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Data Commentary in Research Publications: A Scoping Review

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ABSTRACT

Introduction: The modality of scholarly written communication offers verbal and visual modes that are supposedly to be interrelated. The verbal component is thoroughly studied whereas the visual, including tables, charts, graphs and others are mainly described from a technical perspective. The editorial review aims to synthesize research on data commentary as a comparatively new rhetorical genre.

Method: The review adhered to the PRISMA extension for scoping reviews, and the PPC framework. The eligibility criteria include problem, concept, context, language, types of sources, databases (Scopus, SpringerLink). The time range of the search was subject to availability of indexed publications.

Results: The searches and consequent screening by titles, abstracts, keywords and full texts identified 19 relevant publications. The books on academic writing focused on the three themes: general guidelines on data commentary, functions, and rhetorical structure of such commentaries, figure legends and notes to tables. The functional analysis of the publications singled out a prevailing framework, including rhetorical, ontological, epistemological, and argumentative functions. The rhetorical steps in data commentaries follow patterns suitable for the type of a visual. The review outlines generic steps described and proved by the research publications included in the review.

Conclusion: Though the research field is scattered, and no definite trends were specified, the potential of the field is rising as the implications of such studies are significant. A constant trend towards more visualization of the new knowledge requires more research on the interrelations between the verbal and the visual, with a special accent on data commentary.

KEYWORDS

data commentary, rhetorical steps in data commentary, tables, figures, rhetorical functions

INTRODUCTION

Any act of communication may involve various means to transmit the message (Johns, 1998). In written communication, besides the text as its basis, visual objects considerably add to the modality of communication (Hemais, 2014). The visual components in research publications entailing figures, tables, and other visual materials (Miller, 1998) communicate condensed information to the readers (Parija & Kate, 2017). Royce (2002) points out that the verbal and the visual "create meanings in a complimentary mode". A synergistic interaction of verbal and visual is emphasized (Gross & Harman, 2014).

New knowledge production is overwhelmingly disseminated via research publications in peer-reviewed journals1. The way new knowledge is presented is essential to be correctly understood and perceived as verbal and visual modes create complementary meanings (Hemais, 2014). Being an integral part of research tradition, visual thinking is converted into visual language accompanying verbal mode to communicate reasoning and

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research results to the reader (Cocchiarella, 2015, p. VI). For years, researchers have occasionally turned to relationships between verbal and visual components in the text, including Kress & van Leeuwen (2006) who based their research on the functional grammar theory (Halliday, 1985), visual persuasion and presentation of data (Miller, 1998; Miller, 2004), distribution of visual representations across scientific genres (Tang, 2023).

Though visual presentation of data in research publications entails heterogenous forms (Ariga & Tashiro, 2022), we are to focus essentially on tables and charts of all types as research publications tend to be saturated with tables, figures, and other illustrations of the kind that occupy "from one third to one half of the page" of an average research article (Miller, 1998)[2]. Our special interest lies in what is termed as "data commentary" (Swales & Feak, 2012). The genre, or the type of the text, where such a commentary is placed determines the specificity of data commentary, its length and rhetorical steps it follows (Swales & Feak, 2012). Whereas verbal rhetoric of scholarly publications has been thoroughly studied, starting with the profound work by John Swales (1990), research on data commentary is quite scattered and seems occasional. It is considered as "a relatively new genre" (Parviz & Lan, 2023).

Data commentary (DC) in research or review articles includes paragraphs in the scholarly text preceding or following a visual object as well as notes and legends relating to tables, figures, and other visuals (Swales & Feak, 2012). The significance of further research on DC is rooted in its implications for Academic Writing as a discipline and journal guidelines. Not each academic writing course focuses on rhetoric of data commentary as most instructors prefer to dwell upon the verbal components of the text as DC created in a multimodal context that is quite a challenge not only for student writers but for experienced researchers and instructors (Parviz & Lan, 2023). The reasoning behind selective attention to visual rhetoric is also linked to various limitations within academic writing courses (with a course time limit as the frontrunner), and many other challenges a novice researcher faces to be primarily met.

The emerging field of research on DC requires reviewing for setting the scope of the research area and specifying gaps in the knowledge. To this end, no review has been found. This editorial review aims to synthesize research on data commentary in scholarly publications in peer-reviewed journals and academic writing books and identify the scope and cohesion of the field.

To attain the aim, we are to answer the following review questions:

RQ#1: What are the prevailing themes in the research field?

RQ#2: What guidelines do academic writing books offer regarding commentary on visuals?

RQ#3: What functions do data commentaries perform in research publications?

RQ#4: What rhetoric steps do researchers outline regarding data commentary in various contexts?

METHOD

Protocol

While starting the present scoping review, we meticulously developed a research protocol. The authors hereby certify that this review report constitutes a faithful, precise, and transparent description of the conducted review. No deviations from the protocol were registered. Any departures from the original study design have been duly elucidated. This scoping review stick to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) extension for Scoping Reviews (Tricco et al., 2018) and the framework proposed by Arksey and O'Malley (2005).

Search Eligibility Criteria

In the review, the problem (population), concept, and context (PCC) framework was applied to devise an effective search strategy where each criterion was justified (Table 1).

Search Strategies

The search to attain the aim and to reply to the review questions was conducted in a two-stage mode. At the first stage, the Scopus and SpringerLink databases were thoroughly searched to identify relevant publications. The search was conducted using a range of the keywords: "data commentary", "commentary on data", and "visual commentary" as of September 2, 2024. All other potential keywords were applied in pre-protocol searches but failed to bring any results.

At the second stage, the search in the refence lists was done in the publications selected from the Scopus and SpringerLink databases after screening of the titles, abstracts and full texts. The full-text publications eligible for the review were identified after screening. In addition, after all relevant books on academic writing were selected on the SpringerLink, the authors sifted their reference lists to find more relevant publications. Those with full texts were included in the review.

[2] This claim is true regarding some sections of research articles, including the results and discussion sections, and occasionally the introduction and method section subject to disciplines.

Table 1

Eligibility Criteria

Criterion	Inclusion	Exclusion	Rationale
Problem	Data commentary	All publications that do not deal with data commentary	The review focuses on data or visual commentary. The problem is defined as the interpenetration of the visual and the verbal in a scholarly text
Concept	Rhetorical concept applicable to data commentary (or commentary on visuals)	Other concepts	The aim of the review is to identify the scope and recent trends of rhetorical and other relevant research on data commentary
Context	Relevant research articles on rhetoric of data commentary and academic writing books	Other concepts	The review dwells upon the rhetoric of data commentary
Language	English	Other languages	The object of all research in focus is scholarly publications in English. The language choice is also identified by its status as a lingua franca of international science.
Time period	All publications available in the database	N/A	The pilot pre-protocol searches found that the relevant publications were scattered across a long period of time, starting from the late1990s
Types of sources	In the Scopus database: full texts of articles, reviews, conference papers, books, and book chapters; In the SpringerLink: books	Unavailable sources, unavailable full texts	This review aims to get a comprehensive understanding of the field
Geographical location	Any location	None	Getting international perspective
Database	Scopus SpringerLink	Other bases than Scopus and SpringerLink	The Scopus and SpringerLink databases were selected as two of the biggest covering publications related to visual rhetoric
Areas of Research	All	N/A	As the review focuses on the rhetorical concept, publications rarely go beyond communication and linguistics, studying rhetorical specificity in research across all sciences ultimately may be classified otherwise

Study Selection

Both authors identified research publications and books subject to the eligibility criteria enumerated in Table 1. After the Scopus and SpringerLink filters (language and types of sources) had been applied, each reviewer independently screened the titles, and then the abstracts of the identified documents. The publications were subsequently tagged by each reviewer with “to include” or “to exclude” marks. When occasional disagreements arose, they were settled by mutual consent. No disputed issue required lateral expertise.

The full texts were found via the publishers or at request applying to the authors of the publications. Each full text was profoundly read and independently analysed by each reviewer. Relevant publications were identified. The relevant publications found in the reference list of the selected studies were also included subject to full text.

Data Extraction

With title and review questions determined under the PCC framework, pre-protocol pilot searches made us identify the basic structure of the extracted data we would require:

1. Data from the selected books on academic writing related to commentary on data and visuals, its rhetoric functions and steps;
2. Data from the reviewed publications regarding commentary on tables, figures and other data presented in a visual mode;
3. Data from the articles and books under review containing any reference to rhetorical steps in commentaries on data.

All raw data were double-checked by the authors.

RESULTS

Search and Selection Results

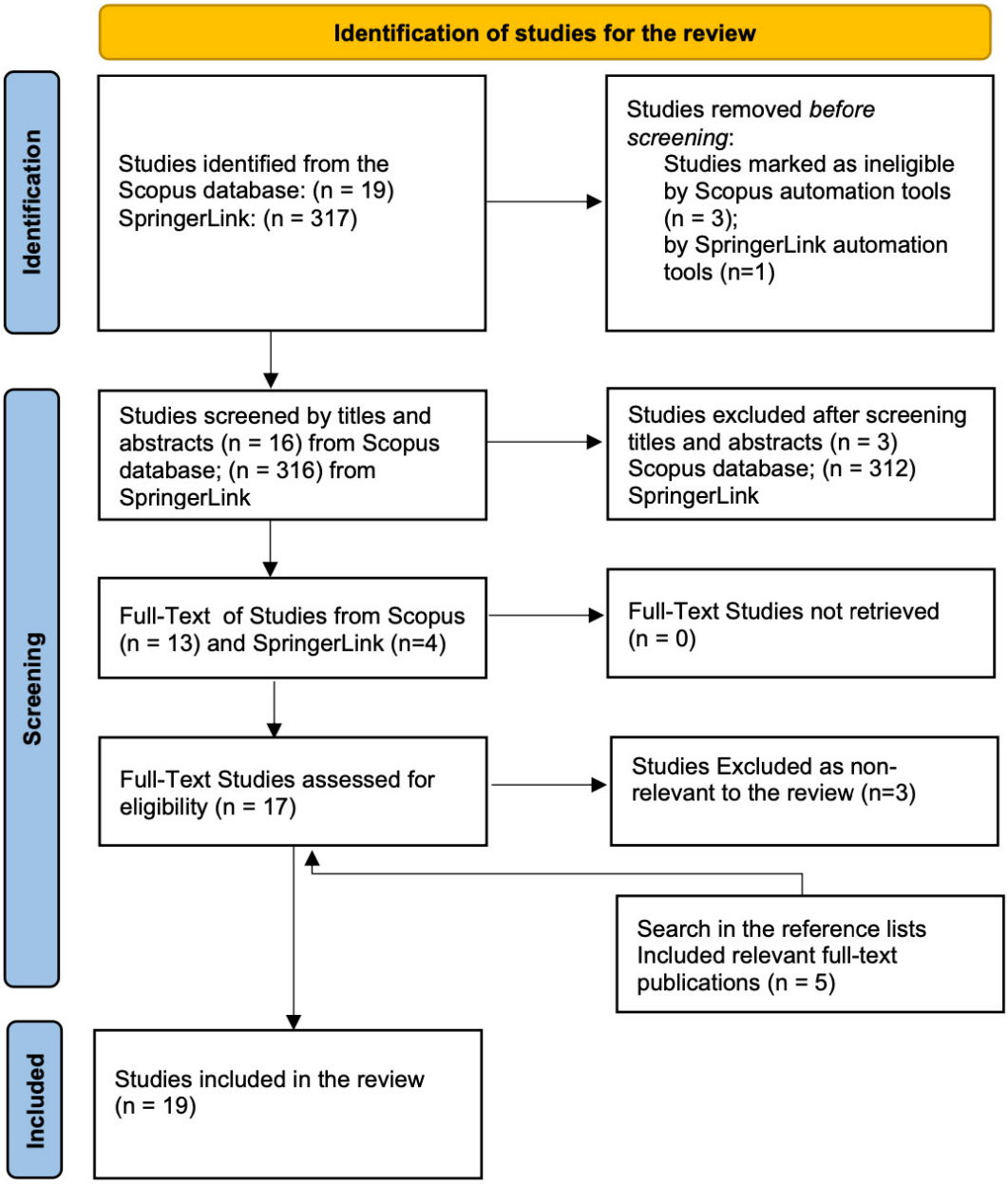
The search results were fixed as of September 2, 2024. A total of 336 documents were initially found, including 19 records in the Scopus database, and 317 records in the SpringerLink. After applied filters (language; in the SpringerLink – language and type of publication), the total decreased from 336 to 332 studies that were eligible for title and abstract screening. After the title and abstract screening, 315 documents were deemed irrelevant and excluded, including 312 books from the SpringerLink and three articles from the Scopus database. The remaining seventeen publications had full texts. After full-text publications had been screened, three article were not included in the final analysis. A thorough search in the reference lists of the selected full-text books and articles brought another three full-text books and two full-text articles. The total of 19 publications was finally selected for further analysis. The PRISMA flow-chart (Figure 1) depicts the whole identification and screening procedure.

Characteristics of the Research Field

The publications indexed in the Scopus database included ten research articles and one book. The timeline for the selected records began with 1998 and ended in 2024, though

Figure 1

Selection of Publications for the Review



the distribution of publications was uneven: 1998, 2012, 2014, 2019, and 2021 with one record each, 2018, 2023 and 2024 with two records. Five publications appeared in the *English for Specific Purposes Journal*; two were published in *ESP Today. Journal of Contemporary Ethnography, Journal of Language and Education, Research in Science & Technological Education,* and *Journal of English for Academic Purposes* brought out one article each. The sampling entailed one book (Swales & Feak, 2012). The eleven publications were authored by 24 researchers, 2.2 authors per record. The authors had twelve affiliations, with Jilin University as the frontrunner (two authors). Most authors were from China (4), Canada (2), and the USA (2). Brazil, Hong Kong, Sweden and Iran accounted for one author each. The affiliation of one author was unidentified. Social Sciences and Arts & Humanities accounted for 52.4 % and 47.6 % of the publications respectively.

The 316 books out of the 317 books were selected from the SpingerLink database as they were published in English. Screening eliminated 312 books as they had no mentioning of data commentary or a description of tables, chart or other visuals.

Both the pre-protocol searches and selection of studies of the review proved that the Scopus and SpringerLink databases had few indexed publications on the rhetorical aspects of commentaries on tables and figures (otherwise termed as "data commentaries"), an effort to single out thematic clusters remained a supplementary task subject to any emerging trends that would be detected during the review process. The total number of the articles and books under review finally worked out at 19 (Table 2). Thus, the ultimate number of the publications was too limited to specify any trends. The field did not show any growth patterns and may be considered next to non-existent at present.

Table 2

Themes of the Publications under Review

Publication	Type of Publication Indexed in Database (if any)	Theme
1. Dougherty & Ilyankou, 2021	Book	Academic writing Data storytelling
2. Du et al., 2021	Article Scopus	DC Figure legends
3. Eriksson & Nordrum, 2018	Article Scopus	Data commentary in master's thesis projects
4. Graves, 2014	Article	Academic writing Visual functions
5. Hemais, 2014	Article Scopus	Visuals in marketing articles
6. Jagadeesh et al., 2023	Book SpringerBook	Academic writing General guidelines on tables and charts DC
7. Johns, 1998	Article Scopus	The visual and the verbal in macroeconomics
8. Lövei, 2021	Book	Academic writing DC Notes to tables Figure legends
9. Lui et al., 2023	Article Scopus	Figure legends (rhetorical moves and phrase frames)
10. Miller, 2004	Book	Academic writing Notes to tables
11. Moghaddasi et al., 2019	Article Scopus	Visual moves in mathematics research articles
12. Parija & Kate, 2017	Book SpringerLink	Academic writing Tables and graphs
13. Parviz & Lan, 2023	Article Scopus	Commentaries on visuals (rhetorical moves and phrasal complexity)
14. Swales & Feak, 2012	Book Scopus	Academic Writing Data commentary (structure) General guidelines on DC

Publication	Type of Publication Indexed in Database (if any)	Theme
15. Van den Scott, 2018	Article Scopus	Visual methods in ethnography
16. Wallwork & Southern, 2020	Book SpringerBook	Academic writing Results. Tables
17. Wallwork, 2023	Book SpringerBook	Academic writing Commentary on tables and figures. Legends and captions
18. Wu et al., 2024	Article Scopus	Commentaries on visuals (rhetorical moves and phrase frames)
19. Zhang et al., 2024	Article Scopus	Data commentary in discourse of economics

Table 2 offers a list of the publications under review and a description of their themes. While sifting the publications (research articles, conference papers, book chapters, and books) found in the Scopus and SpringerLink databases both during the pre-protocol pilot and review searches, we eliminated records on general issues of academic writing and rhetoric moves and steps (genres) of scholarly publications as well as quite many publications relating to technical aspects of data presentation in science. Those publications did not dwell upon data commentary or related issues.

Instructions on Data Commentary in Research Publications in Academic Writing Books

To study today's approaches introduced in Academic Writing as a discipline, we extracted and analysed the raw data from the four academic writing books published by Springer and another four books brought out by other publishers. The choice of Springer books was determined by the authors' personal experiences in teaching Academic English and Academic Writing at several universities. Those books are not merely textbooks but may be classified as comprehensive manuals for researchers. Those four books were the result of our final selection after we had screened 316 books on academic writing and failed to find any mentioning of rhetorical structure or functions of data commentary in 312 of them. Most of the books had no sections on data presentation. The books under review were analysed to extract the data (Table 3).

All academic writing books under review contained instructions on data commentary. The form and scope of the instructions followed various patterns and had individual focuses. According to the raw data (Table 3), the purposes of data commentary that are covered by the books included in the review may be boiled down to highlighting the results, supporting an argument, assessing theory or data reliability, comparing data, evaluating data, discussing data implications, and making recommendations (Swales & Feak, 2012). Most books offered a DC structure (Swales & Feak, 2012; Jagadeesh et al., 2023; Wallwork, 2023; Miller, 2004). The books specified the Results Section as the most appropriate for DC (Wallwork, 2023; Wallwork & Southern, 2020). Two of the books indicated that a narrative should interpret pictures about figures (Dougherty & Ilyankou, 2021; Miller, 2004).

Less attention was paid to legends and table notes. Wallwork (2023) states that legends, being short, are to be self-explanatory. No double presentation and comprehensive information in legends are prescribed by Lövei (2021). Miller (2004) concentrates on a distribution of information among the title, column and row labels, and notes to tables. It is the only book in our review where we found instructions relating to description of variables by types (specifying direction and magnitude of association, considering statistical significance, considering types of variables, units, and distribution, using quantitative comparisons, and organizing the text to coordinate with a table or chart. Thus, DC was extended to cover any text dealing with data that included DC.

The textual analysis shows that the publications under review fall under the following themes:

general guidelines on DC (Jagadeesh et al., 2023; Wallwork, 2020; Swales & Feak, 2012; Miller, 2004); rhetorical structure of DC (Swales & Feak, 2012; Graves, 2014; Eriksson & Nordrum, 2018); and figure legends and notes to tables (Lövei, 2021; Miller, 2004; Parija & Kate, 2017; Wallwork, 2023; Wallwork & Southern, 2020).

The review found that the extent of the instructions relating to DC was uneven, both in length and depth. The objectives of the books may justify the authors' choices. Moreover, at present, there is no definite and widely accepted standard for chapters on data commentary as compared with other more traditional themes in Academic Writing courses. Further developments in the research field might lead to a more conventional pattern in the instructional literature on DCs.

Table 3

Instructions on Data Commentary in Research Publications in Academic Writing Books

Publication	Extracted Data
Swales & Feak, 2012	Data Commentary In many disciplines, the data is displayed in a table, graph, figure, or some other kind of non-verbal illustration. The data may come from a source, or it may be the outcome of your own work - that is, your results. ... Like many other aspects of academic writing, data commentaries are exercises in positioning yourself. There are, as a result, both dangers and opportunities. One danger is to simply repeat in words what the data has expressed in non-verbal form - in other words, to offer description rather than actual commentary or interpretation. An opposite danger is to read too much into the data and draw conclusions that are not well supported. The art of the commentary is for you to find the right strength of claim in discussing the data and then to order your statements in some appropriate way (perhaps in order of interest or relevance)...
Swales & Feak, 2012	It is not easy to predict precisely what you might need to do in a data commentary, but some of the more common purposes are to • highlight the results of research • use the data to support a point or make an argument in your paper • assess theory, common beliefs, or general practice in light of the given data • compare and evaluate different data sets • assess the reliability of the data in terms of the methodology that produced it • discuss the implications of the data • make recommendations
Swales & Feak, 2012	Structure of Data Commentary Data commentaries usually have these elements in the following order. 1. location elements and/or summary statements 2. highlighting statements 3. discussions of implications, problems, exceptions, recommendations, or other interesting aspects of the data
Swales & Feak, 2012	Location Elements and Summaries Many data commentary sections begin with a sentence containing a location element and a brief summary of what can be found in a visual display of information... ... location statements direct readers to view important information in a table, chart, graph, or other figure. Even though research indicates that readers often look at the visual information before reading, location statements are expected. They are considered to be a form of metadiscourse-sentences or phrases that help readers make their way through a text by revealing such things as organization, referring readers to relevant parts of a text, or establishing logical connections.
Parija & Kate, 2017	• Tables, illustrations, and graphs represent data in a format that is easy to understand and grasp at a glance. • They are a substitute for, and not an addition to, voluminous descriptions in the body of the article. • Tables are best when there is more text to display and the data is qualitative. They organize data into understandable classifications.
Wallwork & Southern, 2020	Results: Do not write long descriptions of your results if these could easily be put in a table. And do not repeat information that is clearly shown in a table, instead interpret it. If you can put your results in a table, then use a table. Treat the table and the text as two distinct elements: the table provides the information; the text interprets it.
Wallwork & Southern, 2020	Tables: In captions, and when referring to figures and tables, use the least words possible. Begin the sentence with Figure 3 / Table 5 shows / reports / highlights / reveals etc. Remember that if the first word of your sentence is Table 1, Figure 7 etc., the words table and figure need to be written in full. When associated with a number, table, figure etc. require an initial capital letter (Table 2, Figure 3).
Jagadeesh et al., 2023	Substantial duplication of information in text, figures and tables should be avoided. If a flow chart is used, only the key points could be highlighted in the text while referring to the figure...

Publication	Extracted Data
Jagadeesh et al., 2023	Text–table dichotomy It is important to ensure that text and tables are complementary to each other and not merely repetitive. Describing all parameters that are depicted in the table is not required. Only some salient features and concise description in the text is sufficient to inform the reader as to what is described in the tables…
Jagadeesh et al., 2023	Do not insert any table without the corresponding reference in the text. As with tables, a figure should also be self-explanatory with an informative but precise heading. Other components of a figure include legends, data labels, axis titles, etc. It is noteworthy that text, tables and figures serve different purposes in presenting information, however, repetition of data should be avoided. All figures should be cited in the text and numbered in the order of citation/appearance in the manuscript.
Wallwork, 2023	How should I comment on my tables and figures? When writing *Results sections* you should use the tables and figures to illustrate points in the text, rather than making them the subject of your text.
Wallwork, 2023	A typical mistake when writing the main text is to repeat information from the table… When commenting on a table, your job is to: • interpret / discuss the results • bring to the reader's attention anything that is particularly meaningful or significant • add further details that help to explain the results or which enable them to be compared with previous results…
Wallwork, 2023	What about legends and captions? A typical mistake is to repeat word for word the caption / legend to your figures and tables within the main text… They should be as short as possible and be sufficiently detailed to enable your readers to understand the figure or table without having to read your text. It is vital that you pay attention to legends as some readers may only look at your figures and tables, without even reading the paper itself!
Wallwork, 2023	Every figure and table included in the paper MUST be referred to from the text. Use sentences that draw the reader's attention to the relationship or trend you wish to highlight, referring to the appropriate figure or table only parenthetically…
Wallwork, 2023	Avoid sentences that give no information other than directing the reader to the figure or table. Like the title of the paper itself, each legend should convey as much information as possible about what the table or figure tells the reader: • what results are being shown in the graph(s) including the summary statistics plotted • the organism studied in the experiment (if applicable), context for the results: the treatment applied or the relationship displayed, etc. • location (ONLY if a field experiment), • specific explanatory information needed to interpret the results shown (in tables, this is frequently done as footnotes) • culture parameters or conditions if applicable (temperature, media, etc) as applicable, and, • sample sizes and statistical test summaries as they apply.
Dougherty & Ilyankou, 2021	The goal of data visualization is not simply to make pictures about numbers, but also to craft a truthful narrative that convinces readers how and why your interpretation matters.
Lövei, 2021	There are general design rules for figures that are worth mentioning here. The first is the prohibition of double data presentation. A set of data can be presented in only one way – either in text, on a figure, or in a table. Single values and trends can be mentioned and discussed in the text, but larger parts of the whole dataset cannot be presented in more than one way. A second rule is that figures, together with their captions, have to be self-explanatory: the reader should understand what is pictured on the figure, without reference to the text or to other figures. Note that the interpretation of the figure does not need to be given here – that goes into the text …
Lövei, 2021	Tables, just as figures, must also be self-explanatory: collectively, the title, table headings, and footnotes must allow the reader to understand the content of the table, without reference to the text.

Publication	Extracted Data
Miller, 2004	Notes to Tables Put information that does not fit easily in the title, row, or column labels in notes to the table. Spell out abbreviations, give brief definitions, and provide citations for data sources or other background information. To keep tables concise and tidy, limit notes to a simple sentence or two, referring to longer descriptions in the text or appendixes if more detail is needed. If a table requires more than one note, label them with different symbols or letters, rather than numbers, which could be confused with exponents, then list the notes in that order at the bottom of the table following the conventions for your intended publisher... If you are using secondary data, provide a source note to each table, citing the name and date of the data set or a reference to a publication that describes it. If all tables in your article, report, or presentation use data from the same source, you might not need to cite it for every table.
Miller, 2004	As you write about the patterns shown in your tables, proceed systematically, comparing numbers either across the columns or down the rows of your table. To describe both types of patterns, create separate paragraphs for the "down the rows" and "across the columns" comparisons...
Miller, 2004	Writing about numbers often involves portraying the distribution of a variable or describing the association between two or more variables. These tasks require several of the principles and tools introduced in the preceding chapters: specifying direction and magnitude of association (chapter 2), considering statistical significance (chapter 3), considering types of variables, units, and distribution (chapter 4), using quantitative comparisons (chapter 5), and organizing the text to coordinate with a table or chart (chapters 6 and 7).
Miller, 2004	Systematically introduce and explain the numeric evidence in your exhibits — tables, charts, maps, or other diagrams — building a logical sequence of analyses.
Miller, 2004	To describe a table or chart that encompasses more than one type of pattern, organize your narrative into paragraphs, each of which deals with one topic or set of closely related topics. For instance, a de- scription of a chart portraying trends in unemployment over two decades for each of several occupations might be organized into two paragraphs, the first describing trends over time and whether they are consistent for all the occupation categories, the second comparing levels of unemployment across occupational categories at one point in time and whether that pattern is consistent across time.
Miller, 2004	Start each paragraph with a sentence that introduces the topic of that paragraph and generalizes the patterns. Then present numeric evidence for those conclusions. A handful of numbers can be presented in a sentence or two. For more complex patterns, report the numbers in a chart or table, then describe the patterns using the "generalization, example, exception" (GEE) approach. Refer to each table or chart by name as you describe the patterns and report numbers presented therein.

Functions of Commentaries on Data in the Reviewed Research Publications

Many authors (Mishra, 2004; Liu et al, 2023; Moghaddasi et al., 2019; Morell, 2015; Graves, 2014) in the reviewed publications stick to frameworks based on the following major functions: rhetorical, ontological, epistemological, and argumentative functions (Appendix 2). O'Toole (1996) and Miller (1998) also included a compositional function in their analyses. Moghaddasi et al., 2019 cited a publication by Gross and Harmon (2014) who offered iconic, symbolic, indexical functions as a framework. Explaining was considered as a rhetorical function in Moghaddasi et al. (2019). In rhetorical studies, researchers tend to label functions with phrases. In the reviewed studies, they were essentially expressed by infinitives. There was some overlapping in functions. Sometimes, the researchers assigned various meanings to the functions. The prevailing functions described by infinitives entail:

- To announce results (Wu et al., 2024)
- To clarify information (Clymo, 2014; Franzblau and Chung, 2012; Saver, 2006; Zhang et al., 2024; Miller, 1998; Moghaddasi et al., 2019)
- To communicate simplified information (Graves, 2014)
- To compare findings with others (Wu et al., 2024)
- To conceptualize intractable phenomena (Goodwin, 2001; Moghaddasi et al., 2019)
- To connect the study (Wu et al., 2024)
- To consolidate information (Prus, 1987; van den Scott, 2018; Wu et al., 2024)
- To describe experiments (Wu et al., 2024)
- To discuss (Wu et al., 2024)
- To discuss the implications (Swales & Feak, 2012; Zhang et al., 2024)
- To enhance interpretability (Clymo, 2014; Franzblau and Chung, 2012; Saver, 2006; Zhang et al., 2024)
- To establish presumptions (Wu et al., 2024)
- To highlight the more significant information (Swales & Feak, 2012; Zhang et al., 2024)
- To interpret results (Wu et al., 2024)
- To introduce mathematical concepts (O'Halloran, 2010; Moghaddasi et al., 2019)
- To locate data (Swales & Feak, 2012; Zhang et al., 2024)
- To persuade the reader of the validity of the argument (Miller, 1998; Hemais, 2014)

- To popularize a complex reasoning (Du et al., 2021)
- To present results (Wu et al., 2024)
- To prove argument (Miller, 1998; Moghaddasi et al., 2019; Wu et al., 2024)
- To provide an overview between mathematical participants (O'Halloran, 2010; Moghaddasi et al., 2019); background (Wu et al., 2024); evidence (Lui et al., 2023)
- To save space (Clymo, 2014; Franzblau and Chung, 2012; Saver, 2006; Zhang et al., 2024)
- To summarize information (Swales & Feak, 2012; Clymo, 2014; Franzblau and Chung, 2012; Saver, 2006; Zhang et al., 2024; Wu et al., 2024)
- To support the argument (Graves, 2014; Miller, 1998; Hemais, 2014; O'Toole, 1996; Gross & Harmon, 2014; Moghaddasi et al., 2019)

The functions lay the foundation for the moves and steps described in the reviewed publications. The functions expressed by infinitives easily fit into the functions listed above (argumentative, ontological, epistemological, compositional, iconic, symbolic, indexical functions), with nearly all simultaneously being rhetorical functions.

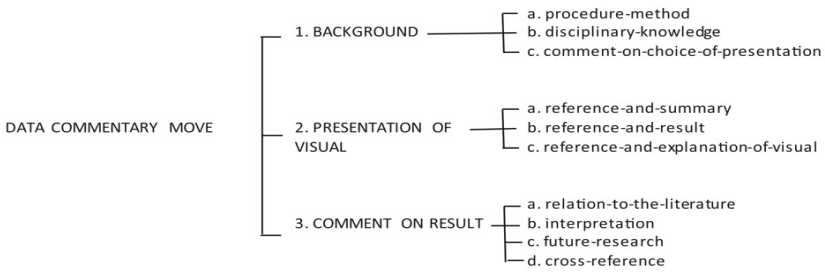
Rhetorical Steps in Data Commentary

The rhetorical steps to follow in DC depend on its type. Judging by the reviewed publications on data commentary at large (Swales & Feak, 2012; Du et al., 2021; Lui et al, 2023; Cargill & O'Connor, 2013; Parviz & Lan, 2023; Wu et al., 2024), the rhetorical steps were approached differently (Table 4). Swales and Feak (2012) outline steps within a DC that precedes or follows a table or a chart, limiting those steps to location elements, highlighting statements and discussion of data aspects. In the same vein, Parviz and Lan (2023) outline the rhetorical steps that are patterned in the data commentaries of students, elaborating some of the steps by Swales and Feak (2012). Location elements were merged with the presention of visual information, discussion of data

Table 4

Rhetorical Steps Typical of Commentary on Data

Publication	Extracted Data	References
Swales & Feak, 2012	Structure of Data Commentary Data commentaries usually have these elements in the following order. 1. location elements and/or summary statements 2. highlighting statements 3. discussions of implications, problems, exceptions, recommendations, or other interesting aspects of the data	
Du et al., 2021	...in science writing figure legends have a general form with five parts which usually occur in sequence: (1) A title which summarizes what the figure is about; (2) Details of results or models shown in the figure or supplementary to the figure; (3) Additional explanation of the components of the figure, methods used, or essential details of the figure's contribution to the results story; (4) Description of the units or statistical notation included; (5) Explanation of any other symbols or notation used.	Cargill & O'Connor, 2013
Liu et al., 2023	...in science writing, figure legends have a general form with five parts, which usually occur in sequence (p. 31): (1) A title that summarizes what the figure is about. (2) Details of results or models shown in the figure or supplementary to the figure. (3) Additional explanation of the figure's components, methods used, or essential details of the figure's contribution to the results. (4) Description of the units or statistical notation included. (5) Explanation of any other symbols or notation used.	Cargill & O'Connor, 2013
Liu et al., 2023	Moves 1. Title 2. Account of experimental details 3. Definition of graphic items 4. Reporting of statistical information 5. Reference of sources of data 6. Result statement 7. Interpretation of results	

Publication	Extracted Data	References
Liu et al., 2023	Nature advises authors that "each figure legend should begin with a brief title for the whole figure and continue with a short description of each panel and the symbols used."[1] Similarly, PLOS ONE requires legends to "describe the key messages of a figure: provide a description of the figure that will allow readers to understand it without referring to the text" and "define all non-standard symbols and abbreviations." [2]	Nature PLOS ONE
Parviz & Lan, 2023	Rhetorical Functions Found in Data Commentary Move 1: Presenting Visual Information Step 1: Providing an explanatory note to set the scene Step 2: Indicating the location of the data Move 2: Highlighting Visual Information; Comparing and Contrasting Key Points Step 1: Describing the facts (with/without providing statistical evidence) Move 3: Commenting on Visual Information Step 1: Personal asides Move 4: Concluding Visual Information	
Wu et al., 2024	Swales & Feak (2012) … suggested that there are three key elements of "data commentary" (as they name it), including summary statements with reference to the visual, highlights of specific information in the visual, and discussions on meanings and implications of the highlighted information.	Swales and Feak, 2012
Wu et al., 2024	• Functional framework for CoVs[3] • Introduction • Providing background • Stating the presumptions • Connecting the current study Data • Describing/ rationalizing experiments • Presenting results • Interpreting results • Discussion • Summarizing the present study • Comparing findings with other studies • Explaining or consolidating findings	
Eriksson & Nordrum, 2018	…the three main moves of the model are *background*, *presentation of visual* and *comment on result*. These moves then contain several submoves or steps (Swales and Feak 2012, 331). It is not necessary to use all moves and submoves in single data commentary. For example, many data commentaries do not include a background move, and if they do, only one of the sub-moves *procedure-method*, *disciplinary-knowledge* or *comment-on-choice-of-presentation* is usually present…	Swales & Feak, 2018
Eriksson & Nordrum, 2018		

[1] https://www.nature.com/nmat/for-authors/preparing-your-submission.

[2] https://journals.plos.org/plosone/s/figures.

[3] Commentary on visuals

Publication	Extracted Data	References
Eriksson & Nordrum, 2018	Figure 1. A moves model of data commentary on result-reporting visuals in chemical engineering. The moves should be read from left to right. an example of a data commentary from a master's thesis in chemical engineering could be a background move realised by submove 1a) reminding the reader of how the data presented in the visual was obtained, followed by a presentation-of-visual move realised by submove 3a) providing a reference to the figure and the main result (e.g. *Figure 1 shows that there is an increase in* (...)), and last a comment-on-result move realised by submove 3d) giving a cross-reference to where in the master's thesis the result in the visual is discussed (e.g. *This increase will be further discussed in Section 4.2*).	

was classified as commenting on and concluding visual information (Parviz & Lan, 2023).

Analysing data legends as a separate genre of data commentary, Du et al. (2021) and Liu et al. (2023) refer to Cargill and O'Connor (2013), presenting detailed steps, including a title, information relating to results, components of a figure, scales and units, other notation or symbols. The steps in the legend that is treated as a DC are subject to a strict order due to limitations (space and no wordiness). Lui et al. (2023) offer their rhetoric framework of graphic legends based on a corpus of articles in four science disciplines, adding more steps such as statistical information (where the research design and statistical methods need explaining) and reference to sources of data (necessary for locating data).

All rhetoric steps extracted from the reviewed publications were summed up in Table 5 as generic moves in data commentary. Each step or rhetorical function found in the publications was analysed, merged into a generic group and included into the table. Moves – Title & Introduction, Data, and Discussion – were specified via generic steps typical of research publications that the authors of the reviewed articles and books had outlined.

We maintain that moves and steps depend more on the type of data commentary. The second essential feature is the type of the publication they are used in. For instance, titles are common for all data commentary, with legends limited essentially to charts, graphs and other visuals of the kind. Tables and graphs in the introduction of a research publication serve more as an argument or illustration. Thus, they may lack in many steps that are considered generic for those if such visuals are placed in the Results section.

DISCUSSION

The findings of this scoping review reveal considerable variability in how data commentary (DC) is approached within academic writing literature, as illustrated by the reviewed publications (Table 2). This variability is evident not only in the depth and length of coverage but also in the diversity of focus, rhetorical functions, and instructional approaches to DC. The review indicates that despite data commentary being an integral part of academic writing, it remains largely underrepresented in conventional academic writing textbooks. Our analysis of 316 academic writing books found only a small fraction (four texts, Table 3) containing sections explicitly addressing DC as a distinct component of scholarly discourse. This finding aligns with the current lack of standardization around DC content in academic writing, suggesting that while many academic disciplines recognize the importance of DC, a codified instructional framework has yet to emerge.

The range of functions attributed to data commentary in the reviewed sources highlights the complexity of its role in academic writing. Major DC functions identified include highlighting results, supporting arguments, assessing data reliability, evaluating implications, and synthesizing comparative data. This diversity of functions is mirrored by the differences in DC rhetorical structures across sources, with frameworks ranging from general guidelines to highly specific steps in the Results section. Publications such as those by Swales & Feak (2012) and Wallwork (2023) consistently emphasize the need for DC to present data without redundancy, thus distinguishing between tables and textual interpretation. However, these sources vary in their recommendations for specific rhetorical steps within DC, such as the inclusion of location statements or the use of metadiscourse, revealing a need for flexibility in DC structuring based on disciplinary and methodological contexts.

In addition, the analysis reveals that many academic writing books emphasize the role of legends and notes, particularly in guiding readers through complex visual data. For instance, Lövei (2021) and Miller (2004) stress that captions and notes should independently convey sufficient information for readers to understand a table or figure without referring to the main text. However, only a few sources, such as Miller (2004), go further by detailing the specific informational elements required in captions, such as abbreviations and quantitative comparisons, thus providing a more granular approach to DC. Such guidance is valuable for researchers who need to convey complex statistical or experimental data succinctly, suggesting that textbooks could benefit from more comprehensive, standardized coverage of DC-specific conventions for captions, legends, and textual commentary.

Table 5

Generic Moves in Data Commentary

Moves & Steps	Swales & Feak, 2012	Du et al., 2021	Cargill & O'Connor, 2013	Liu et al., 2023	Parviz & Lan, 2023	Wu et al., 2024	Eriksson & Nordrum, 2018
Title & Introduction							
A title (which summarizes what the figure is about)		+	+	+			
Location elements and/or summary statements	+			+	+	+	
Providing background, describing experiment					+	+	+
Highlighting statements	+				+	+	
Data							
Presentation of the visual							+
Definition of graphic items		+	+	+			
Description of the units or statistical notation included		+	+				
Reporting of statistical information			+	+			
Reference of sources of data				+			
Commenting on visual information					+	+	+
Discussion							
Connecting to the current study						+	
Discussions of aspects of the data	+						
Concluding visual information					+		
Result statement		+	+	+		+	
Interpretation of results				+	+	+	
Comparing and explaining findings with others					+	+	

The identified rhetorical steps in DC vary widely based on the type of data commentary and its position within a publication. Generic moves, such as those defined by Swales & Feak (2012), begin with location elements, proceed with highlight statements, and culminate in a discussion of implications or exceptions. In contrast, publications focused on figure legends and tables, such as those by Liu et al. (2023) and Cargill & O'Connor (2013), outline a different set of steps tailored to the structure and space constraints of figure captions. These sources emphasize brevity and precision, underscoring the role of captions as both self-explanatory and supportive of the main text. As illustrated in Table 5, generic moves for DC generally align with either a Results-focused or legend-focused structure, depending on the data role in the publication. This distinction underscores the importance of adapting DC strategies to the publication type and the nature of the data being discussed.

CONCLUSION

In achieving the aim of the review of research on data commentary, we found that there was a wide gap in the field of scientific communication and research on rhetorical interrelations between the verbal and the visual in the data presentation. The scattered and occasional distribution of sparse publications communicates an outline of a potentially wider field of research, including verbal and visual meanings and interrelations, rhetoric functions and moves in data commentary and figure legends. The books on academic writing quite rarely focus on DC.

The two major aspects of research on data commentary – DC rhetorical and other functions and moves in DC - show that researchers are unanimous in their approaches. The prevailing functions in the classifications entail argumentative, rhetorical, ontological, and epistemological functions. Though they are elaborated to include dozens of sub-functions expressed in the infinitive phrases. The moves are considered given the location of a visual and its function. Generic moves were exposed for data commentary and commentary and notes in legends.

The limitation of the review relates to some research that are not indexed in the international databases. Further studies of data commentary on discipline-based corpora of diverse genres of research publications might benefit the research field. More elaborated taxonomy and DC moves are top on the agenda. Such studies are in need for academic writing courses as visualization of data are on the rise, with visuals being increasingly employed to communicate scientific information and especially research results in the visual mode. These directions of research are essential for the field development as their implications range from academic communication, academic writing, writing for publication to improved quality of research reporting and better practices of scholar journal publishing.

DECLARATION OF COMPETITING INTEREST

None declared.

AUTHOR CONTRIBUTIONS

Elena Tikhonova: conceptualization; data curation; formal analysis; investigation; methodology; resources; software; validation; visualization; writing – original draft; writing – review & editing.

Lilia Raitskaya: conceptualization; data curation; formal analysis; investigation; methodology; resources; software; validation, visualization; writing – original draft; writing – review & editing.

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APPENDIX 1

Publications Included in the Review

Dougherty, J. & Ilyankou, I. (2021). *Hands-on data visualization. Interactive storytelling from spreadsheets to code*. O'Reilly.

Du, Z., Jiang, F., & Liu, L. (2021). Profiling figure legends in scientific research articles: A Corpus-driven approach. *English for Specific Purposes, 54*, 101054. https://doi.org/10.1016/j.jeap.2021.101054

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APPENDIX 2

Functions of Data Commentaries in the Reviewed Research Publications

Publication	Extracted Data	References	Function
Du et al., 2021	Almost a half of scientific data are represented visually (Hyland, 2006, p. 53), so visual representations are not mere add-ons or ways to popularise a complex reasoning but are an essential part of academic discourse …	Hyland, 2006	To popularize a complex reasoning
Graves, 2014	…the authors use visual representations of their data to accomplish a complex range of activities from informational to rhetorical to ontological to epistemological. "rhetorical" as the role visuals play as evidence supporting argumentative claims or persuading readers of the validity of the interpretation offered for the data. By "ontological," … the visual's role in instantiating (serving as visual "proof") that the scientific phenomenon exists/is real. … "epistemological" to refer to the visual's role as the argument transforms it into a knowledge claim that reciprocally strengthens the argument.	Mishra, 2004	Rhetorical function Ontological function Epistemological function
Graves, 2014	The illustrations are artists' rendering of the concepts meant to communicate simplified information, while the table and charts present complex, highly mediated information that require significant viewer background knowledge and engagement to communicate meaning.		To communicate simplified information
Graves, 2014	…the visuals function as critical pieces of evidence that support the argument …		To support the argument
Hemais, 2014	In articles in academic journals, visuals such as graphs and diagrams provide significant support for the arguments in the text… Visuals are an aid in persuading the reader of the validity of the authors' arguments, since "the last line of defense and foundation of the research argument is the findings themselves, almost always presented in the form of visual display" (Miller, 1998: 30).	Miller, 1998	To support the argument To persuade the reader of the validity of the argument
Liu et al., 2023	…visuals in scientific discourse are not merely an alternative form of data presentation but also serve as "evidence providers" (Morell, 2015, p.138) that help to testify to scientific hypotheses or validate academic claims.	Morell, 2015	To provide evidence
Liu et al., 2023	In mathematics, for example, figures are employed to realize ontological, argumentative, and epistemological functions (Moghaddasi et al., 2019).	Moghaddasi et al., 2019	Argumentative function Ontological function Epistemological function

Publication	Extracted Data	References	Function
Miller, 1998	The last line of defense and foundation of the research *argument* is the findings themselves, almost always presented in the form of visual display… Photographs, graphs, and tables also give the illusion of direct access to the data, which makes this portion of the argument particularly convincing… …visuals in academic articles provide data to convince the reader of the validity of the findings and allow the readers to see how the data were obtained and to interpret the data themselves… The most important use of the visuals in the academic texts is to *support the argument*. The figures and tables invite the readers to see for themselves as if the data rather than the scientist are carrying the argument… The corresponding visual realization for 'theme' is what O'Toole (1996) calls the *compositional function*. This function involves framing, horizontals and verticals, proportion, line, geometric forms, and color cohesion pattern (highlighted by the iconic overlay) among the squares themselves.	O'Toole (1996)	To support the argument Compositional function
Moghaddasi et al., 2019	…visuals … perform three functions: ontological, argumentative, and epistemological… Morell (2015) assigns three functions to non-verbal (that is, visual) material (NVM)[3] in her analysis of conference presentations: illustrative, decorative, and expository. Illustrative NVM contains a verbal component, such as illustrating a process using a flow chart. Decorative NVM creates backgrounds and usually appears in social sciences. Expository[2] NVM fills evidence-providing roles and appears more commonly in sciences and engineering. Morrell's categories identify dominant functions, yet she notes the functions are mixed.	Morell, 2015	Argumentative function Ontological function Epistemological function
Moghaddasi et al., 2019	Regarding visuals in articles in biology, Miller (1998) concludes that visuals in RAs[4] both 'prove' and 'clarify'	Miller, 1998	To prove the argument To clarify
Moghaddasi et al., 2019	O'Halloran (2010) argues that each semiotic resource fulfils particular functions: images 'provide an intuitive overview of the relations between mathematical participants,' language and images 'introduce and conceptualize mathematical concepts and problems' (p. 4), and symbolism 'formalise[s] those relations and solve[s] the problem' (p. 5).	O'Halloran, 2010	To provide an overview between mathematical participants To introduce mathematical concepts
Moghaddasi et al., 2019	Gross and Harmon (2014) also propose that throughout various argument stages visuals fulfil different semiotic meanings: 1) iconic (i.e., they represent the world); 2) symbolic (i.e., they stand for aspects of the world); and 3) indexical (i.e., they show causal relationships in the world). Gross and Harmon argue that viewers interpret this meaning by placing the visuals in the context of argumentative structures… they assign a subordinate position to visuals, stating that they cannot be arguments - a view not shared in all scientific disciplines.	Gross & Harmon, 2014	Iconic function Symbolic function Indexical function To support the argument
Moghaddasi et al., 2019	Mathematization, the primary purpose of some visuals, is defined by Goodwin (2001) as those contextually-driven practices aimed at transforming intractable phenomena into mathematically tractable visuals such as graphs and diagrams.	Goodwin, 2001	To conceptualize intractable phenomena

[3] NVM is "non-verbal material"

[4] RAs stand for "research articles"

Publication	Extracted Data	References	Function
Moghaddasi et al., 2019	Graves (2014) argues that visual data in nanotechnology accomplish complex activities from informational to rhetorical to ontological to epistemological: visual data can constitute the evidence that develops and supports the claims, but it can also be the fact itself or simultaneously form the foundation and the structure for new knowledge.	Graves, 2014	Argumentative function Ontological function Epistemological Function Informational function
van den Scott, 2018	Visuals are data. They are also tools to gather and record data. The visual can help us to understand generic social processes (Prus, 1987). Visuals can add a layer of depth to our analysis, can offer patterns for analysis…	Prus, 1987	To consolidate the information
Wu et al., 2024	As for relevant verbal accounts for the visuals, four main functions were identified, including establishing presumptions, announcing results, proof, and discussion.		To establish presumptions To announce results To prove To discuss
Wu et al., 2024	Functional framework for CoVs[5] • Introduction • Providing background • Stating the presumptions • Connecting the current study • Data • Describing/ rationalizing experiments • Presenting results • Interpreting results • Discussion • Summarizing the present study • Comparing findings with other studies • Explaining or consolidating findings		To provide background To state the presumptions To connect the study To describe experiments To present results To interpret results To summarize the study To compare findings with others To consolidate findings
Zhang et al., 2024	By using graphics, scientific writers can 1) reduce reading time by summarizing key information, 2) supplement the main text to clarify complex information, 3) add visual effect to text to enhance interpretability of knowledge, and 4) reduce word counts to save space (Clymo, 2014; Franzblau and Chung, 2012; Saver, 2006).	Clymo, 2014; Franzblau & Chung, 2012; Saver, 2006	To summarize information To clarify information To enhance interpretability To save space
Zhang et al., 2024	Swales and Feak note that academic writing involves the task in which writers need to discuss data typically displayed in tables, charts or figures. They termed this task 'data commentary' which consists of three sub-tasks to complete: 1) pointing out the location of data and summarizing the graphic content (e.g., Table 5 shows the most common modes of infection for U.S. business.), 2) highlighting the information in graphics from the more significant to the less significant (e.g., As can be seen, in the majority of cases. However, it is alarming to note that…), and 3) discussing implications, problems, etc…(Swales and Feak, 1994, p. 80).	Swales and Feak, 2012	To locate data To summarize information To highlight the more significant information To discuss implications

[5] Commentary on visuals.