Charting Your Contribution

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Explore how new arguments fit into—and build upon—the existing literature, for students writing original papers in mathematics and the sciences.

Writing Focus: *thesis, motive*
Project Stage: *drafting, revising*
Teacher Preparation: *medium*
Student Preparation: *high*
Estimated Time: *50-55 minutes*
Home Discipline: *Mathematics*

EXERCISE

Prep Work: Students should have already established (by laboratory experiments, mathematical proofs, or otherwise) the results that they plan to write about, and they should be prepared to describe those results in detail. They should bring along at least three sources upon which their work builds. Ask in advance for one volunteer whose three sources will be workshopped by the group. You'll need enough copies of these three for everyone to look at during class.

Step One: (10 minutes) Ask students to discuss how they go about assessing the impact of a paper that has appeared in a journal in their discipline. Try to get students to be precise about which parts of the paper they look at first. Encourage students to recognize that it is often possible to figure out the importance of scholarship by focusing on just one part of a paper. (For instance, in the quantitative disciplines, students will often say that a single graph or table is enough to encapsulate a work's primary impact.) As a consensus forms, write down examples on the board. Use the volunteer's set of three sources as a common text to help anchor the discussion.

Step Two: (5 minutes) Have students write about each of the volunteer's sources, describing in informal terms the key contribution of each source. Encourage them to try to boil these down to a single sentence or two: "Miller et al. improved the technique developed by Zhang to make it more precise." "The authors developed a new analysis technique, and applied it to existing data." Remind students if they get stuck that the hot spots they generated in Step One (listed on the board) are great places to start looking for a paper's intervention.

Step Three: (10-15 minutes) Ask the student volunteer to take the lead on describing each source's contribution to the literature, with the rest of the class joining in to offer refinements based on their own assessments.

As a class, help the student volunteer make a chart representing this information on the board. (A completed example appears in Table 1.) First, group the contributions the student has identified

into two or three broad categories—these will serve as the columns in the table. Next, give each source a row, and indicate each source's contribution in the appropriate column.

	Experimental Technique	Analysis method	Theoretical framework
Smith et al. (2011)	New mixture improved efficiency by over 40%		
Xu & Val (2009)			New model 10x more accurate when compared to past data
Wang (2013)		New classification method yielded 10% fewer false positives	Unified Xu & Val model with earlier predictions

Table 1

It's likely that it will take a little back-and-forth to come up with labels for the columns, and you should plan to revise them as you consider each source. (Some sources, like Wang in Table 1, may ultimately appear in more than one column.) Take time along the way to model how students might perform this assessment themselves.

Step Four: (10 minutes) Have students individually complete Steps Two and Three on their respective sources, starting with the process of summarizing each source's contribution. Circulate among the students and answer questions as they arise, and have the student who volunteered circulate as well to serve as a peer sounding board.

Step Five: (5 minutes) Tell the students that the remainder of the exercise will be dedicated to helping them fit their work into the framework they've just created. Remind them that just as they've assessed how their sources made a contribution to the field, future researchers will ask the same question about their project.

Ask the students to add a row to their tables labeled "My Work." In each column, the students should indicate whether and how they innovate over the existing literature. Of course, it's fine if their work doesn't contribute in each column. If they can't fill in a contribution in any column, encourage them to add a column that does capture their contribution and to reassess the rest of the sources along that axis.

Step Six: (10 minutes) Reconvene and invite students to describe the main contributions of their work, using the categories they've defined and discovered in their charts. Encourage them to "tell the story" of their contribution, showing how it fits into the contributions made by sources in the past. In this final wrap-up step, you'll want to emphasize that by building a chart, the students are in essence building a *motive*. The chart makes it clear what gap in the literature their work fills. With this motive in hand, it's much easier to write a convincing and clear literature review structured around the questions that the new work addresses.

REFLECTIONS

This exercise aims to address two questions that every beginning writer in the sciences has. The first feels practical: "How do I write a literature review?" The second feels fraught with a whole different level and kind of anxiety: "How do I make my work stand out?" By showing how the two questions are best addressed in tandem, the exercise makes the whole enterprise less fraught and mysterious, and students finish with a better sense of how to succinctly articulate the way their work improves on the prior state of knowledge.

The practical technique of building a chart distills the essence of the literature review and makes it less likely that they get lost in descriptive prose. But ultimately the psychological benefit of the exercise may be most important of all. "Making a contribution" sounds like a big task for a student, especially one who's new to the discipline. Many students think good papers have to be revolutionary in all respects—better data, better analysis, better conclusions. I have found that breaking down other papers' contributions by using this exercise helps my students feel that "making a contribution" is a smaller and more manageable job, and that their own work can contribute in small but significant ways to the scholarly community.

This exercise was developed with science and mathematics students in mind, but the basic structure can work across the disciplines. History, literature, and philosophy sources, for example, also make contributions in different ways along different axes. For instance, history papers may innovate by bringing to light new primary sources; applying a novel lens to a time period, person, or event; or making a new comparison or connection. Philosophy papers may likewise bring new sources or theoretical frameworks to bear, describe a new philosophical puzzle or problem, or propose a new solution to a problem raised by an earlier thinker. A literature paper could offer unique close readings or thematic analyses.

"Charting Your Contribution" works in different disciplinary contexts, but it also shines in *multi*disciplinary settings. Last summer it was used in a summer research mentorship program pairing graduate students across the humanities, social sciences, and natural sciences with undergraduate research mentees. While the grad students brought substantive expertise in their disciplines, they lacked the pedagogical training to teach the research process itself. By naming features common to scholarship in all fields, the exercise helped mentors and mentees alike identify the intended contribution of undergraduate research proposals. As a surprise bonus, it also facilitated better explanations of what kinds of questions different fields ask and how they go about answering them. Amusingly, given the disciplinary source of this exercise, the mentor/mentee pair from mathematics, who had struggled to explain their work to the "outsiders," found that this exercise produced "Ohhhhh! That's what you do!" moments that resonated the rest of the summer.