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## QUANTITATIVE LITERACY IN THE COMPOSITION CLASSROOM: USING INFOGRAPHICS ASSIGNMENTS TO TEACH ETHICAL AND EFFECTIVE DATA USE

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In 2015, then-candidate-for-president Donald Trump tweeted an infographic on US crime statistics (see Figure 1). This infographic, which combines fake data from a non-existent source with racially charged imagery to argue that African Americans should be viewed as perpetrators rather than as victims of violent crime, demonstrates the stakes of quantitative literacy today. Although detecting and countering misinformation has always been challenging, increasingly, the misinformation that individuals encounter takes the form of quantitative visuals combining data displays with textual information and iconography to make succinct, persuasive arguments. Misinformation presented via quantitative visuals can be particularly difficult for readers to detect and combat because interpreting these arguments requires unpacking a complex combination of statistical, visual, and textual expressions. Writing studies scholars are uniquely positioned to consider how these texts are constructed and how they invent data to advance persuasive arguments, and a growing body of work focuses on the rhetorical dimensions of quantitative arguments (e.g., Beveridge; Wolfe; Rutz and Grawe; Lutsky). This chapter contributes to that work by presenting specific strategies for incorporating quantitative visuals in composition classrooms. It details three infographics assignments of varying scope and sequence designed not only to prepare students to read and produce data-driven arguments, but also to equip students with strategies to discern between ethical and unethical uses of data so they can make persuasive arguments.

The ability to discern between ethical and unethical uses of data in quantitative visuals is important for students as an academic skill and in order for them to participate as fully literate members of democratic society. Quantitative visuals can be enormously effective at infusing misinformation into public discourse, which has serious implications for democratic decision-making processes. As D. J. Flynn, Brendan Nyhan, and Jason Reifler explain, misinformation “can distort policy debates and even affect the content of legislation itself” (143). As an example, in this volume, Shereen Inayatulla and Michael T. MacDonald discuss how misinformation has impacted public debates around immigration as “humans who migrate by choice, by force, and by an ambiguity in between have become subjects of competing, sometimes contradictory, knowledge.”

Today, misinformation spreads more quickly than ever before as “[f]ake news circulates through botnet networks that use algorithms to profile users and feed them stories that fit their individual



Figure 1. Example of an Infographic Disseminating Fake Data from a Fake Source (Greenburg).

biases” (Miller and Leon 10). Timothy Laquintano and Annette Vee point out that the widespread dissemination of fake news stories online indicates the limitations of “many of the tenuous ways we’ve learned to discern what’s true online” (46). Indeed, misinformation visualizations, like fake news stories in general, “often emulate the look and titles of professional news sources,” so that “even if a story has been shared a million times on social media, and if it is found on a website that looks and sounds newsy, and if it is repeatedly linked from a popular hashtag, there’s no guarantee that it’s a credible story” (Laquintano and Vee 46). The prevalence—and success—of quantitative visuals such as the one shown in Figure 1 illustrates the importance of quantitative literacy, not only to prevent individuals from being deceived by false visuals but also to prevent misinformation from skewing significant public debates.

In 2004, Lynn Arthur Steen described quantitative literacy as a “uniquely modern blend of arithmetic with complex reasoning” (3). More recently, Steen and a number of other quantitative literacy advocates have stressed that the logical aspects of quantification, rather than the technical aspects, are central to quantitative literacy. According to Steen, “QR is sophisticated reasoning with elementary mathematics more than elementary reasoning with sophisticated mathematics” (qtd. in Rutz and Grawe). For example, detecting the misuse of data in Figure 1 does not require sophisticated mathematical skills or even thorough fact checking. The infographic does mimic some of the attributes associated with credible data displays, such as the attribution of the data to a source that sounds government-related, the use of the word “statistics” in the title (and the source’s name), and the identification of a timeframe for the data reported. However, signs that the infographic was suspect include the infographic’s claim to present data for 2015 though the year was not over, the lack of a statement about the population from which the percentages are calculated, and the use of

a racially charged image. In other words, recognizing that Figure 1 does not present data ethically and warrants additional scrutiny does not require complicated mathematics. What it does require are quantitative reasoning habits such as questioning the source of all data reported, understanding how data are cleaned, processed, and organized to prepare for analysis, and recognizing how imagery and text work with data to communicate meaning. It also requires an understanding of how such arguments circulate in an online ecosystem comprised of “the variety of information that circulates through networks” and “the interdependence between humans—subjects, researchers, sponsors—and non-human-entities—data, information, algorithms, systems” (Craig 25). The widespread dissemination of Figure 1 illustrates how fake news circulates through networks, as human and non-human actors facilitate the spread of misinformation visualizations with “the veneer of credibility, aided by confirmation biases and easy mechanisms for sharing, and then magnified by popularity algorithms” (Laquintano and Vee 46). Consequently, new approaches to evaluating information are needed, something that Joshua Daniel Wariya, Tyler S. Branson, and James Chase Sanchez also discuss in this volume when they argue that “rhetoric and writing teachers and scholars should both work to apply what they already know about the circulation of texts to the role software plays and actively work to supplement what they know with emergent knowledge in the relatively new area of software studies.”

Certainly, in the context of online information ecosystems, it is not enough to migrate criteria for evaluating print sources to networked information. As Thomas P. Miller and Adele Leon explain, distinctions between primary and secondary sources and between sources subject or not subject to peer review remain useful but are not sufficient for helping students assess the credibility of networked information. They recommend that “[r]ather than continuing to assume a modern rationalist standpoint on such models of knowledge in the making, we should expand our attention to the symbolic dynamics of motivated cognition to consider how we can motivate students to slow down and care enough to engage with others” (19). The importance of helping students to slow down and care enough to engage is especially important in the case of quantitative visuals, which are often credited with more authority than are other types of argument due to their affiliation with statistical evidence. For example, Joanna Wolfe found that even composition and technical communication textbooks generally treat quantitative arguments “as what the early rhetoricians referred to as ‘extrinsic’ or ‘inartistic’ proof” (457). A rhetorical approach to quantitative visuals can help students to slow down enough to recognize how quantitative arguments are invented to be persuasive.

Advocates for including quantitative literacy in composition instruction argue that quantitative literacy has a place in composition courses because quantitative data and arguments are a key means of persuasion and are increasingly prevalent in communications of all kinds as a characteristic of the current era of “Big Data.” In 2014, Carol Rutz and Nathan D. Grawe argued that students need practice using numbers in rhetorically effective ways to provide context, make evidence specific, show change over time, and impart precision in language since “much of their experience with numbers is limited to formal situations that require them to solve problems with correct answers” (1). Yet, teaching quantitative literacy in composition courses can be challenging, not least because quantitative arguments so often take the form of multimodal, digital texts such as infographics

or other types of data visualizations. Equipping students to read and produce these kinds of texts requires attending to technological literacy, multimodal literacy, and visual rhetoric, in addition to dimensions of quantitative argument such as statistical expression.

My own decision to include quantitative visuals in composition courses of varying levels was prompted, initially, by a curricular revision at the institution at which I taught at the time. Following a revision of the entire core curriculum, including the required first-year writing course, writing instructors were asked to develop first-year writing courses around one of four possible themes, one of which was quantitative reasoning (the others were nature and environment, culture and community, and identity and self). The inclusion of quantitative reasoning as one of the four available themes is telling, indicating the growing acceptance of QR as a critical literacy skill that should be taught across the curriculum, including in general education courses like first-year writing. Since I had long taught upper-level professional writing courses that included data gathering and graphical representation, I was interested in the possibility of including similar methods in my first-year writing course. However, the research I conducted on quantitative literacy in preparation for revising my first-year writing course led me subsequently to revise my approach in professional writing as well so that I might make quantitative literacy, and especially quantitative visuals, more central to both types of courses. I became aware of how much my own approach to teaching quantitative argument depended on a dichotomy between true and false and, as a result, oversimplified the rhetorical situation in which quantitative arguments operate. In particular, I was challenged by the work of Wolfe and Aaron Beveridge, both of whom emphasize the importance of attending to how quantitative visuals are invented. In 2010, Wolfe called for “a *rhetorical* education that examines how numbers are used and invented in the service of argument at public, professional, and personal levels” (455). She also emphasized that “students should have practice making their own arguments from quantitative data ... so they can see the role that *invention* plays” (455). More recently, Beveridge has proposed the need for a more sophisticated rhetorical understanding of quantitative visuals. He suggests that rather than only distinguishing deception from fact when it comes to statistical reasoning, compositionists need to consider how all quantitative visuals are the result of choices made during data processing and statistical analysis—in other words, how all quantitative arguments are invented.

Consequently, my own pedagogy of quantitative argument evolved as I worked to extend the method that Beveridge outlines for understanding and analyzing the production of data visualizations for classroom use. According to Beveridge,

*Techne* and data visualization are contingent upon the accessibility of: (1) The underlying data, how it is collected, and how it is archived and accessed; (2) How the data is processed, cleaned, and organized to prepare for analysis; (3) How the data is analyzed and visualized; (4) How the analyses and visualizations are delivered to an audience.

Beveridge’s method is designed to illuminate how quantitative visuals present invented, persuasive arguments, rather than representing “impenetrable and unquestionable forms of evidence.” I believe this method is useful for teaching quantitative visuals in composition courses of all levels, and in this essay, I use Beveridge’s framework to address concerns such as those expressed by both Rutz and Grawe and Wolfe about the need for students to practice using numbers in rhetorically effective

ways. I share examples of three infographics assignments that respond to this challenge. As the assignments move from analysis of others' infographics to creation of students' own infographics, they ask students to explore how all quantitative visuals present invented, persuasive arguments. At the same time, they also equip students with strategies to discern between ethical and unethical uses of data to make persuasive arguments.

## Assignment 1: Analyzing Infographics

I begin by asking students to read and analyze infographics closely. Despite how commonplace infographics are, students have usually not spent time adapting their reading strategies to these texts, and they frequently lack experience in critically reading quantitative arguments as well. Consequently, students need practice working with infographics to understand how these texts use and present data to make persuasive arguments. This assignment can be adapted for shorter or longer periods of time depending on course contexts. It could occur within a single class session or be expanded to fill a course unit. I spend two class periods early in the semester on this assignment, and students receive participation credit for their work.

### *Day 1: Rhetorical Analysis*

I begin class by explaining Beveridge's methodological framework, discussed above, to students. I also talk with students about specific ways that data are manipulated in the process of being visualized, such as discussed by data scientist Randy Olson, who recommends a three-step process for questioning all quantitative visuals: 1) check the data source, 2) check the data alteration, and 3) check the data presentation. Then, using Beveridge's and Olson's terminology and frameworks as a guide, I ask small groups of students to examine a variety of infographics that I provide to them and to answer the questions about each of the examples shown in Table 1.

Table 1. Rhetorical Analysis Questions for Infographics

1	Data Source	Who conducted the study that this infographic is based on and why?
2	Data Alteration	How were the data manipulated from their raw form into the visualization that we see? Are details about the data alteration provided?
3	Data Analysis	What terms are central to the writer's argument (quantitative and otherwise)? How does the writer define the terms? Who would disagree with the way the terms have been defined, and why? Would the writer's argument change if the definition of the term(s) changed; if so, how?

4	Data Presentation	Who is the audience for this infographic and what are they supposed to do with this information? How do the data, images, and design elements work together to draw the audience into feeling a particular way about the topic of the infographic?
5	Data Presentation	What story does this infographic tell? What organizational pattern(s) did the writer use to tell that story? How would using a different organizational pattern change the argument?

As a whole class, we discuss their answers, and students begin to think more rhetorically and critically about infographics. They quickly recognize that all of the infographics have shaped data to tell a particular story but that some of the infographics use data in ways that are unethical and noncredible, such as by fabricating a data source or presenting data in a way that skews them. They also often observe that the same qualities that characterize credible, ethical academic scholarship also characterize credible infographics, including clear and proper attribution and citation, context for the evidence included, and details about how data were gathered and altered. My primary goal for this discussion is to help students move past a simplistic understanding of quantitative visuals as merely deceptive or factual so they recognize that all infographics make use of data to support persuasive arguments. A second goal is to help students begin to recognize that though all infographics manipulate data, some of these manipulations are more ethical than others.

### *Day 2: Digging into the Data*

During the second class period I spend on this assignment, and following our discussion of individual infographics, we look more closely at how each infographic uses data in order to identify particular strategies that infographics' creators employ to choose, alter, and present data. To this end, we spend time creating categories into which we can place the different infographics we encounter. The exact terms that students choose to refer to different classes of infographics is not as important as their ability to use the questions from Table 1 to distinguish which choices the creators made were ethical and which were not. My goal with this assignment is to give students additional practice in analyzing quantitative visuals and to help them see how the rhetorical framework can help them pinpoint what makes a particular infographic's use of data credible or noncredible. Below I present examples of infographics we have worked with in class in order to discuss how my students and I have used the questions from Table 1 to distinguish between the ways that quantitative visuals use data.

### *Data Source Issues*

Students enjoy identifying samples in this class of infographic because most often they only need to work through the first question from Table 1 to determine data source issues. Infographics that students place in this category include those with fake data, a fake source, or a missing source. I emphasize to my students that any infographic that does not identify a data source must be

automatically rejected since it is impossible to assess the credibility of the source; this provides a useful example of the importance of scholarly citation and attribution practices for students who question their value as well. However, this principle is so well established that even infographics using fabricated data will often include a data source to create a false sense of credibility. In the case of Figure 1, for example, a source is credited that does not exist. It would be possible to extend this activity to check the data presented in such infographics for accuracy, but in my courses, I want to reinforce the importance of accurate and complete citation practices as a way to establish credibility and the validity of data.

### *Data Alteration Issues*

Infographics that use cherry-picked data, especially from multiple data sources, are more difficult for students to identify. Nevertheless, the set of questions they use to analyze all the infographics rhetorically has proven effective. For example, Figure 2 was published as part of an online article that provides extensive details about the data sources and context for the data. This detail about sources and context lends credibility to the infographic, though most students do clue in to the use of multiple Wikipedia articles as data sources, which causes them to flag this infographic for a closer look. Question 3 helps them investigate the term “mass shooting” more closely, and they quickly recognize that what constitutes a “mass shooting” is subject to a variety of different definitions. The combination of a contentious term and multiple data sources suggests to most students that the

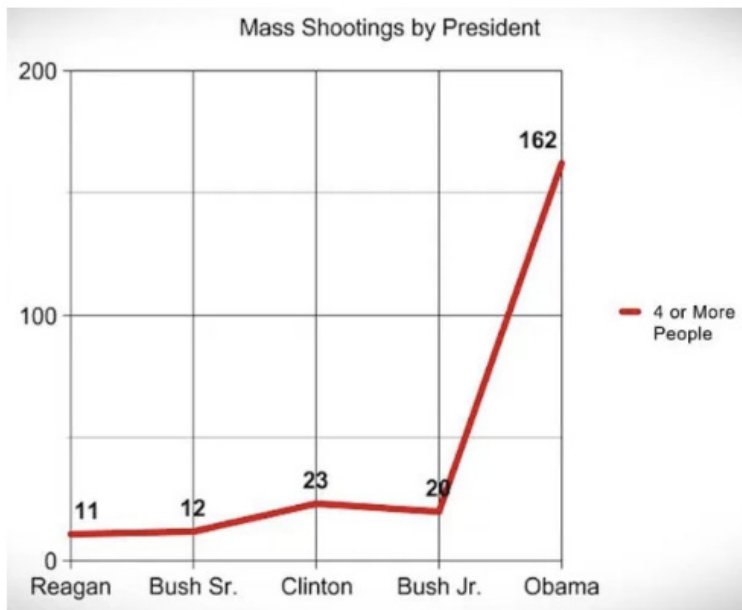


Figure 2. Example of an Infographic with Data Source and Data Alteration Issues (Dykes).

data included might be problematic, especially since the creator's argument—that gun control is ineffective since mass shootings skyrocketed during the Obama administration—is surprising. Checking the original data sources more closely to answer Questions 2 and 3, students recognize that the writer chose to define mass shootings differently for Obama than for the other presidents included on the chart in order to inflate the numbers and support the argument that gun control is ineffective. Consequently, most students agree that this infographic has altered the data too greatly to be considered honest or credible.

### *Data Presentation Issues*

The most common type of issue that students find in infographics is the use of visual tricks to distort data in support of a particular argument. Sometimes, these distortions can be attributed to errors in representing statistical information, but often they seem to be deliberate attempts to make data support a particular argument (see Figure 3). For example, students agree that data in Figure 3 were deliberately distorted to support the argument. At first, students usually flag Figure 3 due to the data source: a partisan pro-life lobbying group providing statistics about abortions. However, when

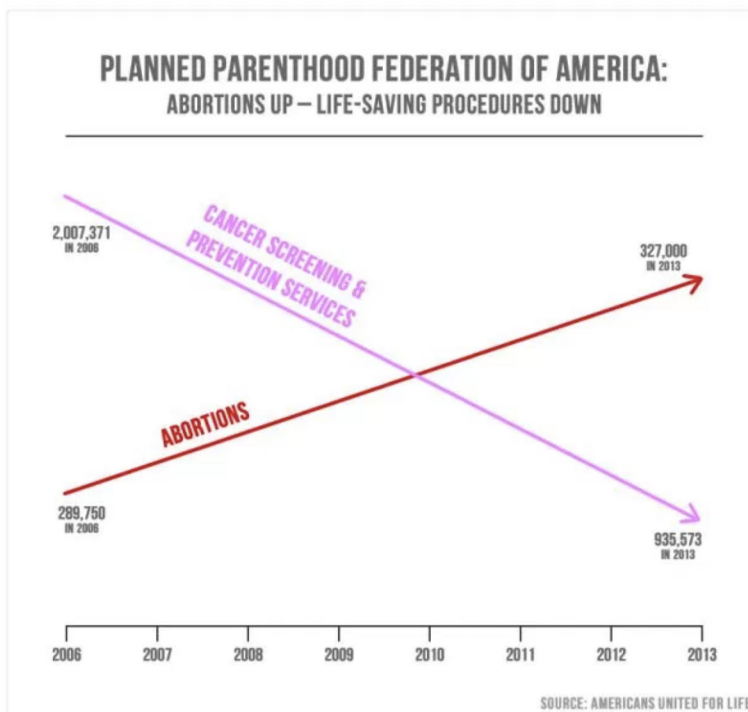


Figure 3. Example of an Infographic with Data Presentation Issues (Americans United for Life).

they dig further, they find that the statistics were acquired from Planned Parenthood through its annual reports. Consequently, Questions 2, 4, and 5 are particularly helpful in analyzing this



infographic. Students recognize that the chart includes no y-axis, which allowed the creators to plot the change in number of procedures in order to make it appear that the number of abortions performed by Planned Parenthood is far higher than the number of cancer screening and prevention services. This infographic thus presents a completely misleading argument about abortion using accurate data.

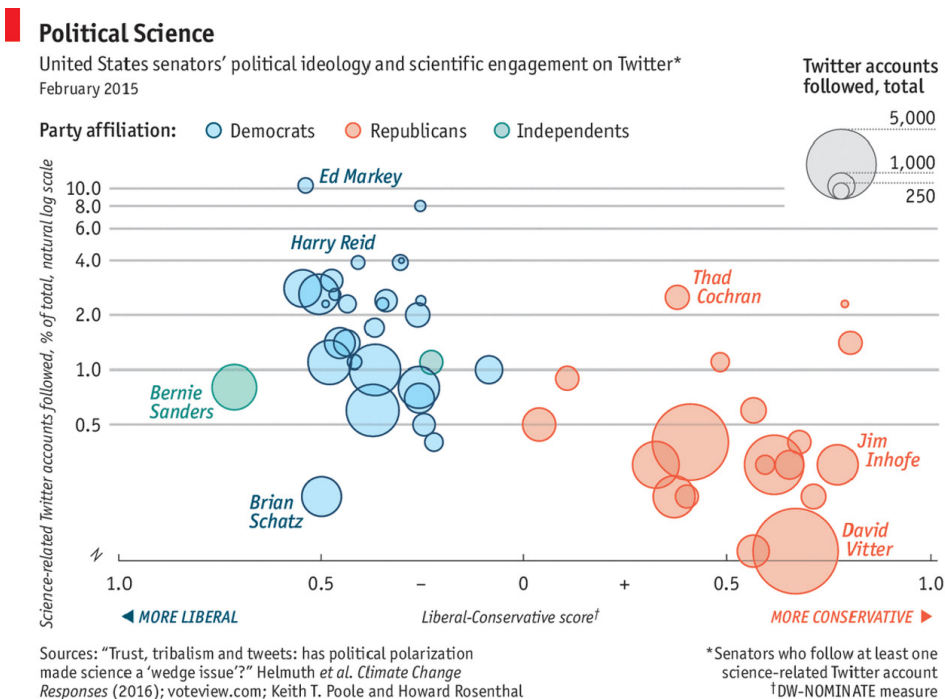
### *Ethical Uses of Data to Persuade*

After recognizing how easily data sources, data alteration, and data presentation can be manipulated in unethical ways, some students question whether it is ever possible to ethically manipulate data for persuasive purposes. They inevitably question whether all data visualization is misleading and should be rejected. This sentiment reflects what Wolfe has referred to as the “paradox” around statistical evidence in general: “on one hand our culture tends to represent statistical evidence as a type of ‘fact’ and therefore immune to the arts of rhetoric, but on the other hand we are deeply aware and suspicious of the ability of statistics to be ‘cooked,’ ‘massaged,’ ‘spun,’ or otherwise manipulated” (453). In the composition classroom, it is therefore important to spend time discussing ethical uses of data to support persuasive arguments and analyzing examples of infographics that present credible quantitative arguments in order to cultivate a rhetorical perspective on quantitative visuals. Giving students the chance to rhetorically analyze credible, ethical infographics reinforces that though all persuasive arguments are invented, some choices that writers make during the process of invention are more ethical than others.

For example, Figure 4 argues that there is a partisan division in the types of science-related accounts that politicians follow and that though Republican senators might be more active on Twitter overall, they are much less likely to follow science-related accounts than are Democratic senators. The data for this infographic came from a scholarly academic article in a peer-reviewed journal, and the infographic uses a bubble chart to plot 1) science-related Twitter accounts followed by individual politicians, 2) politician by party affiliation, 3) the Liberal-Conservative score for the senator, and 4) how many Twitter accounts the politician follows altogether (not only science-related accounts).

In discussing this and other infographics, we talk about how even credible infographics are invented. The data are selected to support an argument; they are processed, cleaned, and organized to make visualization possible; and they employ visual devices to make the argument easy for readers to understand and even appealing to look at. For example, when working through the rhetorical framework, Question 3 prompts students to question what qualified, and did not qualify, as a science-related account for the purposes of the study on which Figure 4 is based. Question 2 leads them to ask how the use of the log scale created the appearance of space between Democratic and Republican senators. They also ask what the DW-Nominate measure is that was used to determine individual senators’ ideological affiliation. Was a bubble chart the best graphical tool to represent these data? How would the argument change if another type of graph had been used? Questions 4 and 5 help students consider the ratio of text to image in the infographic and what other text might have been helpful in providing context for the data or argument. In the end, some students agree with the argument presented in Figure 4, and others disagree. What I stress during our discussion is

that people can reach different conclusions based on credible data; what is important is being able to determine when data are credible in the first place.



Economist.com

Figure 4. Example of an Infographic Using Data to Make a Persuasive Argument (“The Senate’s Scientific Divide”).

Through the two days that I spend on analyzing infographics with my students, my goals are to help them think critically about information sources and the use of data to make persuasive arguments and move beyond a simplistic notion of infographics (and other types of information) as either deceptive or factual. This binary opposition has led to people putting too much faith in supposedly “factual” quantitative visuals that in reality only present a particular interpretation of data. Acknowledging that some uses of data are ethical and some are unethical, and providing strategies students can use to determine how data are being used in specific texts, can help students be confident that the infographics they use for their own personal, academic, or professional research are using data in ethical ways. Additionally, such strategies provide a necessary starting point for students’ own ability to invent persuasive quantitative visuals.

## Assignment 2: Revise the Infographic

This two-week assignment follows the in-class work on rhetorical analysis, and it is graded for completion. For this assignment, I ask students to revise one of the infographics we discussed during the Analyzing Infographics Assignment (to extend this assignment, students could be asked to analyze an unfamiliar infographic). I use this activity to reinforce ethical academic research methods, to discuss visual rhetoric in more detail, to introduce an infographics creation program, and to give students practice creating data displays in a low-stakes activity.

To revise their infographics, students conduct the research necessary to find credible data to use (or corroborate the data included in the original infographic) and redesign the data display as needed either to ensure that the infographic uses data ethically or to change its original argument. Their goal is to present credible data in an ethical way in their revised infographic. Then they write a reflection comparing the original infographic and their revision to consider the choices they made in revising the infographic and how the message of the infographic changed.

### *Step 1: Visual Rhetoric*

During the Analyzing Infographic Assignment, I discuss visual rhetoric in terms of data presentation. During Assignment 2, I spend more time delineating specific aspects of the visual mode that impact data presentation in infographics. Marissa Sandoval Lamb, Jenna Sheffield, and Kristin Winet have discussed the problem of rhetorical illiteracy with regard to visual rhetoric and design, and they suggest that infographics assignments included in composition courses are valuable for allowing students to practice visual rhetoric, design, and writing. Lamb, Sheffield, and Winet have adapted Charles Hill's pedagogy of visual rhetoric for their infographics assignments; they stress the importance of helping students to see images as cultural artifacts and as rhetorical constructs and to appreciate the visual aspects of written texts. I introduce my students to visual rhetoric by sharing these concepts with students and situating our class discussion of the visual mode in the context of invention. Our previous work analyzing how quantitative arguments are invented as persuasive arguments helps my students to recognize how infographics' creators use visual elements of these texts to make their arguments as appealing and persuasive as possible. I also provide them with more specific vocabulary to discuss the visual mode and in particular the visual aspects of written text, using language such as that recommended by Kristin Arola, Jennifer Sheppard, and Cheryl Ball in *Writer/Designer: A Guide to Making Multimodal Projects*, who explain the visual mode in terms of color, layout, style, size, and perspective (6).

Following this introduction and discussion, I ask students to analyze the visual elements of the infographic they are revising in more detail and how these elements contribute to the persuasiveness of the infographic. I also ask them to brainstorm changes they would like to make to their infographic in terms of color, layout, style size, and perspective in order to make the argument more persuasive and/or appealing to its audience.

### *Step 2: Infographics Creation*

Lamb, Sheffield, and Winet recommend using free, web-based, drag-and-drop infographic creation programs, such as Piktochart, to create infographics in composition courses, since these are easy for students to experiment with and master, allowing them to move quickly from “being analyzers of visuals to composers.” This is a goal I share, since I want students to move from analyzing quantitative visuals to composing them as easily as possible. Consequently, I encourage students to use Piktochart for their infographics’ assignments, and I spend about 20 minutes in class showing them the features of Piktochart, such as how to add and delete blocks, insert text boxes and images, and modify colors and fonts.

The majority of this class time is spent showing students how to use Piktochart’s chart creation features and giving them opportunities to create and modify charts and graphs. I provide students with a sample population table that they input into the Piktochart graph creation tool, and then they experiment with different chart types (pie charts, bar graphs, line charts). We share our results as a class and talk about which chart type best allows for a comparison of data, which is best at showing change over time, and so on. Based on this basic understanding of Piktochart’s capabilities and chart-creation features, students then brainstorm ideas for revising the data displays from the infographic they are revising.

### *Step 3: Revision and Reflection*

Figure 5 represents a student revision of Figure 3, the misleading infographic about Planned Parenthood services.<sup>1</sup> Along with their revisions, students submitted one-page reflections detailing the changes they made to the original infographic, the purpose of these changes, and their own evaluation of the success of their revision. The creator of Figure 5 decided to retain the original argument and purpose from Figure 3 but to attribute the data to their original source and correct the data display by adding a y-axis. She also decided to break the dual-line chart from Figure 5 into two separate line charts, one charting abortion services over time and the other charting cancer screenings and prevention services over time. Visually, she chose to use a red background for her infographic since that is the color that the original infographic used for the abortion line (in contrast to a pink line representing cancer screenings and prevention services). She explained that the red background color expressed a sense of danger and warning that she felt made the infographic’s argument more persuasive as well. This student judged her revision to be much more effective than the original. She did express that it turned out to be a little more “boring” visually than she had originally wanted, but that given the time she had to work on it, she felt her attention to color, text size, and data presentation was adequate.

Though students’ revised infographics are often relatively simple in design and content, they demonstrate students’ experiments using visual rhetoric and data displays to make a persuasive argument. Being able to compare the choices that different students make to invent their quantitative visuals also helps them to recognize the extent to which these arguments are designed and use data to be persuasive. Most importantly, after working through the process of researching credible data and creating data displays themselves, students appreciate that data can be used ethically while still

serving persuasive ends.

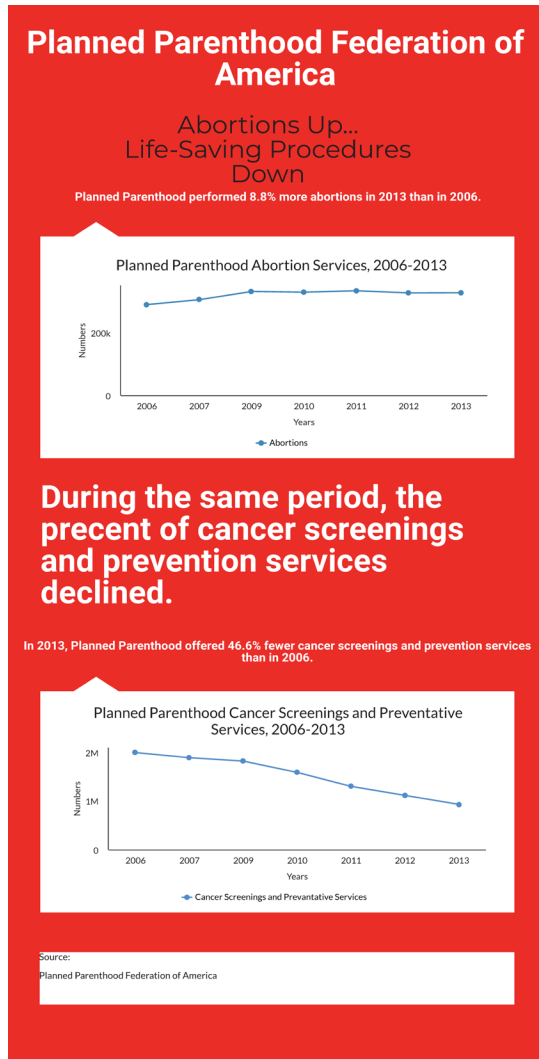


Figure 5. Sample Student Infographic Revising Figure 3. Source: Chaney, Megan. “Planned Parenthood Federation of America: Abortions Up... Life-Saving Procedures Down.” Fall 2016. Marist College, NY. Class Assignment.

### Assignment 3: Producing Infographics

This unit-long assignment asks students to create a research infographic that makes a quantitative argument. I have used this assignment in both introductory writing courses and professional writing courses, and it takes the place of one research essay or report-writing assignment. The goal of the

infographic is for students to tell their own *data story*, putting statistical data in context so that they are meaningful to a target audience. In introductory courses, this target audience is the class. In professional writing courses, this audience is usually a local community non-profit organization with which the class is partnering throughout the semester. This assignment, which is graded for content and design, asks students to demonstrate their rhetorical and technical knowledge of visual rhetoric and quantitative arguments, developed through Assignments 1 and 2. Students complete several process activities as part of this project, and while the research infographic is the culmination of the unit, the process activities provide important opportunities for developing, practicing, and demonstrating rhetorical awareness of quantitative visuals.

### *Assignment Goals and Objectives*

This assignment was originally designed for and taught to students in a technical writing course as a means of including quantitative arguments in the course, but I have since adapted and taught it more frequently in a first-year composition course. This assignment achieves curricular goals related to stating an argument clearly and succinctly, organizing an argument, evaluating research sources, designing meaningful data displays, citing sources properly, and using visual rhetoric.

### *Unit Components*

*Component 1: Rhetorical Strategy.* The first component of this unit is the rhetorical strategy in which students analyze the rhetorical situation for their infographic and plan their document (though they may make changes later as needed). In their rhetorical strategy, they describe the audience for their infographic in as much detail as possible including the size and geographic distribution, the composition of the audience, the level of understanding, the expectations and preferences, and the probable reaction. They also describe their purpose for creating the infographic and choosing the topic they will work with. They generate a list of tasks that the writing situation requires: what research they need to conduct, what sections for the infographic they need to compose, who will review their infographic, and what revisions and editing they plan to complete. They outline specific page layout and design attributes for the infographic, based on their own aesthetic style as well as the audience's needs and their purpose.

*Component 2: Data Displays.* The second component of this unit is creation of data displays. The purpose of creating data displays is for students to gain experience creating their own effective, ethical graphs, and charts. Here all students explore quantitative visuals while continuing to practice using Piktochart and creating charts, building on their work in the Revising an Infographic assignment. Workshopping and receiving instructor feedback on students' data displays prior to their inclusion in the research infographic helps students to catch errors they have made in data alteration and presentation.

Figure 6 demonstrates the kinds of errors that students frequently make in their data displays. Figure 6 reported data in an erroneous way. This student pulled data from a University of Virginia study on leading causes of mortality among college students. He incorrectly reported the mortality rates as percentages of the total population of college students rather than percentages of the students

who died from the study population. As a result, his numbers are completely inaccurate; he states that 6.18 percent of all college students die from suicide, while the study population was limited to 1.6 million students from 157 four-year colleges. Of this population, only 254 students died. Of the 254 students who died, 6.18 percent of these deaths were due to suicide (approximately 16 deaths). The other percentages included in this data display are similarly erroneous. Any argument that the student made in his research infographic based on this inaccurate use of data would necessarily inflate and incorrectly assess the issue of college student mortality, so catching this kind of data analysis error early is important.

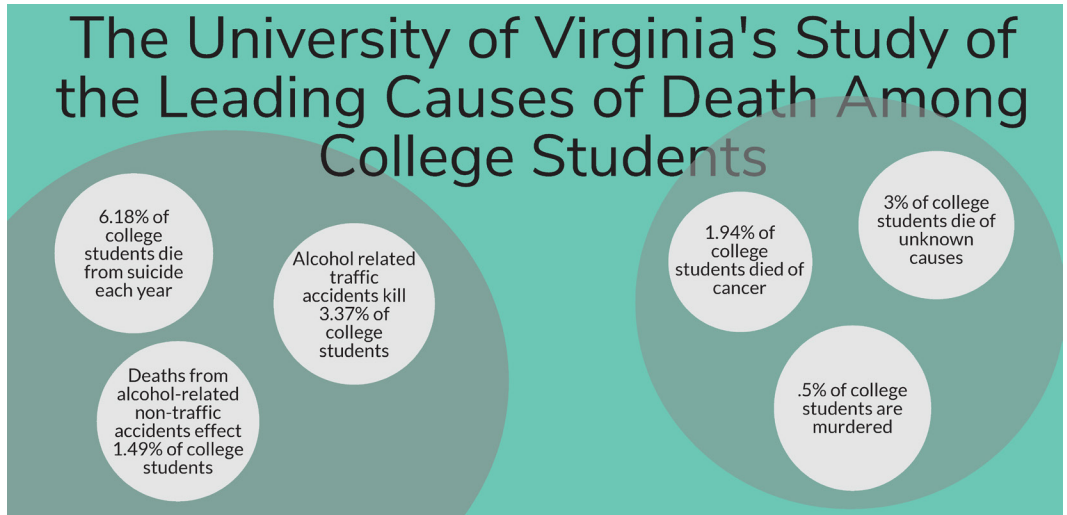


Figure 6. Sample Student Data Display with Inaccurate Data. Source: Robbins, Joseph. “The University of Virginia’s Study of the Leading Causes of Death Among College Students.” Spring 2015. Marist College, NY. Class Assignment.

*Component 3: Research Infographic.* The most significant component of this unit is the research infographic. The research infographic should conform to the genre conventions of infographics, and it should include data displays to develop a quantitative argument: in other words, to tell a story with data. The data should not be extraneous to the argument the student makes but should shape that argument. Students are encouraged to choose topics for their infographics that engage them and about which they really care.

I do not specify a size for the infographic since being able to adjust the size to accommodate the information included is a feature of infographics, and I don’t require students to submit hard copies but instead ask them to submit jpeg or pdf files for grading since infographics are generally created to be published and viewed online. Students receive peer and instructor feedback on their infographics-in-progress. We workshop these in class just as we do every paper they write, using the rhetorical analysis questions for infographics to guide our feedback.

*Component 4: Reflective Essay.* Students submit a reflective analysis of their infographic along with

their final infographics. In this analysis, they explain their choices in terms of content, arrangement, and design and consider how their decisions reflect the material we studied throughout the semester related to infographics, visual rhetoric, and quantitative arguments. I ask them to evaluate the success of their infographic and whether they think it provides a meaningful context for the data they present. I also ask them to reflect on the experience of arguing in this multimodal genre compared to their other traditional essays and reports and how their choices as a writer were broadened and/or constrained by the form of the infographic.

Despite the challenges of juggling several different kinds of skills and information for the infographic project, my students have responded to it enthusiastically and report enjoying the process of creating the infographic. They describe it as an assignment that is relevant to them, that they feel gives them valuable practice making multimodal arguments, and that helps them think about making arguments in a new way.

### *Assessing Students' Quantitative Visuals*

Responding to students' infographics gives instructors the chance to consider how successfully students navigated the choices available to them in inventing and presenting their quantitative arguments. Because most students have less experience composing quantitative, visual arguments than they do traditional academic arguments, they are not always aware of how readers will interpret these texts. As Mary E. Hocks writes, “[T]hrough designing digital documents and then *testing to determine how people see and read them*, our students develop an awareness of themselves as active producers of knowledge in their discipline or profession and as agents in the world around them” (205, emphasis added). Ideally, students receive feedback on their infographics from multiple readers and at multiple times throughout the project.

In my course, students receive feedback from me and their classmates on early versions of their infographics and then again after they have a chance to revise. In responding to student infographics, it is important to ensure that students have not introduced any quantification errors (as in Figure 6) that undermine their arguments; however, it is equally helpful to focus on how students invented the persuasive arguments they present. As Beveridge explains, “for many exploratory data analyses, there are no ‘right’ answers to the questions of which layout or color method is more appropriate—which is another reason why data visualizations are as rhetorical as they are quantitative.” Responding to student infographics is thus primarily about discussing the choices they made to present their arguments and whether these choices are more or less ethical and persuasive. I refer back to the rhetorical analysis questions and categories from the Analyzing Infographics Assignment in my feedback, discussing how students have chosen, altered, and presented data. In the Student Examples section below, I include three student infographics along with a brief discussion of how I responded to these projects.

### *Student Examples*

The following examples of research infographics illustrate the variety of students' understandings of the assignment and its underlying concepts of visual rhetoric, data display, the infographic genre,



and their sense of audience. The three examples were created by technical writing students for a community partner, Mental Health America of Dutchess County (MHADC) in Poughkeepsie, New York. These students were asked to create an infographic the organization could use to raise awareness in the public about The Living Room at Mel's Place, a daytime homeless shelter operated by MHADC.

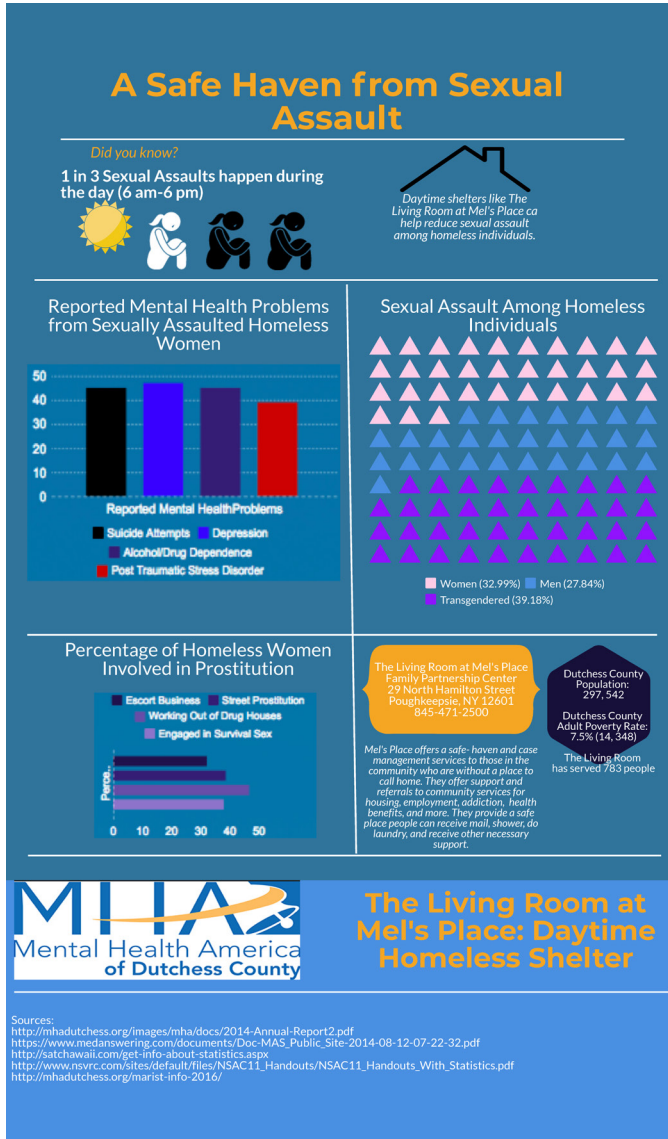


Figure 7. Sample Student Final Research Infographic. Source: Alvarez, Brianna. “A Safe Haven from Sexual Assault.” Spring 2016. Marist College, NY. Class Assignment.

Figure 7 demonstrates how a student stated a clear and compelling argument that she failed to

develop with credible, relevant evidence. Although the student included five different data displays in the infographic, the central argument, that “Daytime shelters like the Living Room at Mel’s Place can help reduce sexual assault among homeless individuals,” is not supported by the evidence. Instead of documenting a decline in sexual assault among homeless people due to the availability of daytime shelters, the student included statistics related to sexual assault in general, the homeless population in the United States, sexual assault among homeless people, and the poverty rate in Dutchess County. These statistics bear no obvious connection to one another since they do not focus on a single population or draw from a consistent data set. Instead, data are drawn from a variety of websites, some of which, such as MHADC, are credible, while others are more difficult to find online. Overall, this infographic does not tell a coherent *data story* about sexual assault and homelessness. It implies that a relationship exists, but the reader is left to interpret what the data mean without enough direction from the writer.

Visually, the infographic is more successful. The student used the color palette provided by the client, though the dark blue background paired with very small white (sometimes italicized) fonts makes reading difficult. Information on the top half of the infographic, in particular, is well-balanced, and the student created two pictograms that clearly illustrate data related to sexual assault. The bottom half of the infographic is more text-heavy, and the font, a very small Times New Roman, is particularly difficult to read clearly. Altogether the infographic gives the impression of including too much information. In my feedback I encouraged the student to develop her argument based on data she was able to find and to ensure that every element she included on the infographic clearly supported that argument.

Figure 8 is a more visually appealing and sophisticated infographic that focuses on a fuller range of services offered by Mel’s Place. Visually, this infographic is the most successful of the three examples. This student used the color palette provided by the client, and her primarily white background with black text makes reading easier than the text in Figure 7. She also made effective use of fonts, drawing the reader’s attention to specific information by employing bold fonts and sparingly using a blue font to highlight an important number. Additionally, she used repeated shapes to give her infographic visual consistency and to build her argument.

The argument presented in this infographic is not entirely clear, however. It is stated most clearly at the bottom of the infographic as “With your help, Mel’s Place can help more people succeed by improving and saving the lives of more people in our community.” It is easy to overlook a main argument added to the bottom of an infographic, especially since in this case the font does not stand out. Numerical information related to the numbers of homeless individuals in Dutchess County and those living in poverty, along with data about how many individuals Mel’s Place served in the previous year, do help support this argument, but as in Figure 7, this infographic also includes data for the US that do not seem to directly relate to the argument about Mel’s Place. The student did a good job of creating data displays that are easy to read, clearly explained, and visually appealing. She included data collected from credible government and non-profit agency sources. The pie chart seems extraneous to the student’s larger argument, though. In my feedback on this infographic, I indicated the student’s success in designing an appealing infographic and presenting credible data in an ethical

way. I advised her that the main argument should be made easier to identify and that she should omit data unrelated to the larger argument she wanted to make.

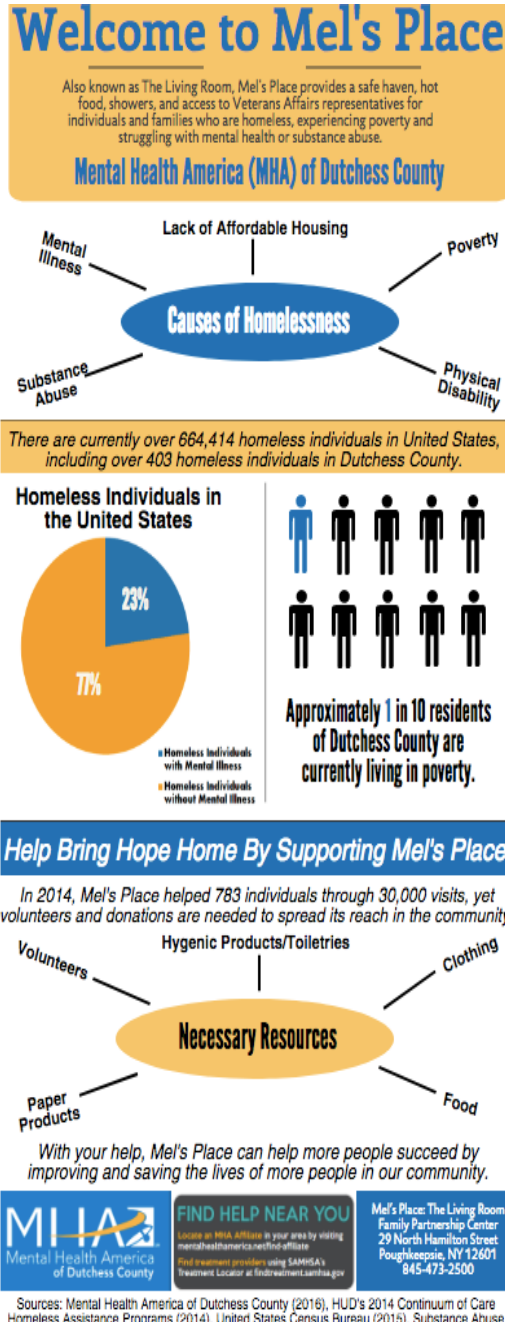


Figure 8. Sample Student Final Research Infographic. Source: Abato, Catherine. "Welcome to Mel's

Place.” Spring 2016. Marist College, NY. Class Assignment.

Figure 9 represents the most rhetorically sophisticated infographic of the three. In this example, the student argues that it is cost-effective and humane to fund daytime shelters, using a large headline at the top to appeal directly to readers and invite them to identify personally with the message. The student presents statistical evidence drawn from credible government and non-profit organization sources for her argument by contrasting the costs associated with sheltering homeless people in the

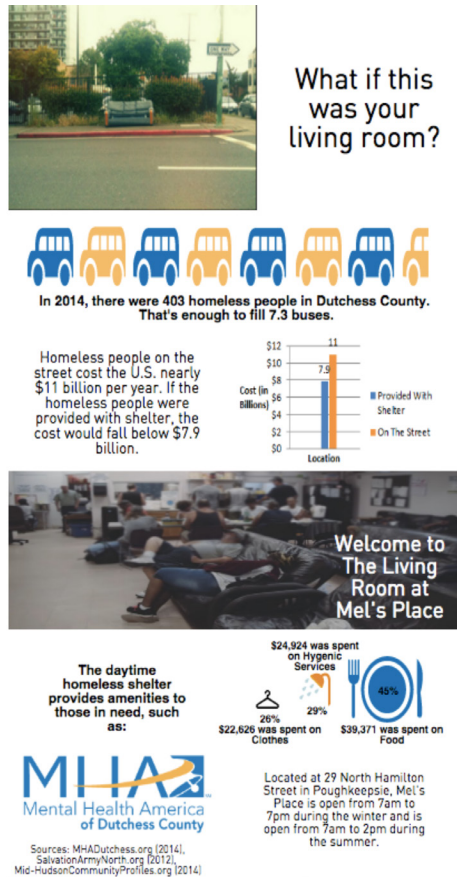


Figure 9. Sample Student Final Research Infographic. Source: Johnson, Emma. “Welcome to the Living Room at Mel’s Place.” Spring 2016. Marist College, NY. Class Assignment.

US versus the costs associated with having them on the streets. She also includes statistics provided by the client, including how the organization spends its budget and what the population size is for the community in which the organization works. Visually, she used the concept of the Living Room to contrast homelessness and having shelter, comparing the realistic photograph of the couch sitting on the sidewalk to the photograph provided by the client depicting couches available at Mel’s Place. In this way, she invited the audience into the Living Room itself, helping the audience to picture

the place they are being asked to support and contrasting this to the image of life on the street. She also created more sophisticated data displays, not only graphing data but also putting these data in context when she illustrates how many people in Dutchess County are homeless in terms of how many school buses this group would fill. Though she also included data for the entire United States and not only the local community, she focused throughout on the issue of costs, and she did indicate how much money Mel's Place spent on specific services.

As an argument, Figure 9 is more rhetorically savvy than the other two in its use of visual and quantitative resources to support the central argument. It is less visually polished than Figure 8, however, and the presentation of data related to how Mel's Place spends money needs additional work. This data display appears crowded and is not properly labeled. It is not clear, for example, during what time period this money was spent. In my feedback, I offered specific recommendations for strengthening this final data display and improving the visual dimension of the infographic, while acknowledging that the student succeeded in many ways at developing a compelling data story.

## Conclusion

Through the assignments described above I have attempted to translate current work in rhetoric and composition on quantitative argument and data visualization for classroom use. I take seriously the calls by Wolfe and Lutz and Grawe, among others, to provide more opportunities for students to practice analyzing and composing quantitative arguments in order to enhance their rhetorical education. In the era of Big Data, when more information is presented numerically than ever before, and much of this information comes packaged in slick visuals, quantitative literacy requires attending to a wide array of issues including visual rhetoric, quantitative reasoning, and information literacy. Composition instructors are well situated to help students recognize the extent to which the quantitative visuals they encounter are invented to persuade audiences. A rhetorical approach to quantitative visuals can allow even introductory students to appreciate how the arguments that these texts present are the result of careful crafting and to determine when infographics' creators have chosen to use data in ethical or unethical ways in the interest of persuading an audience.

This approach also promotes the kind of "slow thinking" that scholars such as Miller and Leon and Lester L. Faigley suggest is key to "focused deliberative effort—the sort of effort involved in slowing down to systematically examine the credibility of sources, the reliability of a writer, and the verifiability of a claim" (Miller and Leon 14). The click-and-go literacies of networked information ecosystems, through which infographics most commonly circulate, do not provide space for such deliberation. Including genres such as infographics in composition courses and taking time to help students learn how the quantitative arguments these texts invent are designed to persuade audiences and circulate through online networks is one step in bridging "the expanding gap between the literacies we teach and the ones our students enact" (Miller and Leon 11-12).

Nevertheless, I also recognize that there are ongoing challenges to adding quantitative visuals to composition instruction, not least of which is that the curriculum is already packed. In my composition courses, I have found that providing opportunities to analyze and produce infographics

helps my students to practice quantitative reasoning skills while still emphasizing foundational writing skills. The assignments I have described grow in complexity and depth, building on one another and requiring only the use of a free, web-based infographic creation program. Each of them can also be adapted for use in a wide variety of composition courses and can be lengthened or shortened depending on specific course goals. Perhaps most importantly, adding infographics to my writing courses has allowed me to give my students opportunities to play and experiment with quantitative arguments and in doing so to move beyond notions of quantitative arguments as always only correct or incorrect, deceptive or factual. In other words, students can learn to recognize the role of rhetoric in constructing these texts and the arguments they present and can begin to adopt the quantitative reasoning habits that QR scholars stress are necessary for literate citizens to participate in public, professional, and personal discussions informed by data.

## Notes

1. All student examples included in this article have been used with the students' permission, and I have changed their names.

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