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Findings, discussion, conclusion: Distinct roles in research

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The first items that many scientific journal editors, peer reviewers, and readers look at in a research article, after the abstract, are the conclusion and the methodology. If the conclusion is successful in describing how the findings and the interpretation of those findings increase valuable knowledge for the discipline or problem area, most editors and reviewers then check the methodology to see if it appears to be rigorous and appropriate enough to generate findings that would support the conclusion the authors are making. In many cases, this means that the conclusion is one of the most important parts of a research article. A strong conclusion, however, can easily be undermined by poorly presented findings and their interpretation.

One of the most common problems found in submissions to scientific journals is combining the findings, discussion and conclusion. Some journals may not require a clear separation, and some disciplines and methods find it more logical to present findings and discussion together. But each component has a distinct role to play in the understandability, applicability, and overall credibility of the research. Authors who understand the distinctions, and make them clear in their presentation, produce contributions to their fields that enable their work to be built upon more easily by other researchers.

1. Distinctions, roles, and checking the weather

The first half of a research article helps the reader understand the context of the research. It identifies a key problem, discusses the state of the field in regards to that problem (including important previous studies and relevant theories and methods), and outlines the procedures and methods used to investigate the problem. The sections in the second half of a research article tell the reader what happened, what it means, and why it is valuable:

- The Findings section presents only the results of data collection and analysis.
- The Discussion section describes what those data and analyses mean in light of the problem.
- The Conclusion briefly synthesizes the meanings and clarifies why they are valuable.

The distinctions between these sections can be highlighted with a very simple research project many of us undertake every day: checking the weather. We might look at an outdoor thermostat for temperature, look at the sky or check a barometer to get a sense of potential precipitation, and thrust a wet finger in the air or look at a weather vane or anemometer to determine wind speed and direction.

Findings would be the results of the measurements we took or collected. For example: Temperature: 28C; Barometric pressure: 760 mm Hg, down .25 in-Hg in the past 3 hours; Wind speed and direction: 14.1 km/h from NW. It would also be important to indicate where and when these measurements were taken, and with what instruments (finger? weather vane? anemometer?). In social science, demographic

information is important for similar reasons. It is important to show these details separately from our interpretation because, as noted below, the same results may have different implications depending on factors not addressed by the data collection and analysis design.

Discussion would be our interpretations of these measurements. For example: If the temperature is 28C in July in Baghdad at noon, this would be considered a very cold day. But the same temperature in July in Sydney at midnight would suggest an absurdly hot night. The dropping barometric pressure and wind direction suggest that a front is coming in from the NW that will bring rain and probably a change of weather. This is where reference to a source describing the characteristics of fronts might be useful.

Limitations that affect the utility and meaning described might include the instruments used. If an individual is using the findings to get a rough idea of the wind to dress for the day, the finger measure is probably fine. If a sailor or airplane pilot needs to know speed and direction to create navigation plans, they probably need something more precise. But this kind of extreme limitation shouldn't be necessary to mention if the problem statement and methodology clearly exclude this domain. A more relevant limitation might be not knowing what the weather is like NW of the location of the measurements. Without this knowledge we might be able to determine that a change of weather is coming, but not whether it will be warmer or colder or the same after the front comes through – useful in synthesizing meaning for our conclusions. In reality, many of us check a website or news broadcast to have someone make these measurements and interpretations for us and even give us a conclusion: "Bring an extra jacket today as it will get much colder later!"

The Conclusion would be the value of those interpretations. For example: There is great value to individuals in collecting and interpreting these measurements in an integrated way because they help us decide what clothes to wear and whether or not to bring an extra jacket or an umbrella. This research also suggests that it would be useful to collect similar measurements from a broader geographic area in the future to improve our likelihood of deciding on clothes and accessories correctly. Before precise measurement instruments were available, many people were caught in the rain or without an extra jacket when the temperature went down quickly. Some even became ill as a result. With the addition of long histories of measurements, many individuals and organizations can be better informed in ways that may generate economic value, reduce public health problems, or affect the urgency of public policies addressing practices affecting climate change.

Presenting these components separately demonstrates to readers that the authors are clear about the distinctions and have designed and conducted their research with this understanding in mind. This makes the authors, the research, and the article itself, more credible. Obviously, scientific research is more complex than the example above. Details about expectations of scientific journal editors are useful.

2. Findings

Editors, reviewers and readers expect the Findings section to present the results of data collection and analysis. This section is often organized by the research questions or hypotheses, or by the dimensions of the theory or method being used. Tables and figures are often useful to supplement the text and provide visual ways of viewing a large amount of data quickly, but it is rarely useful to provide raw data. Many editors, reviewers and readers will seek out tables and figures to gain quick insight into the research, so the presentations (format, colors/shading, content, labels) should enable readers to quickly determine the important aspect of the data on their own. Most publishers will expect you to reference any tables or figures in the narrative text (e.g., Table 2 describes…), include a marker in the text where the table should

go "[Table 2 about here]" and attach the tables and figures in separate files at the end of the manuscript (not embedded with the text).

Statistics require both general and specific presentation techniques. Credible scientific journals are always clear about what style authors should follow. They either have their own style guide or refer authors to another style manual. These style manuals govern the specific presentation of statistics as well as citations and references. These style manuals will also address the content to include for statistics. In general, inferential statistics (e.g., *t* tests, *F* tests, or the chi-square test of independence) should include the magnitude or value of the test, degrees of freedom, sample size, probability level, and direction of the effect. Descriptive statistics (e.g., means) should include measures of variability, such as standard deviation and variances.

The *Findings section is not the place* to interpret or explain the results, declare support or non-support for hypotheses, reference published literature, or repeat data or information included elsewhere.

3. Discussion

The Discussion section provides the interpretation and meaning of the results presented in the findings section. This is where the significance and importance of the findings are described. If research questions or hypotheses have been presented earlier in the manuscript, this is where statements can be made about whether the findings support or do not support those hypotheses. It is important to remember that it is very rare for any findings to "prove" anything. Most commonly, findings will suggest (or similar verb) an interpretation or meaning. It can be helpful in the Discussion section to organize by research questions or hypotheses, or by the dimensions of the theory or method being used.

Some qualitative researchers find it difficult or problematic to separate findings and interpretation. It is important to understand the standard organization of articles in different journals by reviewing their publications of similar work and ensure that submissions follow those patterns.

The *Discussion section is not the place* to restate the findings. The focus is on the interpretation and the reasons or mechanisms for making that interpretation. It is also appropriate to include limitations at the end of the discussion section as they affect the interpretation of the findings.

4. Conclusion

The Conclusion should be a short strong paragraph or two going back to the value of the research as proposed in the problem statement. This is where the authors have a chance to be sure that the readers can answer the question "So what?" about the research. The Conclusion should not include any summarizing of either findings or discussion. It should briefly synthesize material presented thus far and should remind the reader how exciting and unique the research is. The focus is on the interpretation and the reasons or mechanisms for making that interpretation. Many conclusions propose a course of action, a solution, or questions for further study, which in turn gives the research a place in the continuum of inquiry about the topic. Many also point to broader implications of the research than what was studied.

The *Conclusion section is not the place* to restate the findings, introduce the thesis or problem statement for the first time, add evidence or significant references, or discuss limitations.

The best conclusions focus mainly on the value of the research (sometimes the findings, sometimes the investigative power of a theory or method, sometimes both), how it has contributed to addressing the problem identified in the Problem Statement, and why the readers and the field should be as excited by the work as the authors are.

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