# REVISION BEYOND THE COPYEDIT: ENCOURAGING STUDENTS TO REORGANIZE, RESTRUCTURE, AND REFOCUS IN WRITING ASSIGNMENTS

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*Effective writing rarely appears in the first draft. Scaffolding a project with intermediate checkpoints for instructor or peer feedback can help students experience the revision process, but students may still struggle with the idea of a "serious" revision that goes beyond copyediting. Just like the writing process, the revision process can be daunting. By helping students through a sequence of targeted revision strategies, they can tackle different parts at a time and catch different weaknesses on different passes through a document. This paper provides targeted revision strategies that can support students as they write final reports that have gone through meaningful revision including reorganization, a restructure or further development of a statistical argument, and a refocusing based on intended audience.*

## INTRODUCTION

A writer's work is never done, but their workflow is often simplified as a roughly linear process of brainstorming, outlining, drafting, revising, and submitting. This hides the iteration that is required and the fact that revision happens more than once and at many different stages of the process. In a time-constrained environment where teaching writing is not necessarily the focus, such as in a statistics or data science course where a written report for a final project is involved, creating student opportunities for experiencing a realistic writer's workflow can be challenging. The goal of this paper is to make both the revision process and the writing task more concrete and demonstrate how to encourage students' revision processes to become more active and deeper. We start with the idea of "deep" revision as opposed to shallow copyediting and then describe three phases that break up a deeper revision process. We then propose small interventions in pre-existing writing assignments to give the revision part of the process, rather than just the content creation part of the process, its own emphasis. This includes a discussion of some of our own classroom experiences and a set of classroom activities that target each stage of the process.

## COPYEDITING VERSUS "DEEP" REVISION

What does it mean to revise? This question can appear amorphous to students and instructors alike. Faigley and Witte (1981) outline a taxonomy of revision, first distinguishing between changes that result in new meaning and those that do not. They consider "meaning changes" to be those that add information or remove information that "cannot be recovered through drawing inferences," whereas "surface changes" are those where information content effectively stays the same. In this framework, copyediting does not fundamentally change what the piece is communicating whereas content-level edits do.

In studies of student and experienced writers, less experienced writers focused on making "local" changes in their revision process and on workshopping individual words rather than thinking more "globally" about their work (Butler & Britt, 2011; Sommers, 1980). This kind of revision does not reflect the deep revision that occurs in the academic revision process. Peer reviewers in academia do not act as proofreaders but instead offer reviews of the ideas contained in an article and a judgment about the overall presentation's persuasiveness. Efforts to train students away from this local approach can be fruitful. For example, Graham et al. (1995) found that papers produced by students who were given a specific revision goal to "add information" rather than a general one to "make the paper better" were deemed higher quality by independent scorers. Providing a concrete schema for the writing itself can also help students. Wolfe et al. (2009) found that giving a tutorial that outlined the components of an argument improved the quality of the student writing, including students more precisely stating their claim and providing stronger support for their reasoning.

As a writer revises data and statistics content, their textual edits may lead them to new ideas about the analysis, requiring the writer to juggle multiple components and multiple identities as data analyst, data visualizer, and writer. Deep revision that adds information may require the writer to not

only write more but to perform additional analysis or create new plots rather than merely rephrase findings or tweak figure labels. This process may be overwhelming, so it can be helpful to break up the process into manageable chunks.

SCAFFOLDING AND TARGETING PHASES OF THE REVISION PROCESS

Scaffolding a larger assignment gives students tangible goals to build up to a bigger product, such as a final project that requires data analysis, a written report, and/or an oral presentation, and provides the opportunity for feedback throughout the process rather than just at the end. In a statistics course, this may be in the form of a rough draft that either gets instructor or peer feedback before a final draft (Chance, 1997). The first draft may even be further broken into section chunks that are completed throughout the semester with more feedback along the way. This scaffolding can ameliorate the overwhelming "where do I start" feeling and can minimize procrastination tendencies.

Just as the instructor can provide scaffolding for what to write in the form of rubrics and intermediate feedback (Martínez-Plumed & Hernández-Orallo, 2021), they can also scaffold the revision process by providing targeted goals and revision strategies. These targeted strategies can break down the amorphous instruction of "revise your work" and similarly answer the question "where do I start?" At the same time, having students go through multiple rounds of targeted revision where they focus on improving one property of the writing at a time rather than relying on one major overhaul to fully strengthen the piece will have them following a process more like experienced writers (Sommers, 1980).

Students may also struggle to know what to do with feedback, so providing explicit strategies for reflection can be helpful (Cook et. al, 2020). Instead of seeing each annotation as a checkbox on a checklist of things to edit, students can be prompted to look for common themes in feedback. Alternatively, reflecting on the feedback they have received from different peers throughout a course, students may start to recognize what kind of feedback is most useful.

We will consider an already scaffolded project that has some intermediate checkpoints and assume that after these checkpoints, students are left with a draft of each component of a report that will be combined to build a final product. The following sections will consider a series of targeted revisions, each with their own goal in mind. We recommend leaving ample time in a course schedule between the last checkpoint and the final draft to signal to students that there is still significant work left to be done in this revision process.

*Reorganizing Flow*

A first step towards combining draft pieces into a final product will involve organizing the available content. This does not require creation of any new content, but rather focusing on making the current content, including text, plots, and tables, flow. When students start to bring together draft components (such as an introduction, a literature review, a description of the methods, a discussion of the results, and a conclusion) and put them in a natural order, they will be left with some redundancy. Contextual information and summary statistics might be repeated across stand-alone assignments that when combined only have to appear once. Initial explorations or analyses may be made moot by later explorations and analyses. These redundancies motivate a "cut only" revision where the only goal is to strike out redundant text, figures, or tables.

Redundancy can appear at the content level, but it can also appear stylistically. Empty phrases such as "it is important to note," or bulky phrases such as "has the ability to" may also be stricken in this stage (Nolan & Stoudt, 2021). Instructors may also want students to go through a reorganization revision at the content level and at the stylistic level separately to emphasize that revision happens at both levels.

After a targeted cut step, transitions between sections and between sentences may appear jolting. The next revision goal might be to smooth transitions between ideas and phrases. Crucially this requires students to get out of the "strike-out" mentality of just removing weak material and to think about the creation of new material, broadening what revision means to include addition of what may be missing. Reading aloud at this stage can be helpful to identify awkward phrasing.

*Restructuring Arguments*

After the flow of the text and arrangement of tables and plots have been improved at a high level during the organizational process, students will need to address flow at a lower level, within each sub-

component, given the new ordering. This may require breaking up individual components and restructuring them in light of their surrounding components.

At the content level, the goal of a restructuring is to strengthen the statistical argument, which may include strengthening the visual argument in accompanying visualizations. Students may need to be shown examples of strong and weak arguments for use as calibration for their own. Asking targeted questions such as "are all main points supported with concrete evidence?" and "what gaps remain?" can help reveal places that need attention. This is also an opportunity to talk about the value of peer review. A writer has been grappling with the content for some time whereas someone new to the problem can approach it with fresh eyes and give feedback on what is confusing and what they are taking away from the writing.

What makes a statistical argument believable? Abelson (1995) coined the acronym MAGIC to give some guidance: magnitude (effect size), articulation (degree of detail provided in an understandable way), generality (generalizability or applicability of conclusions), interestingness (degree to which belief is changed and importance of issue), and credibility (appropriate methods). Therefore, strengthening the argument may require a change in statistical approach in addition to revising the writing about that approach.

How can a visualization be strengthened? Strategies such as adding context in the form of additional labels or guide lines for overall trends, making axis label wording and notation accessible, and using color schemes that are visible (e.g., to a color-blind individual) or culturally relevant (e.g., red/blue for hot/cold or Republican/Democrat) can improve a reader's ability to make meaning out of the display (Stofer, 2016). Linking the visualization strategy to the structure of the data or design of a study or analysis can also help a reader make the connection between the written and visual arguments (e.g., if investigating a correlation across groups, depicting small multiples of a scatterplot, faceting by the group variable) (Weissgerber et. al, 2019).

A restructuring-focused revision at the style level involves examining sentence structure with fresh eyes. This requires a search for opportunities to simplify overly complicated sentences and vary the sentence structure. If a reader gets lost in the presentation of the material, it will be harder to convince them that the statistical content is believable.

*Refocusing on Audience*

Up until this point the "reader" that students have been writing primarily for is the instructor. As they work towards a finished product, they may want to consider the real intended audience. Outside of the context of the class, who is this product for? Even if the organization and structure flows, the main message may not be emphasized enough, requiring further revision at the component level.

Having an explicit discussion about the intended audience for the final product will inform a targeted revision strategy that focuses on word-level choices. For example, what is considered "jargon" depends on the audience. Students should consider whether a non-technical audience will understand statistical terms usage if those words also have an everyday usage (e.g., significant, random, error) or misinterpret language that may imply an overreach (e.g., slipping into causal language with observational data). The audience should also be considered for visualization choices because different audiences may have different graphical literacy overall or familiarity with interpreting particular types of graphs (Burns et al., 2020; Galesic & Garcia-Retamero, 2011; Okan et al., 2016).

MAKING SPACE FOR REVISION

Implicit in all of this is both carving out time for students to revise and motivating their taking the time to revise rather than spending that time generating new content. It can feel like a zero-sum game when you ask students to add a revision step without taking away a writing step. For example, Stoudt (2022) taught a Stat 2 course with approximately 10 students that had computational labs about once each week. These required a lab report to be written in groups of two or three. Because of the quick pace of these labs, there was no time to reflect on a previous assignment before starting another one. Stoudt decided to experiment with two targeted-revision assignments. For two labs in the middle of the semester, the instructor shortened the lab assignments and then provided an opportunity for students to do a targeted revision and reflect on the experience. One lab's targeted-revision strategy was on empty phrases, and one was on looking for accidental causal language. Anecdotally, this opportunity to do a little less writing and a little more re-writing gave students a better sense for writing qualities that a

reader would be looking for when assessing the reports and gave them the time to read through and smooth their writing after the pressure of the immediate deadline for correct content.

There are other low-stakes ways to encourage more explicit revision no matter what the class. Stoudt has incentivized a lack of procrastination and a "fresh eyes" form of revision by giving bonus points to students who finish a writing assignment early, step away from it for 24 hours, return to the assignment to revise one final time, and write a short reflection about how this technique worked for them. In an introductory statistics course with approximately 30 students, after the individual pieces of the report were completed and students had received feedback on each, Stoudt (2022) provided a "checklist of concrete tasks" to help students put the pieces together into a final draft that included targeted revision strategies. A similar list of strategies could be given to students as part of an in-class peer-review activity. When Stoudt spots a stylistic mistake in a student's writing assignment, she recommends a targeted revision technique that might have caught it for future reference. These approaches can scale to the degree that instructors can give some intermediate writing feedback at either the group or individual level.

## ACTIVITIES

The following activities can be used to scaffold the revision process in classes at any level that have a final project or individual writing-focused assignments. Many of the writing-focused activities can also be repurposed to guide the revision of data visualizations. These can be assigned as completion-based, low-stakes assignments, or they can be completed in class. At the end of a larger writing assignment, instructors may also ask students to reflect on the perceived efficacy of these activities in improving their writing.

### For Reorganizing Flow

The goal of this stage is to take stock of elements available and order them appropriately. Students should leave this stage with a high-level road map of their final product.

- Provide students with an example piece that reflects the audience, content, and style of the final product, and ask them to map the piece's high-level organization, including visualization choices (Nolan & Stoudt, 2020). Encourage them not to deeply read the piece yet but to just focus on the "birds eye view." You may even ask them to only read the section headers and figures at this stage.
- Have students print a draft of a piece of their writing and let them cut it into subsections, creating a textual analogue to a visual storyboard (Stoudt & Nolan, 2021). They can then physically experiment with organization at a global level.
- Ask students to read a subset of their work out loud. For a content-level revision approach, focus on the last two sentences of each paragraph and the first two sentences of the paragraph that follows, and prompt them to listen for awkward transitions. For a stylistic-level revision approach, focus on a subset of paragraphs and ask them to notice when they get out of breath (a sign of overly complicated phrases or redundancies).

### For Restructuring Arguments

The goal of this stage is to adapt material to strengthen an argument. Students should leave this stage with a more detailed outline of their final product.

- Provide students with an example piece that reflects the audience, content, and style of the final product, and now ask them to reflect on the piece's argument strategy both in terms of the written statistical argument and the visual argument of the data visualizations (Nolan & Stoudt, 2020). This will require a careful reading of the content. To make the process of reading more concrete and active, you may ask them to annotate the piece and provide discussion questions to prime them to look out for relevant details.
- Allow students to try a completely new approach to a draft, encouraging them to start from scratch with no copying and pasting from an earlier draft. By breaking out of the established mold of their first attempt, they may discover a better structure.
- Request that students make two different data visualizations that have the same message. Pair students and ask them to discuss which is more effective and why.
- Ask students to read a subset of their work out loud. For a content-level revision approach, focus on the first and last sentence of each paragraph and prompt them to listen for parts of the abbreviated

story that seem out of place in the broader setting. For a stylistic-level revision approach, focus on a subset of paragraphs and have them listen to the rhythm of the words (and thereby catch monotonous or unwieldy sentence structure).

*For Refocusing on Audience*

The goal of this stage is to strengthen the tie between the message and the audience. Students should leave this stage with a product that is tailored to an intended audience.

- Provide students with a pair of pieces, one written formally, and one written for a broader audience (e.g., a blog post or press release) on the same topic. Discuss the similarities and differences in the writing approaches and the author choices made in each.
- Lead a discussion on assumed knowledge to help students unpack their assumptions about different audiences. Ask them "would your audience know about X?" where X is a method used in the class or another context-level term. For visualizations, ask them "how often would your audience encounter graph type Y?"
- Ask students to write a particular component of a bigger product, such as an abstract, introduction, or conclusion, or create a data visualization for two different audiences (e.g., a middle-school student and a CEO of a company, a typical newspaper reader and a state senator, etc.). Prompt students to reflect on the choices they made.

CONCLUSION

The revision process goes hand in hand with the statistical investigation process that we aim to teach our statistics and data science students (GAISE College Report ASA Revision Committee, 2016). It requires an investigation of our own work so far with a critical eye. Decisions must be made about both content and style; problems must be solved concerning reaching the particular level of our audience with our desired message. By adjusting current writing and other communication projects and assignments to leave room and time for revision of content, we model the importance of revision and give students the opportunity to go through that part of the writing process. Being clear about what revision means and providing concrete strategies can help students navigate this stage and show that the process is an active rather than a passive one.

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