. Thus, authors need to always keep in mind these important considerations.

Results sections

We are all aware of the need to obtain positive findings, for doing so greatly increases the likelihood of getting our work published. As a result of this reality, a number of undesirable writing practices in connection with reporting results have emerged over the years whose main purpose is to create the appearance of study outcomes that are consistent with the author’s expected findings. I list below some of the most common malpractices. While many of them are ‘sins of omission,’ others, such as the inappropriate manipulation of images (30), represent ‘sins of commission.’ Space does not permit a complete listing of all malpractices or a thorough explanation of why they might be problematic. But the reader should be aware that many of the errors uncovered in the use of statistics in the biomedical literature (e.g., Strasak et al. [32]) are more suggestive of incompetence in statistical data analysis than of an attempt to intentionally mislead readers. Nevertheless, discussion of the more common statistical malpractices should be a requirement in any training program in responsible writing.

- Failure to reveal the results of some statistical analyses and/or only include those analyses that resulted in statistical significance.
- Failure to include the results of a condition or an entire dependent measure.
- Failure to include the results of an entire study that was part of the same study series.

- Failure to indicate that data, such as outliers, were excluded from analyses mainly because their inclusion led to results that were not consistent with the hypotheses.
- Failure to reveal that an early examination of data led to stopping or to continuing data collection.
- Describing *post-hoc* results as if they are *a priori*.
- Rounding off probability values to conclude statistical significance.

Discussion sections

Most of us do research in the belief that our work will result in some benefit to society, and it is in the discussion section that we address the significance (e.g., clinical, theoretical) of our findings. In this section, we also integrate our results into the existing literature and address their implications, shortcomings, and future directions of the research. The excitement over the prospect of making a significant contribution to society can thwart our objectivity and lead us to overemphasize the significance of our research while we at the same time underestimate or dismiss altogether any risks or drawbacks of our work. As Cummings and Rivara (8) so eloquently describe, such ‘spin’ can also occur in literature reviews. Authors will sometimes resort to exaggerating the importance of the topic or unfairly criticizing others’ research on the basis of “methodological flaws” (what study does not have them?) and “small sample sizes” (they can still provide useful information). In sum, it is important to point out to authors the detrimental effects of these tendencies and for them to maintain the highest degree of fairness and objectivity throughout all facets of their work.

CONCLUSION

Responsible writing is intertwined with other forms of ethical research conduct, such as responsible authorship, which means that only those who have made substantive contributions to the written work as per ICMJE guidelines (14) are listed as authors and that others’ contributions that fail to meet authorship guidelines are properly acknowledged. Any conflicts of interest, real or perceived, that may exist are also to be declared. In sum, responsible writing in the sciences entails the highest degree of transparency with our readers. Such transparency is central to the reader-writer contract as well as to all others aspects of scientific research.

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