

Using paragraph puzzles to teach scientific writing

Writing is a critical skill necessary for undergraduate and graduate students who want to become successful scientists. For new (and old) scientists, writing is one of the final steps to project completion. Indeed, our scientific endeavors can only add to human knowledge if our studies and their results are written and published. Becoming an effective writer, however, takes a lot of practice and repetitive learning (and editing, editing, editing!).

One aspect of science writing that can be particularly difficult for students to grasp is development of their 'Introduction' sections. Generally, the material contained in an introduction section of a scientific paper follows the form of a funnel. The beginning of the introduction (opening of the funnel) establishes broad context of the research and successive paragraphs (and components) tighten their breadth of discussion to a final paragraph that addresses hypotheses and predictions for this particular study (Heard 2016). Each unified paragraph in the introduction is defined by its topic sentence and ends with a transition sentence allowing for better flow between paragraphs.

I teach students how to structure their own Introduction sections by completing paragraph puzzles. This active-learning approach allows students to critically evaluate the structure of introductions from published, peer-reviewed scientific papers. This exercise requires moderate preparation time for instructors and ~30-50 min for students to complete depending on their level of engagement. My writing class generally has 8-10 graduate students each semester (though undergraduate students would also benefit from this exercise) with widely different research interests centered on agriculture and/or natural resources management.

Creating paragraph puzzles

For each student, I locate and print (3.3 x 4.3 cm; standard printer paper) two peer-reviewed papers that are focused on their own individual research interests. All papers follow a canonical writing structure (Introduction, Methods, Results, Discussion). I save all papers as digital PDFs to be used later in the class.

I physically cut out the title and the paragraphs of each introduction (Fig. 1). If a paragraph is disjunct (i.e., in 2 separate columns, on different pages) I cut out each piece and connect them together with transparent tape. I then bundle the title and all paragraphs of each introduction together with a paperclip. Each paragraph within their respective bundle is in a random position (i.e., they are not in order) so students have to organize and piece together each paragraph to create a functional introduction.

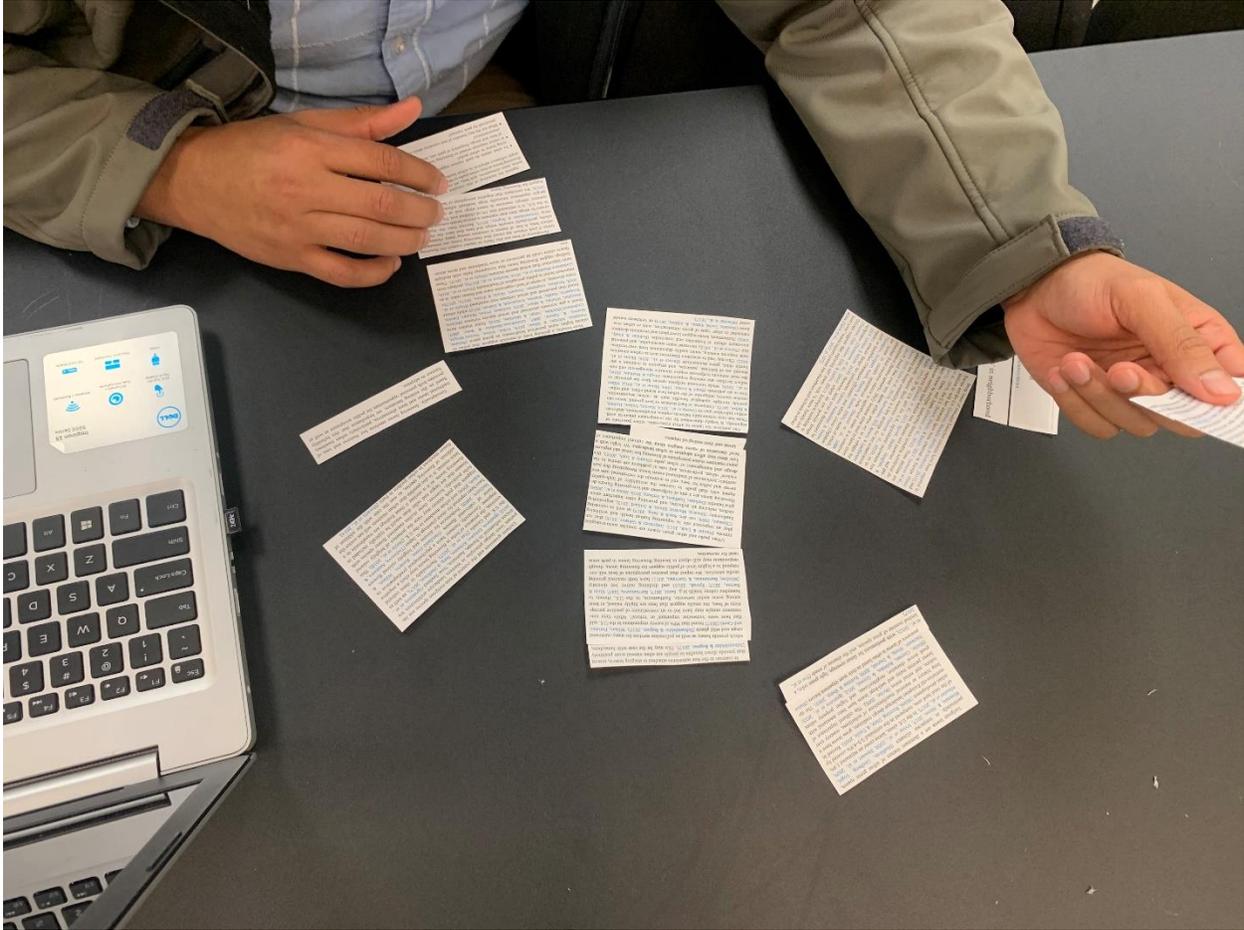


Figure 1. A student evaluates and organizes each paragraph of an Introduction section cut out of a peer-reviewed scientific paper.

At the beginning of class, we discuss how to structure the introduction section of scientific papers (Schimel 2012, Heard 2016). I highlight two learning objectives prior to starting the active-learning assignment. First, I want students to identify succinct topic sentences and transitional sentences within each paragraph (or lack of these key elements). This way, students can realize the importance of these sentences to “connecting” subsequent paragraphs together in the introduction. Second, I want students to understand the “funnel” structure of an introduction. This way, they can identify where each of these unifying paragraphs fit together within an introduction. I then hand each student their own paper-clipped bundles of paragraph puzzle pieces. I ask all students to read each paragraph and then order the paragraphs as they think they should be structured in the introduction. They must complete both sets of paragraph puzzles before the end of class.

Assessment and Reflection

I do not formally assess student learning, or students’ ability to successfully piece together each paragraph puzzle, after completing this exercise. However, after students piece together each introduction, we meet as a class and reflect on why each student chose to organize their assigned paragraphs a particular way. Once we discuss a

particular introduction, I display a large digital copy of the original paper onto the classroom wall and we then evaluate how the original authors chose to structure their introduction. Additionally, we discuss any discrepancy present in the student's choice of organization and the original authors' choice of organization. After completing this active-learning exercise, students should be able to recognize the critical importance of structure and flow in the introduction of a scientific paper and apply it to their own writing.

References

S. B. Heard. 2016. The scientist's guide to writing. Princeton University Press. Princeton, New Jersey, USA.

J. Schimel. 2012. Writing Science. Oxford University Press. New York, New York, USA.

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