San José State University Writing Center
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Visual Tools in Research Writing: How to Effectively Use Tables, Graphs, and Figures

Visual tools such as tables, graphs, and figures play a critical role in research writing. They enhance clarity, allowing readers to quickly grasp complex data, trends, or relationships that might otherwise be lost in lengthy paragraphs of text. When used effectively, visuals can help readers grasp patterns, comparisons, and relationships that may be difficult to convey through text alone.

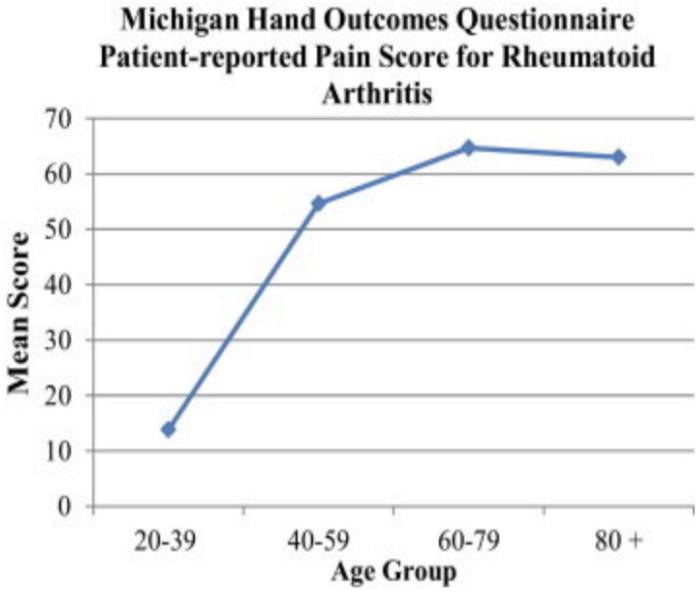
Choosing the Right Visual

Selecting the appropriate visual tool is essential for conveying your message clearly in research. Different types of visuals—tables, graphs, and figures—serve distinct functions, depending on the data and the purpose of your presentation.

Type of Visual	Examples
Tables ● Tables are essential visual tools in research that organize complex data. ● They are especially useful for presenting descriptive statistics, experimental results, and comparative data across groups or conditions. ● A well-designed table has a clear title, logical structure, labeled units, and explanatory footnotes to ensure clarity. ● By summarizing key findings, tables enhance comprehension and reproducibility of research.	*Table 1* *Consumers' (C) and Retailers' (R) ratings of the nutritional and economic values of different foods* *Foods* / *Nutritional* (*C* *R*) / *Economic* (*C* *R*) Meat 62 58 14 11 Milk 55 52 44 95 Eggs 49 48 85 61 Cheese 45 52 30 62 Fresh Veg. 42 24 25 18 Fish 33 52 20 10 Chicken 18 13 70 25 Bread 5 11 5 21 *In decreasing order of Consumers' Nutritional Ratings.

Graphs

- Graphs are powerful visual tools in research that highlight trends, relationships, and distributions, making complex data easier to interpret at a glance.
- They are ideal for showing changes over time, group comparisons, or variables' correlations.
- Effective graphs are clear, well-labeled, and appropriately scaled to avoid misinterpretation.
- By turning data into visual patterns, graphs enhance understanding and strengthen the communication of research findings.



Figures

- Figures—such as diagrams, illustrations, and images—are valuable visual tools in research for explaining concepts, processes, or systems that are difficult to convey through text alone.
- They help clarify complex ideas, demonstrate mechanisms, or show spatial relationships, making them especially useful in fields like biology, engineering, and medicine.
- Well-designed figures can simplify abstract information and enhance reader engagement and comprehension.
- To be effective, they should be clearly labeled, accurately scaled, and accompanied by concise captions that explain their relevance.

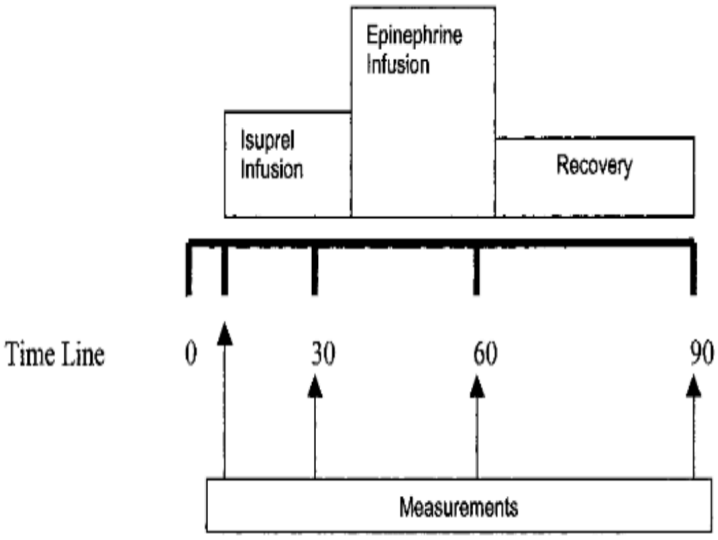


Fig. 5. A complicated treatment protocol can be clearly expressed as a time-line diagram.

Best Practices for Clear and Effective Visuals

Creating visuals that are both informative and accessible requires attention to several key design principles.

Clarity

Avoid clutter, excessive text, and decorative design elements that distract from the data. A clean layout helps readers quickly grasp the main message.

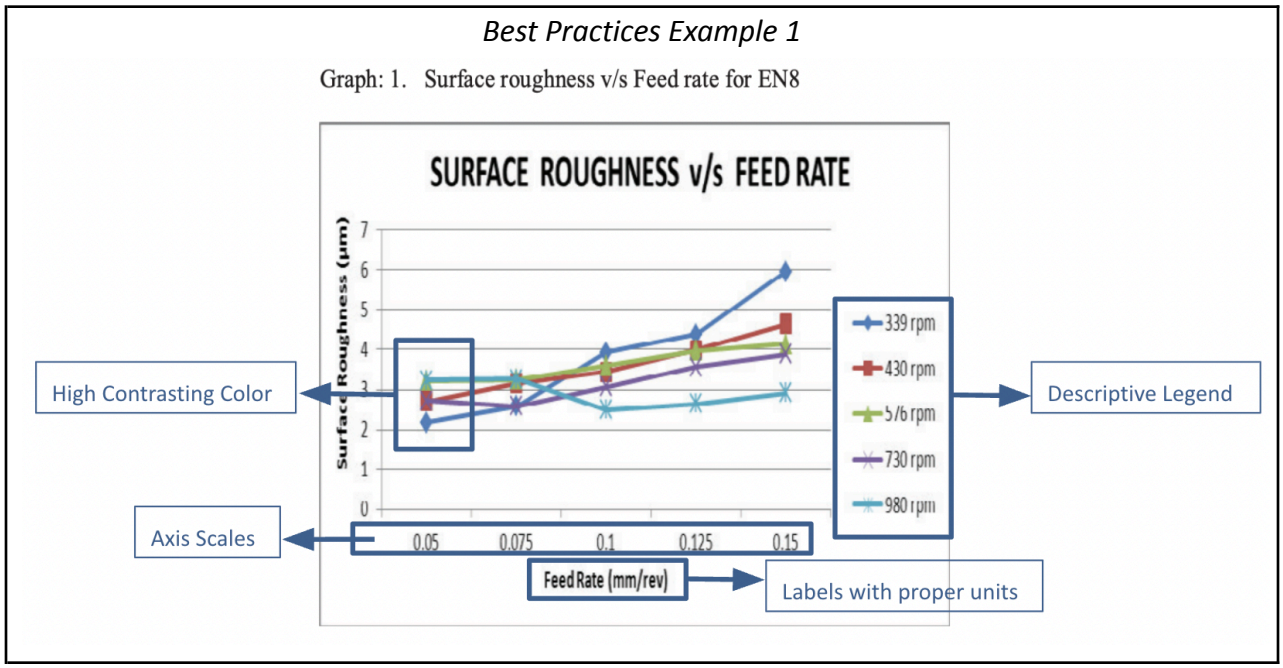
Formatting

Consistent formatting across visuals—such as uniform font sizes, axis scales, and color schemes—makes it easier for readers to compare information and maintain orientation throughout the document.

Color

Color and contrast play a crucial role: use high-contrast combinations (such as blue and orange) to clearly distinguish data points, and avoid visually similar shades like pink and purple, which can lead to confusion in interpretation.

Best Practices Example 1



Best Practices Example 2

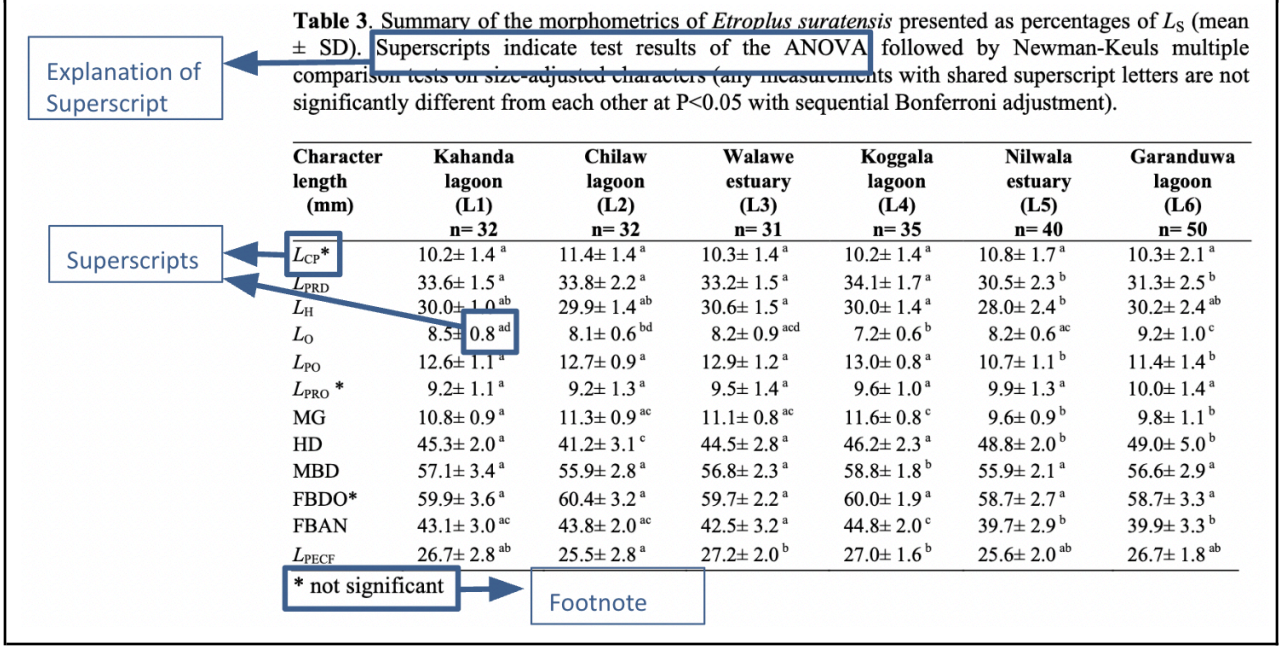


Table 3. Summary of the morphometrics of *Etroplus suratensis* presented as percentages of L_S (mean ± SD). Superscripts indicate test results of the ANOVA followed by Newman-Keuls multiple comparison tests on size-adjusted characters (any measurements with shared superscript letters are not significantly different from each other at P<0.05 with sequential Bonferroni adjustment).

Character length (mm)	Kahanda lagoon (L1) n= 32	Chilaw lagoon (L2) n= 32	Walawe estuary (L3) n= 31	Koggala lagoon (L4) n= 35	Nilwala estuary (L5) n= 40	Garanduwa lagoon (L6) n= 50
L_{CP}*	10.2± 1.4 ^{a}	11.4± 1.4 ^{a}	10.3± 1.4 ^{a}	10.2± 1.4 ^{a}	10.8± 1.7 ^{a}	10.3± 2.1 ^{a}
L_{PRD}	33.6± 1.5 ^{a}	33.8± 2.2 ^{a}	33.2± 1.5 ^{a}	34.1± 1.7 ^{a}	30.5± 2.3 ^{b}	31.3± 2.5 ^{b}
L_{H}	30.0± 1.0 ^{ab}	29.9± 1.4 ^{ab}	30.6± 1.5 ^{a}	30.0± 1.4 ^{a}	28.0± 2.4 ^{b}	30.2± 2.4 ^{ab}
L_{O}	8.5± 0.8 ^{ad}	8.1± 0.6 ^{bd}	8.2± 0.9 ^{acd}	7.2± 0.6 ^{b}	8.2± 0.6 ^{ac}	9.2± 1.0 ^{c}
L_{PO}	12.6± 1.1 ^{a}	12.7± 0.9 ^{a}	12.9± 1.2 ^{a}	13.0± 0.8 ^{a}	10.7± 1.1 ^{b}	11.4± 1.4 ^{b}
L_{PRO} *	9.2± 1.1 ^{a}	9.2± 1.3 ^{a}	9.5± 1.4 ^{a}	9.6± 1.0 ^{a}	9.9± 1.3 ^{a}	10.0± 1.4 ^{a}
MG	10.8± 0.9 ^{a}	11.3± 0.9 ^{ac}	11.1± 0.8 ^{ac}	11.6± 0.8 ^{c}	9.6± 0.9 ^{b}	9.8± 1.1 ^{b}
HD	45.3± 2.0 ^{a}	41.2± 3.1 ^{c}	44.5± 2.8 ^{a}	46.2± 2.3 ^{a}	48.8± 2.0 ^{b}	49.0± 5.0 ^{b}
MBD	57.1± 3.4 ^{a}	55.9± 2.8 ^{a}	56.8± 2.3 ^{a}	58.8± 1.8 ^{b}	55.9± 2.1 ^{a}	56.6± 2.9 ^{a}
FBDO*	59.9± 3.6 ^{a}	60.4± 3.2 ^{a}	59.7± 2.2 ^{a}	60.0± 1.9 ^{a}	58.7± 2.7 ^{a}	58.7± 3.3 ^{a}
FBAN	43.1± 3.0 ^{ac}	43.8± 2.0 ^{ac}	42.5± 3.2 ^{a}	44.8± 2.0 ^{c}	39.7± 2.9 ^{b}	39.9± 3.3 ^{b}
L_{PECF}	26.7± 2.8 ^{ab}	25.5± 2.8 ^{a}	27.2± 2.0 ^{b}	27.0± 1.6 ^{b}	25.6± 2.0 ^{ab}	26.7± 1.8 ^{ab}

* not significant

Labels and legends

Each visual should include clear, descriptive labels and legends. Graph axes should be labeled properly with units, if applicable, and important data points should be annotated when relevant. For instance, in example 1 “Feed Rate (mm/rev)” is used instead of “Feed Rate” or just “FR.”

Superscripts and footnotes

Superscripts and footnotes are helpful tools for clarity without clutter. Use superscripts to indicate statistical significance (e.g., $p < 0.05^{1}$), and footnotes to provide definitions or additional context without overcrowding the visual itself. By applying these best practices, you ensure that your visuals not only support your research but also enhance the reader’s understanding.

Common Pitfalls to Avoid

Even well-intentioned visuals can weaken a research paper if not used carefully. Watch for three of the most common pitfalls, as described in the following sections.

Misleading data representation

This issue often happens when graph scales are manipulated—such as starting a bar graph’s y-axis at a non-zero value to exaggerate small differences—or when essential elements like axis labels, units, or legends are missing. These choices can distort interpretation and undermine trust in your work. Misleading readers through data manipulation negatively impacts your credibility.

Overuse of visuals

This problem includes too many graphs or tables that overwhelm readers and clutter your paper. Instead of clarifying, excessive visuals can distract from your main message. Use visuals strategically—only when they add value or enhance understanding. It may also help to consolidate the information into one table or graph and then label them with proper legends/ footnotes, and superscripts for clarity.

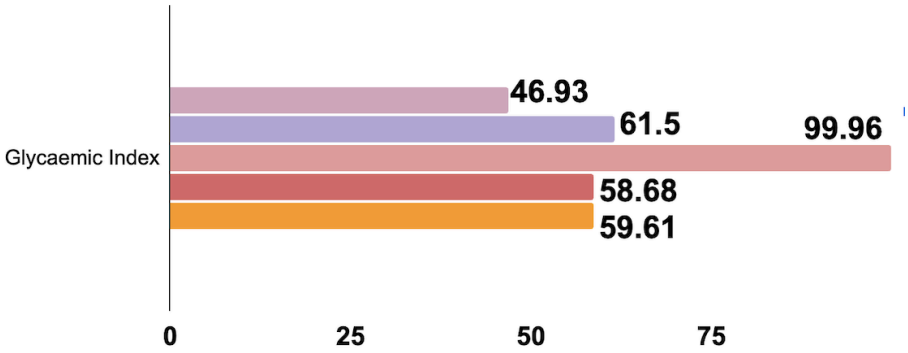
Poor data organization

Poorly organized data can make even accurate visuals confusing. This problem includes inconsistent formatting across visuals, unclear labeling, and/or presenting visuals in an illogical order. For example, using different font sizes, misaligned tables, or unexplained color codes can confuse readers and reduce the impact of your findings.

Activity: Identify and improve

Examine the visual below and identify elements that may make it confusing or difficult for a reader to interpret. What specific features should be added, removed, or improved to enhance the clarity, accuracy, and overall effectiveness of the visual?

Figure 2: Glycaemic properties of plant-based milk substitutes and bovine milk



Answer Key for Activity

1. No legend explaining what the colors represent
2. No label for x-axis
3. Inconsistent font size
4. Colors that are too visually similar

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