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Rhetorical Numbers: A Case for Quantitative Writing in the Composition Classroom

Contemporary argument increasingly relies on quantitative information and reasoning, yet our profession neglects to view these means of persuasion as central to rhetorical arts. Such omission ironically serves to privilege quantitative arguments as above "mere rhetoric." Changes are needed to our textbooks, writing assignments, and instructor development programs to broaden how both we and our students perceive rhetoric.

Statistical thinking will one day be as necessary for efficient citizenship as the ability to read and write.
—H. G. Wells

The world of the twenty-first century is a world awash in numbers. . . . Unfortunately, despite years of study and life experience in an environment immersed in data, many educated adults remain functionally innumerate.
—Lynn Arthur Steen, "The Case for Quantitative Literacy"

Pick up a newspaper, visit your local school's website, or go shopping for a new home appliance, and you are likely to be confronted with quantitative arguments—texts that rely on numbers and data as their available means of persuasion. Such arguments affect our most personal and public lives as we

find ourselves weighing the risks and probabilities of various medical treatments, investment options, and voting decisions. In most, if not all, of these texts, verbal and numerical means of persuasion are tightly integrated, and the neat lines academic culture often draws between writing and calculating are becoming increasingly blurred. As new technologies continue to increase the ease with which we can collect, compile, and compute large quantities of data, quantitative argument will come to play an even larger role in our daily lives as citizens, professionals, and individuals.

Yet alongside the two epigraphs that begin this essay, I imagine most readers could effortlessly place a third: the aphorism variously attributed to Benjamin Disraeli and Mark Twain, "There are three kinds of lies: lies, damn lies, and statistics." This witticism is often used as a reason for throwing up one's hands and rejecting quantitative argument outright. Its reasoning suggests that because statistics, which I show are a highly concise form of quantitative argument, can be misused or misunderstood, we are justified in dismissing them.

Of course, as any student of classical rhetoric knows, similar charges of relativism and moral bankruptcy have been levied against *rhetoric* itself. The sophists were decried for making the weaker argument appear the stronger by exploiting the ambiguities of language or employing logical fallacies—yet these complaints have not stopped us from adopting many of their techniques and embracing a rhetorical education. Just as ancient Athenians saw the need for an education that teaches how to recognize when the lesser good is presented as the greater, so do contemporary Americans need an education that teaches us to recognize the fallacious quantitative reasoning that can make a lesser number appear the greater.

Moreover, there is a paradox in that on the 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. If statistics can be so altered by the method of their presentation—even as they continue to claim access to some sort of factual truth—aren't we clearly in the terrain of rhetoric? Treating numbers as inherently truthful or inherently deceptive is equally naive.

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Rather than reject quantitative argument out of hand, contemporary rhetoricians need to train their students to recognize the unethical, deceptive, and misleading as well as the thoughtful, insightful, and revealing applications of quantitative argument.

Thus I argue that alongside the various types of literacy instruction that one often finds in composition classrooms (including visual, critical, technological, and alphabetic literacies), we might also include a place for quantitative literacy instruction. Quantitative literacy describes a growing educational movement whose advocates seek to liberate quantitative reasoning from traditional mathematics education by stressing reasoning in real-world communicative contexts. This movement has been embraced by math and science educators, such as Lynn Arthur Steen and John Allen Paulos, as well as literacy scholars such as Brian Street, who has attempted to blur the boundaries between verbal literacies and numeracies, treating both as intertwined skills citizens need to be functionally literate in a society. At the higher-education level, initiatives such as Carleton University's QuIRK (Quantitative Inquiry, Reasoning, and Knowledge) have begun to look at how quantitative reasoning and writing across the curriculum initiatives could be merged under the general rubric of argument or rhetoric. Here composition scholars such as John Bean and Carolyn Rutz as well as prominent faculty in other disciplines, such as Neil Lutsky and Robert Abelson, have been active pioneers.

There are substantial parallels between the quantitative literacy movements I have just described and the foundational, democratic goals of rhetoric and composition and literacy studies. Rhetoric and composition, literacy studies, and quantitative literacy all concern themselves with fostering the skills that will prepare students for their future roles as citizens, professionals, and civic leaders. These fields have all embraced the influential ideals of John Dewey, who persuasively argued that civic participation in a democratic society requires a liberating literacy that prepares citizens to think for themselves. They all emphasize communication and reasoning, not as they occur in isolated academic settings but in complex, real-world contexts where individuals must reason through a sea of often contradictory information in order to come to an informed opinion. In fact, the missions of quantitative literacy, literacy studies, and rhetoric and composition are so closely intertwined that John Bean has coyly called for a RAC (rhetoric across the curriculum) movement that would integrate quantitative literacy, information literacy, visual rhetoric, and speech with traditional writing instruction (Rutz).

Yet, despite the involvement of the occasional composition or literacy scholar in quantitative literacy movements, the position I advocate in this essay—that quantitative argument should be explicitly addressed in composition classes and should be part of the core training of new members of our field—will border on heresy to many. Many readers will see such a charge as outside the scope of our discipline and (with some justification) will claim that we have too much to do in our courses already, that composition instructors are not qualified to teach such a subject, that such skills should be the province of math departments. It is perhaps worth pointing out, however, that such protests parallel the resistance many of us have seen from non-English colleagues who feel that writing instruction should remain isolated in English departments. Moreover, such protests overlook the extent to which contemporary rhetoric and quantitative reasoning are often inseparable.

Let me hasten to clarify that in advocating for quantitative reasoning instruction in composition, I am not proposing anything mathematically more complicated than integrating averages, percentages, and ratios (considered eighth-grade math) with messy, real-world rhetorical contexts. Traditional math educators claim to provide such instruction through mind-numbing word problems (i.e., John takes Train A, which leaves the station at 11:20 a.m. traveling at 50 mph while Jessica takes Train B . . . who will get there first?).[1] What I am calling for instead is a *rhetorical* education that examines how numbers are used and invented in the service of argument at public, professional, and personal levels. Thus, by the time students graduate, they should be able to quickly identify fallacies such as "crime has decreased by 229 percent," a statement that Richard Fulkerson found dupes many college-educated adults (it is impossible to have a decrease of over 100 percent). Our students should be able to quickly discern that the statements "there is a one-in-fifty chance that a bad event will happen" and "there is a 98 percent chance that everything will be okay" differ only in rhetorical choice between two mathematically equivalent figures. And students should have practice making their own arguments from quantitative data, not only so they can see the many ways in which such claims can be manipulated, but also so they can see the role that *invention* plays in statistical data, experimental results, and other quantitative arguments that are often popularly perceived as nonrhetorical "facts."

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In short, I argue that composition needs to develop instructional materials and, perhaps more importantly, provide instructor training that will help us teach quantitative argument alongside the other rhetorical skills and literacies we already foster. Such a change would fit with

- our commitment to democracy and literacy: In today's world, a fully literate citizen needs a facility with making and distinguishing good from bad quantitative arguments. Nearly everyone in this culture will at some point want to better understand cost/benefits arguments about public expenditures, evaluate the clinical results of a new drug or treatment, or weigh the marginal risks of purchasing a possibly contaminated bag of spinach against the certain nutritional benefits of a diet of fresh, leafy greens. Such personal decisions are saturated in a quantitative rhetoric in which the verbal and the quantitative are tightly interwoven.
- our commitment to rhetoric: Quantitative argument (including statistics, charts, and numbers) is saturated with rhetoric. We need to move beyond epistemologies that limit rhetoric to something one does with words and extend our rhetorical principles to numerical arguments and their visual representations.
- our commitment to the university: We claim to prepare students for writing in all disciplines but tend to narrowly focus on writing in the humanities. Even readers and textbooks specifically advertised as "writing across the curriculum" texts often fail to include substantive examples of quantitative argument.

This essay proceeds by examining how textbooks and other instructional material in our field currently treat quantitative argument. I contend that such materials ironically tend to reinforce, rather than dispel, naive, popular views that venerate numbers as hard "facts" in contrast to the "mere rhetoric" of verbal argumentation. Next, I show how statistical arguments can be analyzed rhetorically not only through their appeals to ethos, pathos, and logos, but also through their use of the canons of invention and arrangement. In the final section, I outline some simple assignments that illustrate how quantitative reasoning can easily be incorporated into our current writing curriculum and call for more training of our instructors and writing center tutors that will prepare them to teach quantitative argument.

My arguments throughout are clearly indebted to groundwork laid by scholars in the rhetoric of science who have laid important groundwork showing how experimental reports and accounts of natural observations are rhetorical enterprises.

Quantitative Argument as "Fact" in Rhetoric and Composition

Open up a contemporary textbook on argument, and you are likely to find a short section on "statistical evidence," usually as part of a larger discussion on evidence and couched somewhere between "facts" and "expert testimony." This placement says much about how our field views statistics—they are evidence that, like fact or a quotation from an expert source, can be cited but not generated by a writer (the Texas A&M Writing Center goes so far as to define statistics as "facts presented in quantifiable form"). In other words, statistical evidence is treated in our textbooks as what the early rhetoricians referred to as "extrinsic" or "inartistic" proof. Inartistic proof, according to Aristotle, is raw data or evidence unmediated by rhetorical strategy—and is contrasted with artistic argument that uses rhetoric to interpret the raw data of experience and create probable truth. Some textbooks make this division between statistical evidence and rhetorical interpretation explicit. For instance, Sharon Crowley and Debra Hawhee describe statistical data as "extrinsic to the art of rhetoric, because they are not invented according to its principles" (221)—a claim also made by Edward P. J. Corbett and Robert J. Connors. James Jerome Murphy and colleagues go a step further in a book written for teachers of argument, lumping not only "statistical surveys" but also "the results of experiments" (68) among contemporary forms of inartistic, or extrinsic, proof. These classroom texts thus treat quantitative data as arhetorical evidence that can be invoked but not invented.

Brief discussions of statistical evidence sometimes also appear in textbook chapters on visual rhetoric, but here again quantitative visuals are seen as arhetorical. For instance, Timothy W. Crusius and Carolyn E. Channell write that "graphs themselves may not make arguments, but they are powerful deliverers of evidence" (84),[2] while Robert P. Yagelski and Robert K. Miller note that "evidence, especially factual or statistical evidence, is sometimes presented in visual formats within a written argument" (81). In both cases, the authors place statistical evidence outside the realm of argument. More often, however, the topic is simply ignored. In two recent textbooks focused specifically on visual rhetoric, one devotes a total of three pages to the subject (Ruszkiewicz, Anderson, and Friend), while the other ignores it altogether (Atwan). Contrast this to

the typical edition of *USA Today* or the *New York Times*, in which, according to my informal accounting, as many as 10 percent of the visuals accompanying stories communicate quantitative arguments.

Perhaps even more tellingly, examples of quantitative argument are often missing from rhetorics and readers specifically marketed as "Writing across the Curriculum." Such books tend to ignore the types of quantitative discourse we might think of as representative in disciplines such as economics, medicine, engineering, marketing, physics, experimental psychology, and other social sciences. When a gesture is made toward quantitative fields, it frequently involves the popularized science writing of someone like Stephen Jay Gould, whose goal is to communicate with those outside of the sciences. Rarely do we see, for example, a clinical medical study in such readers, despite the fact that such studies are cited on an almost daily basis in our newspapers and almost certainly at one point or another will have a direct and intimate impact on the lives of our students. Even technical writing textbooks, where one would expect to see the topic in detail, contain shockingly few examples of quantitative data (see Wolfe for more on this).

This attitude toward quantitative argument as something outside of our discipline appears to filter down to our one-on-one interactions with students. For instance, in a recent writing center consultation I observed, a student seeking help with an introductory psychology paper expressed concern that a paragraph full of statistics sounded "stuck in there, it's all random," to which the consultant helping her replied, "Well, that's kind of how statistics are, right?"[3] Such cavalier, hands-off attitudes to quantitative argument do students a disservice and damage the *ethos* of centers that, like this one, have a mission to serve writers across the university. By treating quantitative argument as extrinsic to writing instruction we implicitly tell writers in quantitative fields that we can serve as little more than grammar checkers of their disciplinary discourse—a message that clearly goes against the mission of most writing centers.

Artistic Appeals: Pathos, Ethos, and Statistical Argument

Now that I've outlined how statistical expressions are treated as inartistic proof in many rhetoric and composition texts and have tried to suggest what is at stake in continuing to regard them this way, I want to make the following claims that illustrate the inherently rhetorical nature of statistics: (1) the arrangement and presentation of statistical expressions offers writers many options for managing the *pathos* of these expressions; some of these options are more or less *ethical* than others; (2) embedded in statistical expressions

are semantic definitions: in technical situations these definitions are often rigidly constrained, but in many public policy debates, such definitions can be hotly contested: changing these definitions changes the numbers that can be presented; (3) even in cases where definitions are reasonably stable, writers use rhetorical canons of invention and arrangement when creating statistical expressions in order to make an interesting story out of their data: a story that relies on "forceful rhetoric and effective narrative" (Abelson 16). At its heart, statistical expression involves what Chaim Perelman and Lucie Olbrechts-Tyteca call "an invention of significance" (121).

Let me begin my argument about the pathos of statistical expression with a short anecdote. In summer 2002, when an old college friend and I were both pregnant at what some medical practitioners call an "advanced maternal age," we met for (decaf) coffee and talked mostly about pregnancy and the myriad and sometimes conflicting, sometimes dubious advice we had received. At one point, my friend complained about a popular book on pregnancy that had claimed that one in fifty pregnancies by women over thirty-five will result in an abnormal fetus, a figure that had alarmed her. These fears, however, were abated after talking to her doctor, who had presented an alternative statistic: there was a 97 percent likelihood that her unborn child would have no problems. My friend left her doctor's appointment reassured that her pregnancy would be fine and annoyed at the pregnancy text for unnecessarily alarming her.

The problem with this reasoning, as we subsequently discussed, is that the number quoted by the doctor—and the number that reassured my friend—was actually a *worse* statistic than the one that had alarmed her in the pregnancy book. One in fifty translates to two in one hundred, or a 98 percent likelihood that everything would be fine. Thus, the doctor's reassurance that she had a 97 percent chance of escaping this health risk was slightly worse than what the pregnancy book had implied.

Why was one number alarming and another, slightly worse, number reassuring? As my friend said, when she read one in fifty, she thought, "I know fifty people." It was easy to imagine one of these fifty experiencing a tragic event and to further imagine that this one unlucky person might be her. Thus, one in fifty is concrete, something one can visualize. One in fifty represents a number in the language of everyday lived experience. It makes the risk seem real, tangible. By contrast, 97 percent is reassuringly abstract and scientific sounding. It is also a number that years of school have conditioned us to equate with success: a grade of 97 percent is an occasion for self-congratulation, a reason to temporarily rest on our laurels.

This example from medical statistics illustrates how numbers have pathos: the same number has a different emotional resonance with its audience depending on how it is presented. One rhetorical figure takes the concrete, fear-provoking structure of *one in X will . . .* while the other takes the more abstract, scientific-sounding structure of *there is an X percent probability of absence*. One alarms while the other reassures. Thus, the statement *You have a one in twenty chance of winning* excites us with its possibility, makes us grab for that raffle ticket, while the equivalent *There is a 95 percent probability of losing* suggests that playing is a fool's errand, that to hand over money is to throw it against the law of scientific probabilities.

In other words, translating a ratio to a percentage is not just a mathematical operation, but also a rhetorical practice in which artistic appeals are manipulated.

In other words, translating a ratio to a percentage is not just a mathematical operation, but also a rhetorical practice in which artistic appeals are manipulated. Take, for example, the following statistic: "21.3 percent of women and 12.7 percent of men have experienced depression in their lifetime." By performing some basic mathematical operations, this quantitative argument could variously be rewritten as:

1. Over one in five women and one in eight men have experienced depression in their lifetimes.
2. Women are 68 percent more likely than men to experience depression in their lifetime.
3. Approximately six of every ten depressed individuals is a woman.
4. 17.1 percent of individuals have experienced depression in their lifetime.[4]
5. Over 75 percent of women never experience significant depression in their lifetime.

These various representations of the same statistical information have different pathetic, logical, and ethical appeals. A weak ethical appeal is particularly found in number 2 above, which strips the number from its context: a 68 percent increase could refer to the very small difference between 1 percent and 1.68 percent or the much larger difference between 50 percent and 84 percent. The point here is that the basic mathematical operations involved in recasting the original statement are rhetorical choices that can emphasize or de-emphasize the extent to which depression is a woman's problem—or even a problem at

all. The same number, with slight rhetorical manipulation, can support very different arguments.

Statistical Expression and Arguments of Definition

In addition to recognizing rhetorical appeals in statistical expressions, we also need to train students to uncover the often contestable definitions that make these expressions possible. In his very readable book *Mathsemantics*, business statistician Edward MacNeal describes how issues of naming and definition are central to mathematical discussions. He opens the book by providing an example that he used on a test given to prospective market-research applicants: What is two apples plus five oranges? Traditional mathematics education has taught us that apples and oranges are two different categories that cannot be added together. However, MacNeal contends that in many real-world situations, the correct answer is "seven fruit." He writes:

> Whether you can add two things together depends on what they're called. . . . The accounting department has to add apples, oranges, and pomegranates every day. . . . The question is not whether we can add different things, but how we can add them in clear and useful ways. That gets us into meanings, into semantics, with both feet. (6)

In other words, language plays an important role in creating statistics—and questioning statistical data often involves challenging the definitions on which the statistics rest.

To illustrate this, let's briefly examine just one claim in a recent public policy brief about educational spending that claims that "the general public must let facts—and not rhetoric—guide important decisions affecting education spending" (Story). What follows is a list of twenty statements such as this one: "Korea—a nation that only recently rose above third-world status—spends half what the U.S. does per student, yet comes in 13 places ahead of the U.S. on an international math assessment." Acceptance of this claim requires that we agree upon several definitions, the first of which is "spending." Is spending here being defined as raw dollars, proportion of GNP, or some other measure? If raw dollars, then it is unlikely that $1,000 spent in Korea is the same as $1,000 spent in the United States. And does spending include money spent on public education only or public and private together? Does it include postsecondary education? Similarly, the definition of "student" in this statistic is also up for debate: does this category mean the same thing in both nations? Does Korea

have the same mission of universal education as the United States? Certainly if one country has a higher drop-out (or weed-out) rate than the other, this factor will influence overall score performance.

Such statistical expressions are thus as much "language" issues as they are "math" ones. We need to work to dispel popular perceptions that statements involving numbers such as the one above are fact rather than rhetoric. Granted, many rhetoric textbooks warn students to examine any data they quote for biases, but such advice rarely goes beyond a brief admonition. Students need much more practice in unpacking the definitional arguments embedded in statistical expressions. For instance, Phyllis and David J. Whitin provide a heuristic of seven questions to ask about data and then go on to describe their experiences teaching both fifth graders and kindergarteners in developing a critical orientation to statistics. Certainly, we should be able to provide similar guidance in our college classes. We need to extricate statistics from the "facts" and "extrinsic proofs" sections of our textbooks and instead teach critical practices that view statistical expressions as highly concise arguments that need to be unpacked in much the same way that we might use Stephen Toulmin's model to unpack other types of argument.

Rhetorical Invention and Arrangement in Quantitative Arguments

Key to developing a more rhetorical understanding of statistical expressions and other quantitative arguments is understanding the principles by which such arguments are invented. In this section, I am indebted to previous scholars in the rhetoric of science—including Charles Bazerman, Jeanne Fahnestock, Alan Gross, and Lawrence J. Prelli—who have all articulated the ways in which persuasion lies at the heart of scientific reporting. I extend these scholars' observations to drive home the point that both verbal and numerical observations and representations of the natural world rely on a range of rhetorical tactics.

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To understand the role of rhetorical invention in statistical expression, take a look at Table 1, which is a data dump of fictional test scores for students at three public schools. The table is just an excerpt from a data set than spans dozens of pages. Such raw data is the closest that numbers come to extrinsic proof—there is little rhetorical expression here, little meaningful order or arrangement to the data. Perhaps if a dedicated reader were to stare at and

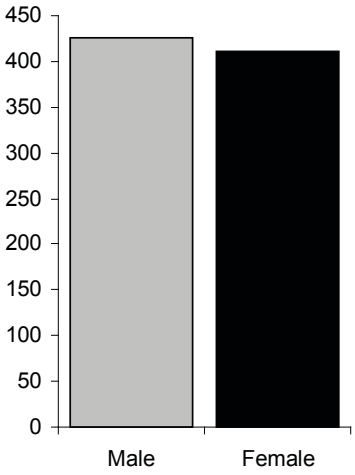
ponder this table, some sort of meaning would eventually emerge, but to most this table remains an uninteresting heap of numbers.

Now contrast this raw data with the four graphical representations in Figure 1, all of which are based upon this data. These four representations, unlike the raw data of Table 1, are visual arguments that advocate for particular interpretations of the data. These four representations differ considerably at the levels of both invention and arrangement.[5]

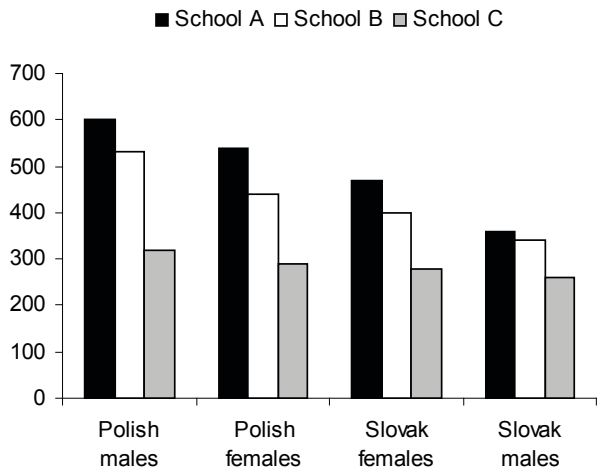
Perhaps the most dramatic difference among the four representations in Figure 1 is the different levels of interpretation that they employ to make sense of the data. Interpretative level is a concept that comes from Perelman and Olbrechts-Tyteca to describe the act of choosing among competing, valid interpretations. According to *The New Rhetoric*, the choice of interpretative level governs whether we interpret a given phenomenon according to the narrowest possible context or on the level of symbolic abstraction or somewhere in between. To take an example from *The New Rhetoric*, the choice of interpretative level prescribes whether we describe a process as the tightening of a bolt, the assembling of a vehicle, or earning a living. Such a choice is an act of "creation, an invention of significance" (121). By foregrounding one interpretation in the audience's consciousness, the rhetorician often pushes other interpretations into the shadows (121–22). Prelli makes a similar point, arguing that "selection

Table 1. Excerpt from Table of Fictional Test Score Data Arranged by Student ID

ID	School	Gender	Race	Verbal score	Math score
520	A	M	2	400	410
521	A	M	1	510	620
522	B	F	1	570	520
523	A	M	1	720	680
524	C	M	2	270	330
525	A	F	5	540	500
526	B	M	1	580	700
527	A	F	1	660	640
528	A	M	1	600	640
529	B	F	1	550	560
530	B	F	1	580	420
531	C	F	2	420	370
532	C	M	3	280	350
533	B	M	2	480	470



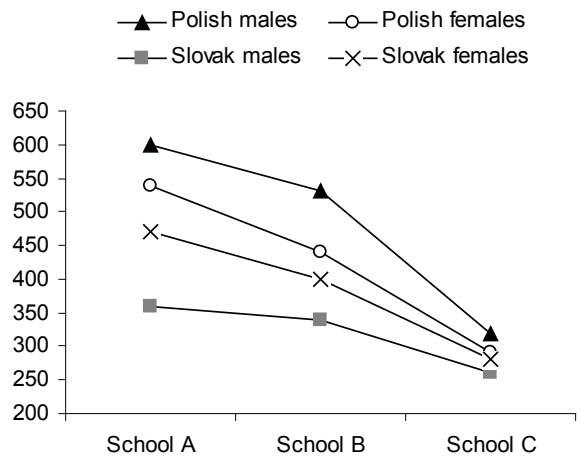
a. Average test scores by gender



b. Average test scores by gender-ethnicity and school

Ethnicity	*Average Test Scores*
German	507
Polish	505
Turkish	392
Slovak	319
Other	401
All Groups	***433***

c. Average test scores by ethnicity



d. Average test scores by gender-ethnicity and school

Figure 1. Four different arguments based upon the data in Table 1. All four illustrations represent the same raw data.

is necessarily persuasive in its consequences. In choosing one term over others, one directs attention toward particular meanings and relationships and excludes or minimizes those supplied by other terms" (16).

Thus, we can choose to interpret the data in Table 1 at the level of school, gender, ethnicity, verbal and math scores separate or combined, or any combination of the above. ~~Thus~~ Figure 1 (a) examines data at the interpretative level of gender and (c) at the level of ethnicity, while both (b) and (d) employ a finer-grained analysis that groups gender and a subset of ethnicity together and analyzes these factors in conjunction with school site. These different choices about interpretative level lead to very different narratives or stories told about the data. Thus, (a) suggests that there is little "story" here—that the data reveal little in terms of gender bias—while (c) points to a disturbing achievement gap between various ethnic groups. This narrative of ethnic differences is repeated by both (b) and (d) with more nuance and somewhat different emphasis. Note, for instance, that both (b) and (d) drop German and Turkish students from the analysis in order to better focus readers' attention on the Slovak/Polish achievement gap. The different narratives these representations tell are determined by the interpretive level chosen.

Not only rhetoricians but also statisticians note relationship between persuasion and selection of an appropriate interpretative level. Yale statistician Robert Abelson, who frequently refers to data interpretation as a "narrative," uses the acronym MAGIC (magnitude, articulation, generality, interestingness, and credibility) to discuss what gives a statistical claim persuasive force. Thus, according to Abelson, the statistician trying to decide among the four representations in Figure 1—or the literally hundreds of other ways this data could be represented—primarily weighs rhetorical concerns, such as whether the claim is *interesting*, whether it can be *articulated* in a way that the audience can understand, and whether it is *credible*. Such rhetorical considerations allow the writer to weigh what of interest can be said about the data against the counter-claims or rebuttals that a critical audience might pose. These audience considerations are central to the statistician's choice of interpretive level.

Readers should not become distracted by the fact that the data in Figure 1 is presented visually rather than verbally. Such data could easily be represented in verbal terms—and, in fact, the argumentative conventions for quantitative writing require that visual representations be accompanied by verbal text that elaborates on their significance. Thus (a) could be rewritten as "There was little difference in the test scores of men and women: male students averaged

scores of 426 out of 800 while females averaged 411," while the rhetorically more complex (b) could be written as "Slovak males scored substantially lower than all other groups. This difference was most striking in School A, where Slovak males averaged test scores of 360 compared to an average of 600 for Polish males. Moreover, School C consistently underperformed the other schools in the district, a factor that seemed to eradicate the ethnic-gender differences seen in other schools by drawing everyone down to the same low common denominator." If the verbal elaboration of this data seems more clearly rhetorical, this is partly because it is less concise. Regardless, however, of whether these averages are expressed in visual or verbal form, they involve substantive rhetorical choices that both precede and eclipse the relatively minor mathematical operations that are involved.

Not only does Figure 1 above illustrate the role of invention (in terms of interpretative level) in quantitative argument, but it also underscores the importance of arrangement. Graphs (b) and (d) represent arguments that employ the same interpretative level—both examine ethnic-gender groupings by school—but the two graphs differ in what they chose to foreground and how they present the data. ~~Thus,~~ By placing the gender-ethnic groupings on the horizontal X axis, (b) emphasizes demographic differences and makes school performance a secondary argument, while (d) does just the opposite by emphasizing the poor performance of School C. Graph (b) also employs several rhetorical choices that help clarify its argument: thus, the ethnic-gender groupings do not alternate male-female-male-female as one might expect, but rather male-female-female-male. This choice was made to emphasize the dramatic downward slope of the scores. Arranging the groups otherwise would have muddled the argument slightly. Similarly, in order to further emphasize the downward slope, School A (where the difference among demographic groups is most pronounced) is placed first and assigned the darkest color. Similar rhetorical choices of arrangement are employed in (d), not least of which is the somewhat unusual choice of a line graph for this type of categorical data. Such rhetorical choices contribute to the persuasive force of the interpretation.

A Call for Change

Robert Orrill, executive director for the National Council on Education and the Disciplines, writes that "in life numbers are everywhere and cannot be segregated into one subject and left out of others, as often happens when we build our academic cubbyholes" (xviii). Rhetoric and composition, although interdisciplinary in many other aspects, has been guilty of sequestering itself

into its own academic cubbyhole when it treats statistical and quantitative argument as external to rhetoric. Such sequestration is no longer viable if our field is to confront more clearly the literate practices that twenty-first-century citizens need. I therefore advocate for the following specific changes.

Composition textbooks and readers that pay better attention to quantitative argument. Rhetoric textbooks need to discontinue the practice of lumping statistical argument with facts, expert testimony, and other kinds of extrinsic proof. More attention needs to be paid to how statistical information can be modified to increase pathetic, ethic, and logical appeals, and more guidance is needed in helping students unpack the definitional arguments embedded in concise statistical arguments. In addition, sections on argumentative fallacies should also be expanded to include fallacies of quantitative argument, including fallacies of de-contextualized statistics (presenting numbers without sufficient baseline context to understand what they mean), fallacies of misleading percentages (using percentages to hide small or inadequate sample sizes, or using percent increases to exaggerate small changes), and what linguist Mark Liberman refers to as "pop-Platonism," the fallacy of perceiving a group average as applying to every member of a group.

Readers, especially those labeled as writing across the curriculum, should include examples of writing from fields such as economics, medicine, transportation, or psychology, where quantitative argument is common. In particular, such readers should seek to foster a critical orientation toward studies reporting experimental results. Fostering such critical literacies may be particularly crucial to the education of humanities students, who will be unlikely to develop such skills in their core content coursework. As K. Anthony Appiah argues, the education most humanities students currently receive leaves them incompetent to participate in many discussions of public policy. Rhetoric and writing courses should be at least one place where students are treated to a more liberal education that empowers them with the knowledge and skill base to become engaged and critical citizens.

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Textbooks on visual argument and multimodal pedagogies also need to discuss visual representations of quantitative arguments. As Whitin and Whitin note, quantitative arguments are multimodal: they use digital technologies to incorporate numbers, visual representations, and language. Yet the ability of our citizens to understand these texts has not kept pace with the increasingly

sophisticated means for creating them. A recent International Adult Literacy Survey found that only 19 percent of U.S. adults could correctly answer questions pertaining to advanced "document literacy" such as the ability to draw conclusions from comparing two pie charts or correctly find information on a products rating chart (Dossey). Visual rhetoric should be defined to include such skills.

Assignments that require students to produce quantitative arguments. It is consistent with philosophies generally accepted in our field to assume that when students engage in meaning making with content over which they feel ownership, they will develop better understandings of how such knowledge is created and used by others. Not surprisingly then, Whitin and Whitin attribute part of their success in ~~teaching fifth-grade and kindergarten students to develop a~~ critical orientation to statistics to the fact that students were working with data they themselves had designed, collected, and analyzed. Composition instructors should likewise give students opportunities to collect and interpret data over which they feel ownership.

Such opportunities can easily be integrated into our existing pedagogies. For instance, proposal arguments lend themselves particularly well to requirements to include a survey data or some other sort of quantitative evidence documenting a problem or the benefits of a particular solution. Edward P. J. Corbett's well-known style analysis likewise gives students opportunities to combine quantitative reasoning with narrative reflection on students' own writing processes. In Corbett's style analysis, students calculate averages and proportions of particular stylistic issues in both their own and professional writing—such as average sentence and paragraph length; proportion of simple, compound, and complex sentences—as a means of comparing their style to that of writers whom are trying to emulate. Although the quantitative concepts are simple, this assignment can also bring to light some fundamental flaws in quantitative reasoning (such as misunderstanding the concept of an average).[6]

Alternatively, instructors who wish to expand the types of genres they cover in their classes could add a brief survey or observational assignment as a means of teaching the IMRaD (introduction, methods, results, and discussion) genre that is so pervasive in many disciplines outside of the humanities. I have had considerable success with ~~having~~ students conduct small experiments ~~in class~~ to emphasize points discussed in class. For instance, students have collected data in class that compare how different font styles affect reading speed and perceptions of the document author, what type of flyer design will best attract student attention about campus events, what types of plagiarism

are most likely to be caught by electronic plagiarism detectors, or what types of literacy experiences are most common among different groups. I have also had success in assigning research on gender or ethnicity and communication from the 1980s and challenging students to collect data to see whether these trends are still true today (such hands-on work often gives resistant students new perspectives on gender issues). Other researchers have reported success with concordance analysis assignments in which students examine large sets of documents to see what types of keywords and word combinations are most prevalent in different fields (Mudraya; Swales). Such concordance analyses are becoming increasingly easier to conduct as more and more sources are available in electronic format, and concordance analysis assignments that ask students to search for various linguistic features—such as frequency of passive voice, common subordinators, number and length of headings, types of common topoi used (cf. Walsh)—can be effective ways to teach students about genre differences.

In fact, greater attention to quantitative argument can coincide nicely with Douglas Downs and Elizabeth Wardle's recent call to make writing studies the focus of composition classes. Not only does ~~much of the~~ writing research consist of quantitative argument that classes can analyze and discuss, but students can conduct their own writing research by conducting mini studies and experiments.[7] When such an approach is combined with genre instruction, we might not only train students to write in different genres but also provide them with heuristics for analyzing and adapting to new genres that they might encounter, thus creating transferable skills they can take with them into other disciplines and new rhetorical situations.

Graduate training that prepares composition instructors to teach quantitative argument. This is perhaps the most crucial area for change since my previous suggestions will likely have little impact if we do not expand the training given to new composition instructors to include examples of writing and argument outside of the humanities. New instructors need to learn how writing functions in academic contexts with which they are unfamiliar. Such an education will necessarily include some attention to how quantitative argument functions in science, business, and other fields. However, instruction that focuses just on training new instructors to read and analyze quantitative arguments is unlikely to be sufficient: instructors will also need hands-on opportunities to create their own arguments based upon quantitative evidence in order to truly appreciate the importance of invention in framing and interpreting quantitative data.

Downs and Wardle contend that writing programs contribute to their own professional marginalization with broad, generic curricula that suggest no special training is required to teach composition. They argue that we should narrow the focus of writing classes to reflect our unique disciplinary knowledge base in writing studies. I would take this argument one step further by suggesting that composition more firmly embrace an interdisciplinary identity that includes training in the rhetorical conventions of a wide range of disciplines—training that would be difficult to acquire *outside* of composition studies. Thus, ironically, taking a more interdisciplinary stance—one that includes quantitative argument as a phenomenon worthy of our attention—can help us argue for the discipline-specific nature of our field.

Writing centers are one natural place for such cross-disciplinary training to occur. At many institutions, these centers have a mission to serve the entire university, but many of the consultants are unaware of the standards and conventions of disciplines outside of the humanities. Kristin Walker, for instance, describes how writing center consultants working with engineering students had to adjust their assumptions about the need for an explicit thesis or when to use passive voice. In addition, these consultants needed to learn how to advise engineering students to use topic and concluding sentences linking the data in their report to general implications or principles. In writing centers developed to serve the entire university, training in nonhumanities genres should become standard. Writing centers might also investigate the possibility of cross-disciplinary collaborations in which tutors from diverse disciplines such as English and math work together to advise students on writing.

Conclusion

In this essay I have argued that rhetoric and composition needs to begin dismantling neat and counter-productive distinctions between the verbal and numerical. We need to see instruction in basic quantitative literacy, and quantitative argument in particular, as part of our discipline's charge. Key to effecting this change will be making adjustments to the training we provide to new instructors as we move toward a more interdisciplinary approach to composition studies—one that requires us to learn more about rhetorical and meaning-making practices in disciplines outside of the humanities. John Dewey argued that defining a truly liberating literacy is a never-ending process because human nature and society are in a constant state of change. Composition needs to take new stock of these changes as it reconsiders its identity in the new millennium.

Notes

1. If there is one issue on which quantitative literacy experts agree, it is that traditional mathematics education is part of the problem—not the solution—to what is often portrayed as a quantitative literacy crisis in the United States. We currently have a situation where students can take higher-level mathematics courses, including college algebra, trigonometry, or pre-calculus, and yet lack the "walking around" quantitative skills we would expect of any literate citizen (Dossey). A National Assessment of Educational Progress study found that 60 percent of young adults (ages twenty-one to twenty-five) in this country were unable to correctly figure out the change they should receive and the amount of tip they should leave from a restaurant bill. Similarly, business analyst Edward MacNeal found that fewer than half of the applicants for a clerical position in his office (who presumably had graduated from high school) could correctly convert simple fractions such as 7/10 to a percent (i.e., 70 percent). To see how such skills fare at the college level, ask your students to calculate the grade of an individual who received an average of 85 on the papers for a class and 95 on class participation, where papers are worth 80 percent of the final grade and participation 20 percent. The fact that a sizeable minority of students can enter college (let alone graduate from college) without being able to solve independently and quickly such a basic problem surely shows that our educational system is not preparing them for the everyday skills they need.

2. A more recent version of this book corrects this naive statement.

3. All data regarding human subjects cited in this essay were collected and analyzed according to the IRB (Institutional Review Board) practices in effect at my institution.

4. This statistic was calculated by looking up the proportion of women to men in the overall population and figuring this into the number presented—in other words, two different data sets were combined, a practice that is common, legitimate, and rhetorical.

5. I have chosen unusual ethnicities to avoid the potential distraction that reproducing stereotypes (or alternatively, failing to acknowledge very present and painful realities) might cause. My apologies go out to my fellow Slovak/Polish brethren.

6. As an example, I have had students write arguments such as Writer X had an average sentence length of 25 words while my average was only 17 words. However, this comparison is not entirely fair since Writer X's essay was 7 pages long and mine was only 3 pages. Obviously, such an assertion reveals a fundamental misunderstanding of what an "average" is. The fact that college students can hold such fundamental misunderstandings underscores the need for quantitative literacy training at the general education level.

7. As examples, readings in such a curriculum might include

- studies on how grammatical errors are perceived by non-academics, such as survey research by Maxine Hairston, Larry Beason, and Jeanette Gilsdorf and Don Leonard;
- studies on writing processes such as Mary Lynch Kennedy's comparison of the note-taking strategies of stronger and weaker writers or Davida Charney's analysis of the rhetorical reading strategies of graduate students and faculty;
- studies on how various textual or linguistic features affect reader comprehension such as Stephen P. Witte and Lester Faigley's analysis of coherence strategies in strongly and weakly rated essays or Michael Alley and colleagues' research on how variations in the design of PowerPoint presentations affects audience retention.
- Cross-disciplinary genre analysis studies such as those summarized in John M. Swales and Christine B. Feak's *Academic Writing for Graduate* Students (which also contains exercises prompting students to collect their own data on language usage in their disciplines); Diane Dowdey's analysis of citation practices across disciplines; or Susan Peck MacDonald's analysis of how knowledge claims change as they move from their original accounts in scientific publications to journalistic publications.

Not only would students benefit from reading and analyzing such studies, but they could also replicate most of ~~these studies~~. Such an activity would give students the experience of making an argument from data they have collected themselves and would also help reinforce many of the concepts we seek to teach. If students' own data shows them how poor organization impedes reader recall or how businesspeople are particularly bothered by certain types of errors, they are more likely to take such lessons to heart.

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