Testing Visual-based Modules for Teaching Writing

MIKE MARKEL

If you were to visit an advanced course in technical communication at a college or university today, you likely would see students making documents not seen in a classroom 5 years ago: brochures, manuals, Web pages, and online help files. If you were to visit a freshman writing course at the same school, you likely would see students making essays that look just like the ones you wrote 10, 20, or 30 years ago.

Certainly, the two courses have very different goals. The technical communication course is intended to help students learn how to make documents that address the needs of various audiences working in high-tech environments. The freshman writing course is intended to help students find their voices, achieve some stylistic fluency, learn problem-solving techniques, and make convincing arguments.

Still, it is clear that the technical communication course exists in the world of modern multimedia communication—with words, graphics, and perhaps even sound and video—whereas the freshman writing course is almost exclusively word-centered. Freshmen write word-based text, mostly essays and research reports; they are not taught how to create or interpret visual information. With few exceptions, the visual dimension of writing is simply not part of the course.

Perhaps not surprisingly, the instructional material in the freshman course makes little use of the visual dimension. The leading handbooks—the “grammar books” that explain the writing process, paragraph development, grammar, style, and usage—employ only the most rudimentary design. Yet for decades it has been well known that well-designed documents are more interesting to look at, easier to read, easier to understand, and easier to remember.

This article describes a study to find out whether an increased use of some of the common techniques of visual design used in technical communication—such as variations in typography and line spacing and the use of text boxes and simple graphics—would improve the effectiveness of instructional materials intended for novice writers. If the results are positive, the implications extend beyond the freshman English classroom to the workplace. Technical communicators—those who teach college writing and those who work every day with subject-matter experts—can play an important role in furthering our understanding of how people learn to write effectively.

I begin by sketching some of the areas of research about the relationship between visual and verbal media in communicating information. Next I describe my study: its methods and results. Finally, I offer some thoughts on how the growing use of online media is likely to affect the way we teach people to write.

AN OVERVIEW OF RESEARCH ABOUT VISUAL AND VERBAL RHETORIC

Before summarizing some of the most important research, I want to define a key term. Visual rhetoric has been defined as “the ability of the writer to achieve the purpose of a document through visual communication, at any level: for example, through the choice of a typeface (Courier, Helvetica), of graphic cues (bullets, lines, icons), of textual arrangement (lists, flowcharts, trees), of data displays (a pie chart, line graph), even of the color, shape, and size of the page” (Kostelnick 1989, p. 77).

The research literature on the interplay between visual and verbal rhetoric is so vast that I can only identify some of the major perspectives from which it has been investigated.
There is substantial evidence that design and graphics play a positive role in the comprehension and learning of children and adults alike.

Cognitive psychologists have known for some decades (see Samuels and Eisenberg 1981 for a summary) that comprehension is determined by internal and external factors. Internal factors include the reader’s own knowledge, attitudes, and motivation. External factors include physical characteristics of the text, including typography, layout, and factors of textual coherence and cohesion such as headings, advance organizers, and sentence structure.

There is substantial evidence that design and graphics play a positive role in the comprehension and learning of children and adults alike. Levin (1981) argues that the effects of adding pictures to children’s literature are “positive, potent, and pervasive” (p. 204). When the pictures reinforce the story’s content, these effects are particularly strong, increasing comprehension at least 40 percent. These effects extend to other kinds of prose with other readers.

Combining words and pictures, a technique called media redundancy, also appears to increase the effectiveness of instructional material. Research summarized by Pettersson (1989) shows that media redundancy increases learning in children compared with either verbal or visual media alone (also see Levie and Lentz 1982, Paivio 1983, Haber and Myers 1982, and Misanchuck 1992). Adults studying text with graphics learn about one-third more than people reading text without graphics (Levie and Lentz 1982). And graphics help readers retain what they learn; people remember some 43 percent more when the document includes graphics (Smith 1995).

Some readers actually rely on the visual elements of a text. Case studies of the thought processes and working methods of great scientists, inventors, and engineers, for instance, reveal that many of them, including Einstein, Newton, Faraday, Edison, and Tesla, were primarily visual thinkers. Some of these thinkers were not only undistinguished verbally but actually deficient. (See Dixon 1983, Ferguson 1992, John-Steiner 1985, and West 1991 for examples of case studies.) Einstein’s comment about his own way of thinking is often quoted:

The words of the language, as they are written and spoken, do not seem to play any role in my mechanisms of thought. The psychological entities which seem to serve as elements in thought are certain signs and more or less clear images which can be voluntarily reproduced or combined. . . . The above mentioned elements are, in my case, of visual and some of muscular type. (Quoted in McKim 1972, p. 9)

Research clearly suggests, then, that people learn better and more quickly if the information includes visual cues beyond traditional typography, and that some people are significantly better at processing visual information than verbal information.

Nikola Tesla would apparently visualize his next invention without even drawing it. Then he would visualize it running for weeks, “after which time he would examine it thoroughly for signs of wear” (McKim, p. 8).

Case studies such as these, combined with insights gained by cognitive psychologists, have led some researchers to question whether our culture is wise in focusing on linguistic abilities, to the exclusion of other ways of knowing, including the visual. Perhaps the best known study of this question is Howard Gardner’s Frames of mind (1983). Gardner argues that, in addition to linguistic intelligence, people in fact possess five other intelligences: musical, logical-mathematical, spatial, bodily-kinesthetic, and personal (what today we might call interpersonal). Gardner advocates a thorough revision of our educational system to accommodate people’s different aptitudes. His approach would provide special enrichment opportunities for the
gifted, as well as remediation for people with marked weaknesses.

Research clearly suggests, then, that people learn better and more quickly if the information includes visual cues beyond traditional typography, and that some people are significantly better at processing visual information than verbal information. It would seem to follow, then, that an informed and judicious use of visual elements in instructional materials about writing would improve their effectiveness.

THE FOCUS OF THE PRESENT STUDY
In previous articles (Markel 1995, Markel and Wilson 1996) I have provided strong evidence that readers who studied a designed document as a model improved their writing in two significant ways. As might be expected, looking at designed documents—typical examples of technical communication—helped writers see how to use design elements in their own writing. Perhaps of more importance, studying designed documents also helped writers understand how the design elements signaled the verbal rhetoric in documents. For instance, writers saw that the simple typographic cues used in signaling first- and second-level headings—size differences, italics, and indentation, in this case—indicated that the second-level heads were subordinate to the first-level heads. This insight helped writers understand the role of the advance-organizer text that followed the first-level heading. These students were better able to understand the role of the advance organizer—because the design cues highlighted that role—than they were when reading the same text presented without the designed headings.

However, those studies concentrated on aspects of overall organization and development in the document, not on the sentence- and paragraph-level concerns that are an integral part of all writing instruction. In the present study, I want to extend those earlier investigations by examining the effect of incorporating principles of visual rhetoric in the instructional material itself—the explanations of concepts—not just in samples of sentences and paragraphs and in models of documents.

Why is this important? There are some two million college freshmen in the U.S., almost all of whom are studying principles of writing from one of about a dozen handbooks. If students learn more from well-designed materials than from minimally designed materials, the implications are powerful. Better writing skills mean greater success in college, in the workplace, and in the civic arena. For technical communicators, improved writing skills among subject-matter experts can reduce costs and improve quality and safety. And a better understanding of how to teach writing would assist those technical communicators who coach and edit the writing of subject-matter experts, as well as those thousands of technical communicators who teach college writing courses.

First, I want to offer a few comments about how writing is taught in colleges today. In one respect, at least, writing is taught today in much the same way it has been for over two millennia: aurally. We ask our students to listen to what they are saying. This approach is most obvious in classroom activities in which students read their drafts aloud to the class or to members of their collaborative writing group. In teaching writing aurally, we are still treating it as an activity that occurs in time, even though we know that writing is also an artifact—a document—that exists in space. (See Ong 1958 for a discussion of the evolution of writing.) By failing to exploit the visual dimension of writing in our teaching materials, we are depriving our students of a rich set of cues to help them understand how to write effectively.

Most writing texts display minimal design, and they are only now beginning to devote a few pages to basic principles of typography and white space. Most writing scholars and teachers are not trained or educated in visual rhetoric. Even in the field of technical communication, in which
Visual rhetoric is sufficiently well established as a discipline that its major tenets are widely available.

documents routinely combine words and images, most textbook writers are trained in verbal rhetoric, not visual rhetoric (see Markel 1995). In freshman texts, visual design is virtually ignored, except for the rare exercise in sentence diagramming. Most writing teachers are primarily verbal thinkers rather than visual thinkers.

◆ The products that the students create most often—the theme and the academic research paper—are almost completely devoid of design, and so there is no motivation for teachers to think in terms of design. It is strikingly ironic that although typical college freshmen write on personal computers more powerful than the computers used to land astronauts on the moon in 1969, their papers come out of the printer with 80-character lines, double spaced, with five-character indents for new paragraphs, looking essentially like typewritten text.

Visual rhetoric is sufficiently well established as a discipline that its major tenets are widely available. For instance, technical-communication texts explain and exemplify basic principles of visual rhetoric; texts reflect the research on typography, such as the effects on comprehension of uppercase versus lowercase type and optimal line length (see Felker 1980 for a summary). Texts also address the relative effectiveness of different kinds of visual displays (such as tables and flowcharts) versus prose for communicating different kinds of technical information. More sophisticated principles of visual rhetoric, such as the Gestalt theory, are discussed frequently in the literature (see Bernhardt 1986, Moore and Fitz 1993, Barton and Barton 1985, and Gribbons 1992, for instance). Beyond Gestalt theory, several scholars (Dragga 1992, Kostelnick 1989, and Kostelnick 1990) have formulated useful theories for evaluating visuals.

In addition to extending my own previous studies on integrating design elements in instructional materials, I want to extend the work of two scholars in particular. The most ambitious attempt to define a theory of textuality that combines both verbal and visual rhetoric was published by Kim Sydow Campbell (1995). In essence, Campbell links basic text-processing theory with Gestalt theory in describing a unified approach to coherence, continuity, and cohesion. Campbell’s approach, the first to unify auditory, visual, and verbal symbol systems, is a pioneering effort in that it treats the process of comprehending documents as a truly multimedia phenomenon. And Elizabeth Tebeaux (1988) has argued persuasively that freshman English courses need to be reoriented to help students understand how to communicate better in the workplace. One of the most significant insights she presents is that the question of design is not merely a matter of how effectively readers can understand and remember information. The question of design is also a pedagogical issue: can learning to write with an awareness of the principles of design also help the student “see” and understand the text better?

METHODS

I tested four teaching modules in two versions each (one version primarily verbal and one a combination of verbal and visual) to see whether the version had any effect on the students’ comprehension of the material and attitudes toward the module. The following paragraphs describe the materials, the participants, the procedures, and the statistical analyses used in this study.

Materials

For my study, I focused on four topics that are a part of almost every freshman writing course: active and passive voice, dangling modifiers, comparison and contrast as a means of developing a paragraph, and classification and division as a means of developing a paragraph. For each of these four topics, I selected a brief sample of instructional material from Rules for writers (1996), by Diana Hacker, reproducing the design of her materials. I then rewrote each of the four samples, using her phrasing and examples as much as possible, but incorporating basic elements of visual design mentioned earlier: text boxes, simple graphics, and variations in typography and line spacing. Appendix A includes these instructional materials. Thus, I used

I tested four teaching modules in two versions each (one version primarily verbal and one a combination of verbal and visual) to see whether the version had any effect on the students’ comprehension of the material and attitudes toward the module.
eight sets of materials in this study: four by Hacker that were primarily verbal, and four revisions by me that combined verbal and visual elements. Although both the Hacker materials and my revisions contain both verbal and visual elements, for convenience I will refer to the Hacker materials as being “verbal” and my revisions of them as being “visual.”

I chose these four topics—voice, modification, comparison, and classification—because I wanted to focus on the fairly low-level thinking processes required to process these sentence- and paragraph-level topics; I wanted to avoid the higher-level processes required for problem-solving at the whole-document level. In addition, I wanted to study two topics (voice and modification) for which my revisions were relatively modest—mostly variations in typography and text boxes—as well as two topics (comparison and contrast, and classification and division) for which my revisions were somewhat more extensive— involving simple diagrams. Doing so would enable me to isolate the graphics to see whether they are fundamental to the effectiveness of the materials.

I chose the Hacker materials as the basis for my revisions for two reasons.

❖ Hacker’s books are extremely popular and highly regarded by writing teachers, thus making it unnecessary to introduce significant changes to the original. In fact, I felt it useful to change Hacker’s original in only one of the four sets of materials: on voice. (I will discuss this change later.) I used her explanations and her examples.

❖ The Hacker materials are more highly designed than those of most of her competitors. Specifically, her materials make fairly good use of indentation, and they display revision clearly; when she wishes to show how to revise a flawed sentence, the revisions are signaled with carets and are presented in a cursive typeface, in a different color. The relatively ambitious design of the Hacker materials in effect strengthens my case if I can show that students learn more from my revision or prefer them to the originals.

Participants

Participants in this study were 327 freshmen at Boise State University, a comprehensive state university in Idaho. Of these 327 participants, 253 were enrolled in English 101, the first writing course taken by some 90 percent of the freshmen; 74 were enrolled in English 010, the remedial writing course taken by the approximately 5 percent of our freshmen who score lowest on our placement test (the Computerized Placement Test produced by the College Board). For purposes of convenience, I will refer to students in the English 101 course as “standard students” and those in English 010 as “remedial students.” For all the test participants, the study was conducted on the first day of the semester.

Procedures

Each of the participants read and responded to one set of materials, either a “verbal” or “visual” version of one of the four sets. After listening to and reading along with a brief set of instructions, the student read the materials, then responded to two comprehension questions, a set of attitude questions about the materials, and a set of demographic questions. (The two comprehension questions for each of the four sets of materials are in Appendix B; the attitude and demographic questions, which were the same for all 327 participants, are in Appendix C.) The students were given 8 minutes to read the materials and respond to the various questions.

To eliminate the chance that students would try to give me the answers I wanted, I made clear in the instructions that I was not their instructor, that they would not see me again in their classroom, and that their participation in the study had nothing to do with their performance in the course. In addition, the responses were completely anonymous.

Each of the 253 students in the standard course responded to one of eight test packages: either the verbal or the visual version of one of the four different topics. Each of the 74 students in the remedial course responded to one of four test packages: the verbal or visual version of the voice materials or the comparison materials. Because the number of remedial students was relatively small, I restricted them to two topics (four sets of materials) to increase the likelihood that the data for these students would be statistically significant. Before the test packages were distributed, they were randomized.

Why did I ask only two comprehension questions? One reason was practical: I wanted to reduce the amount of class time the study took. Another reason is that student understanding of the topics addressed in the teaching materials could be measured by questions that yielded binary answers. For instance, after reading the discussion of voice, students could be asked to decide whether a sentence is written in active voice or passive voice. After reading the discussion of dangling modifiers, students could be asked to decide whether a sentence did or did not contain a dangling modifier. Certainly, a set of eight questions about each of the four topics would have yielded more sensitive data (students answering five of eight questions correctly perhaps understood the material better than did students answering three correctly, for instance), but for a basic study such as this, the fact that only two questions were asked does not decrease the validity of the results, because the imprecision of the measure applies to all participants.
Although it may be objected that some readers might infer, in a two-question test, that one of the sentences, say, is active whereas the other is passive (rather than that both are active or both are passive), there is no reason to think that these inferences would introduce any statistical bias. First, any bias would likely split down the middle, with half the biased results showing two correct when the student did not really understand the material, or zero correct when the student did in fact understand the material. In addition, the fact that students reading the Hacker originals and those reading my revisions responded to exactly the same questions, in the same sequence, would virtually eliminate the possibility of bias, because any irregularities introduced by the questions were introduced equally, to the readers of both the visual and verbal versions of each set of materials.

What is the purpose of attitude questions? Why not rely on comprehension questions, given that the real goal of the study is to determine whether students comprehend the material better when it is presented in one style than they do when it is presented in the other style? The reason for assessing attitude is that learning is an extremely complex phenomenon. Comprehension data can be misleading. We cannot tell, for instance, whether a particular reader already knew the material before reading about it. Attitude data provides at least some measure of how the reader responded to the materials. All other things being equal, materials that students find clear, easy to understand, and attractive are preferable to those they find unclear, difficult to understand, and unattractive for the obvious reason that students are more likely to spend the necessary time studying materials toward which they have a more positive attitude.

Data Analysis
To assess performance on the comprehension questions, I recorded for each student the number correct: 0, 1, or 2. Then I used logistic regression to determine whether topic, version, or a combination of the two were a factor. To study differences in comprehension scores between students in standard classes and students in remedial classes, I used a three-way analysis of variance (ANOVA). For this analysis, I considered only the two topics that the remedial students studied. To determine whether there were significant differences between versions, I used a row-mean-score test, which is an appropriate test with ordered column variables (such as the number of correct responses). To assess attitudes about the instructional materials, I used a two-way ANOVA, with topic and version as the class variables, using 0.05 as the test for significance. To assess the effect of demographic, experience, and attitude variables on attitudes toward the instructional materials, I used a three-way ANOVA.

RESULTS
I will discuss the results in two major categories: comprehension and attitudes. Where appropriate, I will describe any relevant demographic factors.

First, let me point out that the comprehension data and attitude data were different for each of the four sets of instructional material. That is, the comprehension data for the materials on voice differed from those for the materials on classification, and so forth. In general, however, these differences are irrelevant to this study; my focus is on differences between the visual version and the verbal version of each set of materials. The differences between the data among the four sets of topics are of interest in only one respect: two of the four sets (on voice and on modification) are only minimally designed even in the visual versions, whereas the other two sets (on comparison and classification) included simple graphics in the visual versions. In those cases where the data on the voice and modification sets differed from the data on the comparison and classification sets, I present results.

Comprehension
For a baseline measure, I studied whether the comprehension data for the standard students differed significantly from the data for the remedial students. It did, as shown in Table 1, which shows the number of students scoring zero, one, and two correct responses to the comprehension questions after reading the verbal versions of the test materials. The verbal versions are those reproduced directly from Hacker’s handbook.

### TABLE 1: COMPREHENSION SCORES FOR ALL STUDENTS READING VERBAL MATERIALS

<table>
<thead>
<tr>
<th>Classification of Student</th>
<th>Percentage Scoring Zero Correct</th>
<th>Percentage Scoring One Correct</th>
<th>Percentage Scoring Two Correct</th>
<th>Row Mean Scores Differential</th>
<th>p value &lt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standard</td>
<td>17.2</td>
<td>10.9</td>
<td>71.9</td>
<td>3.95</td>
<td>0.047</td>
</tr>
<tr>
<td>Remedial</td>
<td>37.5</td>
<td>5.0</td>
<td>57.5</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
The $p$ values reported in Tables 1–7 indicate the probability that the relationship between two variables is the result of chance. In many fields, a $p$ value of 5 percent or less ($\leq 0.05$) is used to indicate statistical significance. For example, if the $p$ value for the difference in test scores between two groups is 0.04, that means that the probability that the scores are different merely because of chance is 4 percent. In other words, there is a 96 percent probability that the test scores are different because of the factor that you are studying (one group is smarter, one group had better training, and so forth). In this case, the findings that the two groups’ scores were different is called statistically significant.

**TABLE 2: EFFECTS OF VERSION ON THE COMPREHENSION OF STANDARD STUDENTS**

<table>
<thead>
<tr>
<th>Version</th>
<th>Percentage Scoring Zero Correct</th>
<th>Percentage Scoring One Correct</th>
<th>Percentage Scoring Two Correct</th>
<th>Row Mean Scores Differential</th>
<th>$p$ value $&lt;$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Verbal</td>
<td>17.2</td>
<td>10.9</td>
<td>71.9</td>
<td>0.002</td>
<td>0.965</td>
</tr>
<tr>
<td>Visual</td>
<td>14.8</td>
<td>16.4</td>
<td>68.9</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**TABLE 3: EFFECTS OF VERSION ON THE COMPREHENSION OF REMEDIAL STUDENTS**

<table>
<thead>
<tr>
<th>Version</th>
<th>Percentage Scoring Zero Correct</th>
<th>Percentage Scoring One Correct</th>
<th>Percentage Scoring Two Correct</th>
<th>Row Mean Scores Differential</th>
<th>$p$ value $&lt;$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Verbal</td>
<td>37.5</td>
<td>5.0</td>
<td>57.5</td>
<td>8.168</td>
<td>0.004</td>
</tr>
<tr>
<td>Visual</td>
<td>5.9</td>
<td>11.8</td>
<td>84.4</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**TABLE 4: EFFECTS OF VERSION ON THE COMPREHENSION OF STANDARD STUDENTS, BY TOPIC**

<table>
<thead>
<tr>
<th>Topic</th>
<th>Version</th>
<th>Percentage Scoring Zero Correct</th>
<th>Percentage Scoring One Correct</th>
<th>Percentage Scoring Two Correct</th>
<th>Row Mean Scores Differential</th>
<th>$p$ value $&lt;$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Voice</td>
<td>Verbal</td>
<td>9.1</td>
<td>9.1</td>
<td>81.8</td>
<td>1.833</td>
<td>0.176</td>
</tr>
<tr>
<td></td>
<td>Visual</td>
<td>17.2</td>
<td>17.2</td>
<td>65.5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Modification</td>
<td>Verbal</td>
<td>21.2</td>
<td>21.2</td>
<td>57.6</td>
<td>1.081</td>
<td>0.298</td>
</tr>
<tr>
<td></td>
<td>Visual</td>
<td>27.3</td>
<td>30.3</td>
<td>42.4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Comparison</td>
<td>Verbal</td>
<td>25.8</td>
<td>12.9</td>
<td>61.3</td>
<td>1.403</td>
<td>0.236</td>
</tr>
<tr>
<td></td>
<td>Visual</td>
<td>12.5</td>
<td>15.6</td>
<td>71.9</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Classification</td>
<td>Verbal</td>
<td>13.8</td>
<td>3.5</td>
<td>82.8</td>
<td>1.512</td>
<td>0.219</td>
</tr>
<tr>
<td></td>
<td>Visual</td>
<td>6.1</td>
<td>0</td>
<td>93.9</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
significant. If, however, the \( p \) were 0.06, the researcher would say that the finding was nonsignificant.

For standard students, version (verbal or visual) had no significant effect on comprehension, as Table 2 shows. However, version had a considerable effect for remedial students. Table 3 shows that the remedial students scored significantly higher with the visual version.

Beyond these generalizations, topics, versions, and student classification interacted in interesting ways. As shown in Table 4, the standard students actually performed slightly better on the verbal than on the visual versions of voice and modification topics, but slightly better on the visual than the verbal versions of the comparison and classification topics. However, this data is not statistically significant.

As mentioned earlier, the visual version of the voice materials included one explanation that was not included in the verbal version: a description of how the passive voice can be unclear. Table 4 suggests, however, that the difference in content between the two versions of the voice materials had no measurable difference. In fact, the comprehension results for the verbal version of the voice materials are better than those for the visual version.

As shown in Table 5, for the remedial students, the performance differential between visual and verbal versions is more pronounced for both topics, but markedly so for the comparison topic. For these students, the visual version of the voice materials—the version that incorporates more design elements and slightly more content—elicited better comprehension results, although the difference is not significant. However, the comparison materials with more design elements and the graphic elicited strikingly superior comprehension results.

### Attitudes

For both groups of students combined, the visual versions of the two sets of materials that all students saw (voice and comparison) outscored the verbal versions on all six measures of attitude, as shown in Table 6. The difference in attitudes is statistically significant for two measures: attractiveness and design. I included two sets of semantic differentials questions ("unattractive"/"attractive" and "poorly designed on the page"/"well designed") because I suspected that many or even most of the students would not know the meaning of the word design as used in this context; using the two sets of semantic differentials increased the chances of eliciting the information I sought.

When the responses of remedial and standard students are analyzed separately, the attitude data is more interesting. Whereas the comprehension data shows that remedial students were affected by version much more than standard students were, the result is just the opposite for attitude data. For remedial students, version makes no significant difference in any of the attitude questions. As shown in Table 7, however, for standard students, version makes a significant difference in three key areas.

In addition, there were numerous expected interactions between attitudes and demographics. In general, the more capable the student writer, the more he or she liked the instructional material (regardless of version). For example, students who found their past writing textbooks useful or interesting tended to see the test materials as useful or interesting. In addition, as suggested by Table 6, the more capable the student writer, the more likely he or she would find the visual version preferable to the verbal version.

And students who find writing satisfying found the visual versions significantly more attractive than the verbal versions, whereas students who do not find writing satis-

### Table 5: Effects of Version on the Comprehension of Remedial Students, by Topic

<table>
<thead>
<tr>
<th>Topic</th>
<th>Version</th>
<th>Percentage Scoring Zero Correct</th>
<th>Percentage Scoring One Correct</th>
<th>Percentage Scoring Two Correct</th>
<th>Row Mean Scores Differential</th>
<th>( p ) value &lt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>Voice</td>
<td>Verbal</td>
<td>30</td>
<td>0</td>
<td>70</td>
<td>0.771</td>
<td>0.380</td>
</tr>
<tr>
<td></td>
<td>Visual</td>
<td>10.5</td>
<td>15.8</td>
<td>73.7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Comparison</td>
<td>Verbal</td>
<td>45</td>
<td>10</td>
<td>45</td>
<td>9.62</td>
<td>0.002</td>
</tr>
<tr>
<td></td>
<td>Visual</td>
<td>0</td>
<td>6.7</td>
<td>93.3</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* The remedial students read the voice and comparison topics, but not the modification or classification topics.
fying did not find the visual versions any more attractive than the verbal versions \((p < 0.0497)\).

Perhaps the most compelling data about attitudes derives from the narrative responses to the questions about what the students liked and disliked about the teaching materials. This data shows that many of the students noticed and liked the design of the visual materials. Table 8 shows all the comments related to design made by all the students. In assembling this data, I have of course omitted most of the comments that the students made. For example, many students commented that the material was interesting, or that it was boring, or that they learned something,

### TABLE 6: ATTITUDES ACCORDING TO VERSION, ALL STUDENTS

<table>
<thead>
<tr>
<th>Measure of Attitude</th>
<th>Version</th>
<th>Mean Score</th>
<th>Standard Deviation</th>
<th>(p) value &lt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interesting</td>
<td>Verbal</td>
<td>3.39</td>
<td>1.09</td>
<td>0.149</td>
</tr>
<tr>
<td></td>
<td>Visual</td>
<td>3.63</td>
<td>1.22</td>
<td></td>
</tr>
<tr>
<td>Easy to Understand</td>
<td>Verbal</td>
<td>4.10</td>
<td>1.29</td>
<td>0.449</td>
</tr>
<tr>
<td></td>
<td>Visual</td>
<td>4.25</td>
<td>1.50</td>
<td></td>
</tr>
<tr>
<td>Attractive</td>
<td>Verbal</td>
<td>3.38</td>
<td>1.06</td>
<td>0.048</td>
</tr>
<tr>
<td></td>
<td>Visual</td>
<td>3.72</td>
<td>1.33</td>
<td></td>
</tr>
<tr>
<td>Useful</td>
<td>Verbal</td>
<td>3.96</td>
<td>1.29</td>
<td>0.491</td>
</tr>
<tr>
<td></td>
<td>Visual</td>
<td>4.07</td>
<td>1.19</td>
<td></td>
</tr>
<tr>
<td>Well Designed</td>
<td>Verbal</td>
<td>3.99</td>
<td>1.13</td>
<td>0.025</td>
</tr>
<tr>
<td></td>
<td>Visual</td>
<td>4.37</td>
<td>1.32</td>
<td></td>
</tr>
<tr>
<td>Letter Grade</td>
<td>Verbal</td>
<td>2.59</td>
<td>0.63</td>
<td>0.150</td>
</tr>
<tr>
<td></td>
<td>Visual</td>
<td>2.74</td>
<td>0.86</td>
<td></td>
</tr>
</tbody>
</table>

### TABLE 7: EFFECTS OF VERSION ON THE ATTITUDES OF STANDARD STUDENTS

<table>
<thead>
<tr>
<th>Question</th>
<th>Version</th>
<th>Mean</th>
<th>Standard Deviation</th>
<th>(p) value &lt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>Attractiveness</td>
<td>Verbal</td>
<td>3.44</td>
<td>1.11</td>
<td>0.0228</td>
</tr>
<tr>
<td></td>
<td>Visual</td>
<td>3.76</td>
<td>1.17</td>
<td></td>
</tr>
<tr>
<td>Quality of Design</td>
<td>Verbal</td>
<td>4.10</td>
<td>1.07</td>
<td>0.0015</td>
</tr>
<tr>
<td></td>
<td>Visual</td>
<td>4.54</td>
<td>1.07</td>
<td></td>
</tr>
<tr>
<td>Letter Grade</td>
<td>Verbal</td>
<td>2.62</td>
<td>0.73</td>
<td>0.0240</td>
</tr>
<tr>
<td></td>
<td>Visual</td>
<td>2.83</td>
<td>0.75</td>
<td></td>
</tr>
</tbody>
</table>
## TABLE 8: NARRATIVE COMMENTS ABOUT LIKES AND DISLIKES

<table>
<thead>
<tr>
<th>Topic</th>
<th>Comments by Students Reading the Verbal Version</th>
<th>Comments by Students Reading the Visual Version</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Voice</strong></td>
<td>Likes</td>
<td>None</td>
</tr>
<tr>
<td></td>
<td>Dislikes</td>
<td>None</td>
</tr>
<tr>
<td></td>
<td>♦ None</td>
<td>♦ The graphics made the concept easy to follow.</td>
</tr>
<tr>
<td></td>
<td>♦ The boxes explaining what is what and why it does or doesn’t work.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>♦ I liked all the space between the sentences. The space makes it easier to focus on the one sentence. I also like the little boxes with the explanation.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>♦ Very visual, does not include excess information.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>♦ Colored boxes helped distinguish between different sections.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>♦ The boxes and arrows made it more friendly.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>♦ The picture.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>♦ The boxed portions instruct better than if you just underlined the answer and explained it later or below the example.</td>
<td></td>
</tr>
<tr>
<td><strong>Modification</strong></td>
<td>Likes</td>
<td>None</td>
</tr>
<tr>
<td></td>
<td>Dislikes</td>
<td>None</td>
</tr>
<tr>
<td></td>
<td>♦ Although the material is good it needs eye catching information.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>♦ It was boring and unattractive.</td>
<td></td>
</tr>
<tr>
<td><strong>Comparison and contrast</strong></td>
<td>Likes</td>
<td>None</td>
</tr>
<tr>
<td></td>
<td>Dislikes</td>
<td>None</td>
</tr>
<tr>
<td></td>
<td>♦ The bar that pointed out and separated the mistake.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>♦ The big bold letters.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>♦ Neat looking. Easy to look at.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>♦ I liked the brackets pointing out the errors.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>♦ I thought it was laid out well on the page. Spacing is good.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>♦ The boxes above the sentence are somewhat confusing, I think they are not as useful as they should be.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>♦ The visual diagraming and the notes.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>♦ The instructional text was easy to understand.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>♦ Gave definition: what you were learning about was in big block.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>♦ The diagrams.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>♦ Well designed.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>♦ Way it was set up.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>♦ It was very clear. The diagrams helped.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>♦ It was put in very plain terms and designed very well.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>♦ I liked that it was very well organized and the directions were very easy to read.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>♦ The box on the left points out the differences when they appear.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>♦ The layout and examples shown.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>♦ Made me feel like a 6 year old, using pictures.</td>
<td></td>
</tr>
</tbody>
</table>
TABLE 8: NARRATIVE COMMENTS ABOUT LIKES AND DISLIKES, CONTINUED

<table>
<thead>
<tr>
<th>Topic</th>
<th>Comments by Students Reading the Verbal Version</th>
<th>Comments by Students Reading the Visual Version</th>
</tr>
</thead>
<tbody>
<tr>
<td>Classification and division</td>
<td>Likes None</td>
<td>Likes</td>
</tr>
<tr>
<td></td>
<td>Dislikes</td>
<td>Dislikes</td>
</tr>
<tr>
<td></td>
<td>♦ The material could have been set up in an earlier way to make it clearer.</td>
<td>♦ Pictures and instructions seemed out of order.</td>
</tr>
</tbody>
</table>

♦ This student offered both a positive and negative comment when prompted for "likes."

Although the students lacked the technical vocabulary to articulate their perceptions, clearly they noticed and liked the design elements.

or that they already knew it. If the comment did not directly relate to design, I did not include it here. Students’ comments are presented unedited. Each bulleted item is a particular student’s response to the prompt.

DISCUSSION
The results of this study suggest that using basic design principles can improve the effectiveness of instructional materials, in terms of both comprehension and attitudes.

The most obvious result regarding comprehension is seen with the remedial students. Although remedial students do significantly less well than standard students when both groups study the verbal materials, both groups score equally well when they study the visual materials.

In terms of attitudes, the situation is reversed: the remedial students expressed no measurable difference in attitude toward the two versions, whereas the standard students clearly felt that, compared with the verbal versions of the teaching materials, the visual versions were better designed, more attractive, and, in general, of higher quality.

The strongest indication that the visual versions are more effective than the verbal versions is contained in the narrative responses. Among the 166 students who read the verbal versions, 3 made negative comments about design—and not a single student made a positive comment. Of the 161 students who read the visual versions, 4 made negative comments about design, whereas 30—almost 19 percent—made positive comments. That these comments came in response to a general question about attitude, not a question designed to elicit a response about design, is quite remarkable. Although the students lacked the technical vocabulary to articulate their perceptions, clearly they noticed and liked the design elements.

What does the comprehension data mean? Why were the greatest gains made by the remedial students, not the standard students? My guess is that a greater percentage of the remedial students found the material challenging and therefore benefited from the extra cues provided by the design elements. The remedial students benefited more

Attitude data provides at least some measure of how the reader responded to the materials.
My conclusion about this data is that the more the material challenges the cognitive abilities and knowledge base of any reader, the more helpful the visual materials will be.

from the visual versions of the materials on comparison and contrast as a method of organizing paragraphs than they did from the visual versions of the materials on voice. The set of materials on comparison and contrast was the more abstract, and it was also the set that contained the graphic as well as the design cues.

My conclusion about this data is that the more the material challenges the cognitive abilities and knowledge base of any reader, the more helpful the visual materials will be. In the case of the materials used in this study, a smaller proportion of the standard students compared with the remedial students “needed” the extra information provided by the visual materials. In other words, compared with the remedial students, a higher proportion of the standard students already knew the material or found it not difficult, and therefore they relied less on the instructional materials. If the study had included a more challenging topic, such as the correct way to use the not only . . . but also correlative construction, I believe the data would show that all the students, not just the remedial ones, would benefit noticeably from the visual materials.

If the remedial students benefited more from the visual materials than the standard students did, why were the attitudes of the remedial students toward the visual materials less positive than the attitudes of the standard students? If the remedial students learned more from the visual materials than from the verbal materials, why didn’t they express their appreciation?

My explanation is that the attitudes expressed by all the students in this study do not reflect an objective assessment of the usefulness of the materials. Rather, the attitudes reflect a broader, more complex set of feelings and experiences that expresses the individual student’s self image as a writer: those students who have received the most positive reinforcement for their writing are most positive about the materials. It therefore follows that the remedial students are more grudging in their positive comments. The fact that the study included an “examination” element—the two comprehension questions—probably heightened any negative feelings that the students might have had. In fact, of the seven students who made negative comments about design—about either version—six were remedial students. But despite their unwillingness to evaluate the materials positively, the remedial students were the ones who benefited most substantially from the visual materials.

Perhaps the most positive inference to draw from the difference between the comprehension results and the attitude results is that if remedial students had learned from better-designed materials throughout their schooling, they would have learned more and been less likely to become remedial students in the first place.

**IMPLICATIONS OF THIS STUDY**

The project described in this proposal is a first step in assessing whether we can re-orient writing instruction to better take advantage of both the biological/psychological realities of how people process information and the cultural and technological changes in our society. It might be useful to try to exploit these facts by looking at writing instruction in a new way. The insights gained from this project can have significant implications for the teaching of writing, both text-based and electronic, both in school and the workplace.

Certainly, we need to do much more research to understand the interplay between verbal and visual elements in writing instruction. We do not know, for instance, which kinds of topics are most appropriate for an expanded use of visual elements, or which visual elements are most effective, or which students would benefit most. Still, the present study suggests clearly that the subject is worth investigating.

What are the additional challenges facing those people who wish to create instructional materials that employ visual rhetoric comprehensively? I think there are three.

♦ **It is simply easier for most of us to create text-based materials.** This is what we do in our classes: we talk to (at?) our students. Every experienced writing teacher has devised a way to explain the points that come up term after term. We all know how to “explain” the difference between restrictive and nonrestrictive modifiers, and we all have sample sentences to write on the board. Shifting to a more visual means of presenting this information would be hard work, calling for graphics more ambitious than the informal underlining and boxes that we routinely draw on the board. In the workplace as well, it easier to use existing texts and handbooks, all of which are basically verbal rather than visual.

♦ **Some aspects of writing instruction work better with a visual presentation than others do.** In revising Hacker’s materials, I tried to make them as
effective as I could. Still, I was able to think up graphics to accompany only two of the four topics: the ones on paragraph development. The other two topics did not present (to me, at least) any obvious opportunities for effective graphics. Instructors and trainers who wanted to make a serious effort to integrate visual and verbal techniques would benefit from working with designers and illustrators, who could offer many useful suggestions, but of course this collaboration would be expensive.

♦ A verbal presentation is much more economical than a visual presentation. I am referring here not to the extra work involved in creating a visual presentation, but rather to the extra space needed to present it. As a textbook writer myself, I am keenly aware of the pressure to say a lot in a little space. Publishers want to keep page counts down to reduce production and distribution costs.

Words fit into small spaces better than pictures do. The first two challenges mentioned here will become less daunting as time goes by, for more and more people who think visually as well as verbally will begin to create instructional materials. The steady growth in the number of technical communication instructors and trainers who are educated in visual rhetoric—who study the work of William Horton, Jan White, and Edward Tufte—bodes well. In addition, more and more college instructors have workplace experience, and with the development and growth of internship programs that enable instructors to work for extended periods in industry, that number will increase.

The third challenge, the space problem, will also recede in time, as more and more instructional material is delivered online. Space is a significant problem only if we use paper. Once the materials are online on CD-ROM or intranets—in several versions that appeal to the needs and tastes of different readers—we can concentrate on figuring out how to present information as effectively as possible, without worrying about the cost of adding extra pages or increasing the trim size of the book. (And, as an added bonus, we won’t have to worry about the extra cost of color.)

Regardless of how we feel about the integration of visual and verbal media, that integration is occurring all around us. Whether we like it or not, online communication employs a much fuller integration of visual and verbal media than most print communication does. As early as the late 1980s, scholars were forecasting that the development of hypertext, hypermedia, and multimedia was bringing about a fundamental reconceptualization of the way we communicate in a literate society. “Hypertext,” wrote Helen J. Schwartz (1992), “may qualify as a prosthetic because it can integrate the right-brained experience of graphics and the left-brained analysis of language” (p. 106). Richard Lanham (1992) explains the changes engendered by digital rhetoric through the use of the terms transparent and opaque. Traditional, pre-digital rhetoric is transparent: the reader reads through the text to see the meaning underneath it. By contrast, digital rhetoric is opaque: the reader reads the surface of the page or screen, interpreting the role of the design, layout, and typography in creating the meaning of the text.

According to Pamela McCorduck (1992), modern digital rhetoric is a return to the communication media of prehistory. For early modern humans, the visual arts “were employed socially, to organize knowledge for effective, long-term retention and retrieval, the visual arts taking advantage of the neocortex’s singular capacity for image processing: perceiving images, storing, and recalling them in a code of such breathtaking economy that we still don’t fully understand the process” (p. 250). With the explosive growth of the Web, we are in “a transitional stage” (p. 257), and “the primacy of text is over, though text is hardly dead” (p. 255). Our collective challenge is to devise instructional techniques that keep pace with this transition.

Technical communication practitioners, instructors, trainers, and researchers can contribute positively, for they are the architects of this transition. In their daily work, they chart the interplay between verbal and visual rhetoric as they create, revise, and test numerous forms of teaching materials, product documentation, and oral presentations addressed to a wide variety of audiences. A quick look at a typical manual from 1997, compared with a similar one from 1987 or 1977, shows clearly that the marketplace is an effective laboratory; the information produced by technical communicators is presented more clearly and more attractively every year, primarily due to greater reliance on graphics and more-sophisticated layout and design.

The community of technical communicators will also be the beneficiaries of this transition from the verbal to the visual. The subject-matter experts with whom they work were once college students taking writing courses. And these subject-matter experts enroll in the training programs offered in the workplace. Improvements in the way these courses are taught benefit the subject-matter experts and the technical communicators who teach these courses and
create and edit the documents produced in their organizations. When the basic principles of visual rhetoric fundamental to technical communication are integrated effectively in the way writing is taught in the classroom and in the workplace, everyone wins.

ACKNOWLEDGMENTS

I would like to thank the Society for Technical Communication, which awarded me a research grant to carry out this study. I would also like to thank Laura Bond, statistician with the Office of Information Technology at Boise State University, for her assistance in designing this study and analyzing the statistics. Finally, I appreciate the contributions of the editor of Technical communication and the anonymous reviewers who offered unusually insightful comments and suggestions that helped me improve this article.

REFERENCES


Haber, Ralph Norman, and Bonnie L. Myers. 1982. “Memory for pictograms, pictures, and words separately and all mixed.” Perception 11: 57–64.


APPENDIX A: VERBAL AND VISUAL MODULES

ACTIVE AND PASSIVE VOICE

Use the active voice unless you have a good reason for choosing the passive.

Transitive verbs (verbs that take a direct object) appear in either the active or the passive voice. In the active voice, the subject of the sentence does the action; in the passive voice, the subject receives the action. Although both voices are grammatically correct, the active voice is usually more effective because it is simpler, more direct, and less wordy.

ACTIVE The committee reached a decision.

PASSIVE A decision was reached by the committee.

To transform a sentence from the passive to the active voice, make the actor the subject of the sentence.

For the opening flag ceremony, a dance was choreographed by Mr. Martins to the song “Two Hundred Years and Still a Baby.”

We did not take down the Christmas decorations were not taken down until Valentine’s Day.

Very often the actor does not even appear in a passive-voice sentence. To make such a sentence active, the writer must decide on an appropriate subject—in this case, we.

The passive voice is appropriate if you wish to emphasize the receiver of the action or to minimize the importance of the doer.

APPROPRIATE PASSIVE
Many native Hawaiians are forced to leave their beautiful beaches to make room for hotels and condominiums.

APPROPRIATE PASSIVE
As the time for harvest approaches, the tobacco plants are sprayed with a chemical to retard the growth of suckers.

The writer of the first sentence wished to emphasize the receivers of the action, Hawaiians. The writer of the second sentence wished to focus on the tobacco plants, not on the people spraying them.
ACTIVE AND PASSIVE VOICE

What are the active and passive voices?
Transitive verbs—verbs that take a direct object—are either active or passive. Although both voices are grammatically correct, the active voice is usually more effective because it is simpler, more direct, and less wordy. Therefore, you should use the active voice unless you have a good reason for choosing the passive.

ACTIVE  The committee reached a decision.

PASSIVE  A decision was reached by the committee.

Using the passive voice inappropriately
Sometimes, writers use the passive voice when they should use the active voice. Here is an example:

PASSIVE  When you record a program, be sure the appropriate tape speed is selected.

ACTIVE  When you record a program, be sure you select the appropriate tape speed.

The passive voice—is selected—is inappropriate here because the reader doesn’t know whether he or she is supposed to select the tape speed or someone else is supposed to do it.

The active voice—you select—is better here because it makes clear that you are supposed to select the tape speed when you record a program.
Changing the passive voice to the active voice

To transform a sentence from the passive to the active voice, make the actor the subject of the sentence.

For the opening flag ceremony, a dance was choreographed by Mr. Martins to the song “Two Hundred Years and Still a Baby.”

We did not take down the Christmas decorations until Valentine’s Day.

Note that in this original sentence the actor does not even appear. To make such a sentence active, you must decide on an appropriate subject—in this case, we.

Note: The passive voice is not incorrect. In fact, the passive voice is appropriate if you wish to emphasize the receiver of the action or to minimize the importance of the doer.

APPROPRIATE PASSIVE
Many native Hawaiians are forced to leave their beautiful beaches to make room for hotels and condominiums.

APPROPRIATE PASSIVE
As the time for harvest approaches, the tobacco plants are sprayed with a chemical to retard the growth of suckers.

The passive is appropriate because the writer wants to focus on the tobacco plants, not on the people spraying them.
DANGLING MODIFIERS

A dangling modifier fails to refer logically to any word in the sentence. Dangling modifiers are usually introductory word groups (such as verbal phrases) that suggest but do not name an actor. When a sentence opens with such a modifier, readers expect the subject of the following clause to name the actor. If it doesn’t, the modifier dangles.

DANGLING Deciding to join the navy, the recruiter enthusiastically pumped Joe’s hand.
[Participial phrase]

DANGLING Upon seeing the barricade, our car screeched to a halt. [Preposition followed by a gerund phrase]

DANGLING To please the children, some fireworks were set off a day early. [Infinitive phrase]

DANGLING Though only sixteen, UCLA accepted Martha’s application. [Elliptical clause with an understood subject and verb]

These dangling modifiers falsely suggest that the recruiter decided to join the navy, that the car saw the barricade, that the fireworks intended to please the children, and that UCLA is sixteen years old.

To repair a dangling modifier, you can revise the sentence in one of two ways:

1. Name the actor immediately following the introductory modifier; or
2. turn the modifier into a work group that includes the actor.

→ I noticed

As I entered

Upon entering the doctor’s office, a skeleton caught my attention.

A dangling modifier cannot be repaired simply by moving it: A skeleton caught my attention upon entering the doctor’s office. The sentence still suggests—absurdly—that the skeleton entered the doctor’s office.

When the driver opened

Opening the window to let out a huge bumblebee, the car accidentally swerved into an oncoming car.

The car didn’t open the window; the driver did.

→ women have often been denied

After completing seminary training, women’s access to the pulpit has often been denied.

The women (not their access to the pulpit) complete the training.
DANGLING MODIFIERS

What is a dangling modifier?
A modifier is said to be dangling if it fails to refer logically to any word in the sentence.
Dangling modifiers are usually introductory word groups (such as verbal phrases) that suggest
but do not name an actor. When a sentence opens with such a modifier, readers expect the
subject of the following clause to name the actor. If it doesn’t, the modifier dangles.

Examples of dangling modifiers

This participial phrase . . . incorrectly refers to this word.

DANGLING Deciding to join the navy, the recruiter
enthusiastically pumped Joe’s hand.

This preposition followed
by a gerund phrase . . . incorrectly refers to this word.

DANGLING Upon seeing the barricade, our car
screeched to a halt.

This infinitive phrase . . . incorrectly refers to this word.

DANGLING To please the children, some fireworks
were set off a day early.

This elliptical phrase
with an understood subject
and verb . . . incorrectly refers to this word.

DANGLING Though only sixteen, UCLA
accepted Martha’s application.
How to fix a dangling modifier

Here is a sentence with a dangling modifier:

**DANGLING** Upon entering the doctor's office, a skeleton caught my attention.

To repair a dangling modifier, you can revise the sentence in one of two ways:

- name the actor immediately following the introductory modifier

  Now this participial phrase . . . correctly refers to this word.

  Upon entering the doctor's office, a skeleton caught my attention.

- turn the modifier into a work group that includes the actor

  Now the correct actor—I, not a skeleton—is entering the doctor's office.

  Upon entering the doctor's office, a skeleton caught my attention.

**Note:** A dangling modifier cannot be repaired simply by moving it:

The skeleton . . . is still walking around.

A skeleton caught my attention upon entering the doctor's office.
COMPARISON AND CONTRAST

To compare two subjects is to draw attention to their similarities, although the word *compare* also has a broader meaning that includes a consideration of difference. To contrast is to focus only on differences.

Whether a comparison-and-contrast paragraph stresses similarities or differences, it may be patterned in one of two ways. The two subjects may be presented one at a time, block style, as in the following paragraph of contrast.

So Grant and Lee were in complete contrast, representing diametrically opposed elements in American life. Grant was the modern man emerging; beyond him, ready to come on the stage, was the great age of steel and machinery, of crowded cities and a restless burgeoning vitality. Lee might have ridden down from the old age of chivalry, lance in hand, silken banner fluttering over his head. Each man was the perfect champion of his cause, drawing both his strengths and weaknesses from the people he led.

—Bruce Catton, “Grant and Lee: A Study in Contrasts”

Or a paragraph may proceed point to point, treating the two subjects together, one aspect at a time. The following paragraph uses the point-by-point method to contrast the writer’s academic experiences in an American high school and an Irish convent.

Strangely enough, instead of being academically inferior to my American high school, the Irish convent was superior. In my class at home, *Love Story* was considered pretty heavy reading, so imagine my surprise at finding Irish students who could recite passages from *War and Peace*. In high school we complained about having to study *Romeo and Juliet* in one semester, whereas in Ireland we simultaneously studied *Macbeth* and Dickens’ *Hard Times*, in addition to writing a composition a day in English class. In high school, I didn’t even begin algebra until the ninth grade, while at the convent seventh graders (or their Irish equivalent) were doing calculus and trigonometry.

—Margaret Stack, student
COMPARISON AND CONTRAST

What is comparison and contrast?
One way to develop ideas in a paragraph is to use comparison and contrast. To compare two subjects is to draw attention to their similarities. To contrast is to focus on differences.

There are two basic patterns for developing a comparison-and-contrast paragraph: the one-at-a-time pattern and the alternating pattern.

The one-at-a-time pattern for comparison-and-contrast paragraphs

One pattern for a comparison-and-contrast paragraph is to present each subject one at a time.

First you discuss one subject...

...then the other.

Here is an example:

So Grant and Lee were in complete contrast, representing diametrically opposed elements in American life: Grant was the modern man emerging beyond him, ready to come on the stage, was the great age of steel and machinery, of crowded cities and a restless burgeoning vitality: Lee might have ridden down from the old age of chivalry, lance in hand, silken banner fluttering over his head. Each man was the perfect champion of his cause, drawing both his strengths and weaknesses from the people he led.

—Bruce Catton, “Grant and Lee: A Study in Contrasts”
The alternating pattern for comparison-and-contrast paragraphs

The other pattern is to alternate between the two subjects, discussing one aspect at a time.

Here is an example of the alternating pattern: the writer is contrasting her academic experiences in an American high school and an Irish convent.

Strangely enough, instead of being academically inferior to my American high school, the Irish convent was superior. In my class at home, Love Story was considered pretty heavy reading, so imagine my surprise at finding Irish students who could recite passages from War and Peace. In high school we complained about having to study Romeo and Juliet in one semester, whereas in Ireland we simultaneously studied Macbeth and Dickens' Hard Time, in addition to writing a composition a day in English class. In high school, I didn't even begin algebra until the ninth grade, while at the convent seventh graders (or their Irish equivalent) were doing calculus and trigonometry.

—Margaret Stack, student
CLASSIFICATION AND DIVISION

Classification is the grouping of items into categories according to some consistent principle. The following paragraph classifies species of electric fish.

Scientists sort electric fishes into three categories. The first comprises the strongly electric species like the marine electric rays or the freshwater African electric catfish and South American electric eel. Known since the dawn of history, these deliver a punch strong enough to stun a human. In recent years, biologists have focused on a second category: weakly electric fish in the South American and African rivers that use tiny voltages for communication and navigation. The third group contains sharks, non-electric rays, and catfish, which do not emit a field but possess sensors that enable them to detect the minute amounts of electricity that leak out of other organisms.

—Anne Rudloe and Jack Rudloe, “Electric Warfare: The Fish That Kill with Thunderbolts”

Division takes one item and divides it into parts. As with classification, division should be made according to some consistent principle. The following paragraph describes the parts of a lemon and their uses.

Absolutely every part of a lemon is useful in some way, from its seeds to its outermost peel. Lemon-pip oil, unsaturated and aromatic, is important in the soap industry and in special diets. The pulp left over from squeezed lemons is evaporated and concentrated into “citrus molasses” which is sold as a base for making vinegar and as an ingredient in bland syrups and alcohol. The remains of the “rag” or pulp is also sold as cattle feed. Most of the pectin used to thicken and solidify jams, jellies, and marmalades comes from the white pith of citrus fruits. Among these, lemon and lime pectin has the highest “jelly grade” or capacity to thicken liquids. It is widely used in medicines taken to combat diarrhea. The flavedo, or outer yellow layer of lemon peel, is invaluable for its intense taste and scent. (The word zest, which originally meant “skin or peel,” then specifically “citrus peel,” is now in common use as signifying “lively enjoyment.”)

—Margaret Visser, Much Depends on Dinner
CLASSIFICATION AND DIVISION

What is classification?

Classification is the grouping of items into categories according to some consistent principle.

Example of a paragraph organized according to classification

Scientists sort electric fishes into three categories. The first comprises the strongly electric species like the marine electric rays or the freshwater African electric catfish and South American electric eel. Known since the dawn of history, these deliver a punch strong enough to stun a human. In recent years, biologists have focused on a second category: weakly electric fish in the South American and African rivers that use tiny voltages for communication and navigation. The third group contains sharks, non-electric rays, and catfish, which do not emit a field but possess sensors that enable them to detect the minute amounts of electricity that leak out of other organisms.

—Anne Rudloe and Jack Rudloe, “Electric Warfare: The Fish That Kill with Thunderbolts”
What is division?

Division takes one item and divides it into parts. As with classification, division should be performed according to some consistent principle. Here a personal computer is divided into its major operating components.

Example of a paragraph organized according to division

The following paragraph describes the parts of a lemon and their uses.

Absolutely every part of a lemon is useful in some way, from its seeds to its outermost peel. Lemon-pip oil, unsaturated and aromatic, is important in the soap industry and in special diets. The pulp left over from squeezed lemons is evaporated and concentrated into “citrus molasses” which is sold as a base for making vinegar and as an ingredient in bland syrups and alcohol. The remains of the “rag” or pulp is also sold as cattle feed. Most of the pectin used to thicken and solidify jams, jellies, and marmalades comes from the white pith of citrus fruits. Among these, lemon and lime pectin has the highest “jelly grade” or capacity to thicken liquids. It is widely used in medicines taken to combat diarrhea. The flavedo, or outer yellow layer of lemon peel, is invaluable for its intense taste and scent. (The word zest, which originally meant “skin or peel,” then specifically “citrus peel,” is now in common use as signifying “lively enjoyment.”)

—Margaret Visser, Much Depends on Dinner
APPENDIX B: COMPREHENSION QUESTIONS

Questions for the materials on active and passive voice
1. Is the following sentence written in active voice or passive voice?
   - Active ___ Passive ___
   The goalie crouched low, swept out his stick, and hooked the rebound away from the mouth of the net.
2. Is the following sentence written in active voice or passive voice?
   - Active ___ Passive ___
   The coolant pumps were destroyed by a power surge.

Questions for the materials on dangling modifiers
1. Does the following sentence contain a dangling modifier? Yes ___ No ___
   Exhausted from battling the tide and the undertow, the swimmer saw a welcome sight: the beach!
2. Does the following sentence contain a dangling modifier? Yes ___ No ___
   While still a beginner at tennis, the coaches recruited my sister to train for the Olympics.

Questions for the materials on comparison and contrast
1. Is the following paragraph organized by block style (one item at a time) or point by point (one aspect at a time)?
   - Block style ___ Point-by-point ___
   A one-million-fold increase in speed characterizes the development of machine computation over the past forty years. The increase results from improvements in computer hardware. In the 1940s, ENIAC, an early electronic computer, filled a room with its banks of vacuum tubes and miles of wiring. Today you can hold in your hand a computer costing about $200 that is 20 times faster than ENIAC, has more components and a larger memory, is thousands of times more reliable, costs 1/10,000 the price, and consumes the power of a light bulb rather than that of a locomotive.
2. Is the following paragraph organized by block style (one item at a time) or point by point (one aspect at a time)?
   - Block style ___ Point-by-point ___
   The two instructors could not have been more different. Mr. Smith had a lesson plan that he followed to the letter. Ms. Brown knew what she wanted to accomplish, but she let the class chart its own path. Mr. Smith like to lecture, whereas Ms. Brown had her students work in small groups and then report to the class. Mr. Smith graded every assignment, using numerical grades. Ms. Brown wrote comments on every assignment, but often she did not put a grade on the assignment at all.

Questions for the materials on classification and division
1. Is the following paragraph organized by classification or by division?
   - Classification ___ Division ___
   There are three basic kinds of New Yorkers. There is, first, the native New Yorker, the person who was born in the city and takes it for granted. This New Yorker accepts its size and turbulence as natural and inevitable. Second, there is the New York of the commuter—the city that is devoured by locusts each day and spat out each night. Third, there is the New York of the dreamer: the person who was born somewhere else and came to New York in quest of something.
2. Is the following paragraph organized by classification or by division?
   - Classification ___ Division ___
   The function of the middle ear is to deliver sound to the inner ear, where it is processed into a signal that our brain recognizes. The middle ear is a small cavity with the eardrum (tympanic membrane) on one side and the entrance to the inner ear on the other. Within the middle ear are three small bones known as the hammer (malleus), anvil (incus), and stirrup (stapes) because of their shapes. These bones act like a system of angular levers to conduct sound vibrations into the inner ear. The hammer is attached to the lining of the eardrum, the anvil is attached to the hammer, and the stirrup links the anvil to the oval window, the opening to the inner ear.
APPENDIX C: DEMOGRAPHIC AND ATTITUDE QUESTIONS

Circle a number to express your attitude about the instructional material you read on the previous page.

1. Boring 1 2 3 4 5 6 Interesting
2. Hard to understand 1 2 3 4 5 6 Easy to understand
3. Unattractive 1 2 3 4 5 6 Attractive
4. Not very useful 1 2 3 4 5 6 Very useful
5. Poorly designed on the page 1 2 3 4 5 6 Well designed

6. What did you particularly like about the instructional text you have just read?

7. What did you particularly dislike about the instructional text you have just read?

8. Using a letter grade from A to F, how would you rate the overall quality of the instructional text you have just read? ______

9. Age ______

10. Sex Female___ Male___

11. If you have declared a major, write it here __________________________
    If you are undeclared, check here ______

12. How many years have you attended college as a full-time student? ______

13. How many years have you worked, at least 20 hours per week, as a professional, such as an engineer, accountant, or computer systems analyst? Do not count any experience as a clerical worker, construction worker, sales clerk, or other similar non-professional worker.______

14. How many years have you worked at least 20 hours per week as a technical communicator (sometimes called tech writer, information engineer, documentation specialist, etc.)? Do not count any experience you have had as a secretary or administrative assistant or similar clerical worker.______

Circle a number to indicate your experience in the following areas:

15. word processing None 1 2 3 4 5 6 Highly Experienced
16. desktop publishing None 1 2 3 4 5 6 Highly Experienced
17. graphics software None 1 2 3 4 5 6 Highly Experienced
18. technical drafting None 1 2 3 4 5 6 Highly Experienced
19. CAD software None 1 2 3 4 5 6 Highly Experienced
20. writing instructions/manuals None 1 2 3 4 5 6 Highly Experienced
Circle a number to express your attitude about the writing you have done in high school and college.

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<th>Very difficult to do</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>Very easy to do</th>
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<th>Number</th>
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<th>2</th>
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<th>4</th>
<th>5</th>
<th>6</th>
<th>Very satisfying to do</th>
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</thead>
</table>

Circle a number to express your attitude about the writing texts—grammar books, handbooks, etc.—you have used in high school and college.

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<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>Very useful</th>
</tr>
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