Improving Instructional Materials by Improving Document Formatting

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Abstract

Instructors constantly create handouts and other instructional materials. Although the content of these materials are usually well thought out, the formatting is not generally given a second thought. Due to the limitations of the typewriter, which was the predominant method used by instructors to create material for years, generations of instructors have been taught formatting habits that are not appropriate for improving document readability. Few instructors in higher education understand the influence document formatting has on students' ability to read and understand material. This is true for average students, but is particularly true for students who have learning disabilities that involve reading.

This paper will provide some historical background on lead type and typewriters, and describe a number of formatting techniques and concepts that are based on principles used in publishing and teaching reading to students with learning disabilities. These techniques have a proven affect on students' reading of instructional material and other documents. With each of the formatting techniques discussed, an explanation of the principle involved is provided.

Introduction

One of the luxuries teachers have in this day and age is the ability to create instructional material on computers and computer printers. Gone are the days of handwritten or typewritten instructional material that is difficult to produce and even harder for students to read. With the modern tools available, anyone can create a document that provides clear, clean text and professional formatting. However, teachers have been taught very little about using the formatting capabilities of the tools they have available to create instructional materials and their impact on students' use of these materials. In the days of typewriters, people were trained to apply specific rules for formatting documents, but these rules were based on the limitations of the typewriter and are not appropriate for the computer. In fact, most of these rules are never appropriate for maximizing readability and communication. Techniques for formatting documents that have been utilized in the publishing industry have been shown by research to improve comprehension and reading speed. With the modern computer and the right software, an instructor can create documents that utilize these techniques with little effort. Knowledge of appropriate formatting techniques also allows instructors to evaluate textbooks and other purchased instructional materials more astutely.

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Movable Lead Type and the Typewriter

Although based on lead type, type on a typewriter needed to be uniform for easy manufacture. Therefore, the height and the width of the metal bases for each letter were designed so that they did not vary with each letter's width. This is referred to as Monospaced type. With only a single monospaced typeface available on standard typewriters, appropriate formatting was seriously handicapped. IBM attempted to eliminate some of these problems with its model 72 Selectric that was introduced in the 1960s. Known as the "Golf Ball" typewriter, the Selectric was designed with interchangeable "balls" that provided the typist with more than one typeface. IBM's Model C Executive typewriter, manufactured around the same time, was designed with letters of varying widths, but was difficult to use when centering type and had letter alignment problems. These new typewriter designs still did not eliminate the typewriter's limited ability to provide formatting capabilities that were as good as lead type (Beeching, 1978; Bergsland, 2002; Williams, 1990).

Formatting Issues Related to Fonts and Case

One of the first issues that must be faced by the creator of any document is the choice of fonts, and case. These can impact the readability of the document like nothing else. These choices have even greater impacts on individuals with reading difficulties.

Upper Case vs. Mixed Case Text

Probably the single worst thing that can be done in a document is to set the body text in all capitals or uppercase letters. Many studies have shown that text set in all caps is harder to read. The reason is that capitals do not provide as many visual "cues" for identifying words. As readers, individuals read both the shape of the letters and the shapes of words (Adler, 1991; Bergsland, 2002; Garzia, 1995; McWade, 1994; Spiekerman & Ginger, 1993; Williams, 1989). See Figure 2.

For individuals with reading problems, the choice of font and case is extremely important. Students with reading disabilities require as many visual eye-cues as possible. Teachers of remedial reading frequently have students draw boxes, like those illustrated in Figure 2, around words in order to help them see the word shapes (Simmons, 1998).

Figure 2: Word Shapes

Figure 3 illustrates the ease of reading mixed case text, which can be compared to the same text set in all uppercase in Figure 4.

> These are examples of text that is in all capitals and mixed case. Notice that the mixed case font is considerably easier to read. When creating documents, it is important to understand how people read, especially when dealing with people with reading disabilities.

Figure 3: Example: Mixed Case Type

> THESE ARE EXAMPLES OF TEXT THAT IS IN ALL CAPITALS AND MIXED CASE. NOTICE THAT THE MIXED CASE FONT IS CONSIDERABLY EASIER TO READ. WHEN CREATING DOCUMENTS, IT IS IMPORTANT TO UNDERSTAND HOW PEOPLE READ, ESPECIALLY WHEN DEALING WITH PEOPLE WITH READING DISABILITIES.

Figure 4: Body Text set in All Upper Case Type

In contrast to the use of lowercase for body text, there are some instances when an uppercase letter is the best choice. In lead type, certain lower case letters are referred to as the "type demons" because they are easily confused when setting lines of type. These lowercase letters are d, b, p, and q (Hird, 1982; Miller & Broekhuizen, 1978). For this reason, particularly when formatting multiple choice and matching test questions, uppercase letters should be used to identify answer selections. Even for students who do not have reading difficulties, lowercase b and d are harder to discriminate from each other when they are not part of a word.

Font Selection
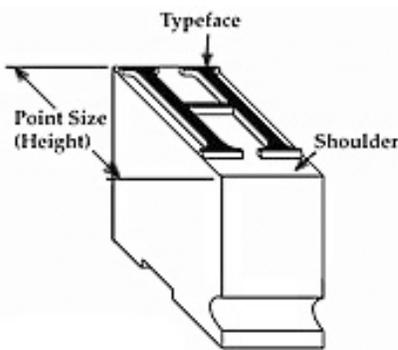
Figure 1: Lead Type

The raised letters used on the typebars of typewriters were directly based on the design of movable lead type. Lead type uses a reversed raised letter, the typeface, on a metal base. The width of the each metal base varies with the width of the raised letter on it, but its height, measured in points, remains constant for a specific typeface size so that letters can be combined into words and sentences. See Figure 1.

The term "font," derived from the word foundry, also originated from lead type, although it is now defined slightly different. A font of lead type specifies a collection of upper and lower case letters, numbers, and punctuation marks that are all in one size and one style (for example: Times Roman, 12 point, Italic) (Hird, 1982; Miller & Broekhuizen, 1978).

Typefaces have been classified into several systems. For the majority of people, classifying typefaces as Serif, San Serif, Script, Symbols, and Display is sufficient. Figure 5 provides examples of fonts that fit into these classifications. Serif and San Serif typefaces are the workhorses of the typeface styles. Script and Display fonts should be considered decorative only and never used for body text.

Figure 5: Font Classifications

Serif fonts can be distinguished from San Serif fonts by their decorative ends (the term serif means foot), and their thick and thin elements. San Serif fonts, by comparison, not only lack the decorative ends of Serif fonts, but are uniform in thickness. Because we read the shape of words, a Serif font is the better choice for long lines of body text. Their thick and thin elements and serifs provide superior letter discrimination. It has also been suggested that the serifs on Serif fonts create "bridges" between letters in words, which further distinguish the words from the spaces between them. Although not appropriate for long lines of body text, short lines of San Serif fonts do not seem to cause reading problems, particularly when limited to main headings and subheadings (Garzia, 1995; McWade, 1994).

Sentence Formatting

Beyond the selection of font and case, paragraph formatting can also enhance or detract from the readability of instructional material. Most of the paragraph formatting standards are still based on old typewriter rules because individuals creating documents do not understand that line spacing, alignment, line length have an affect on reading speed and comprehension.

Sentence Spacing

Double-spacing at the end of a sentence was a practical way of dealing with Monospaced type. Monospaced type was used on typewriters, as mentioned earlier, to make their manufacture easier. Because letters in monospaced type occupy the same amount of space regardless of the size or shape of the letters, narrow letters had more empty space surrounding them than wide letters. This had the unfortunate effect of creating the appearance of "holes" in words where several narrow letters fell together. This not only makes monospaced type harder to read, but makes locating the end of each sentences more difficult (Adler, 1991; Garzia, 1995; Shusman & Wright, 1989, Spiekerman & Ginger, 1993; Williams, 1989). See Figure 6.

Figure 6: Spacing Differences between Monospaced and Proportional Type

With computers, there now is a choice of typefaces, some are monospaced, but most are proportional. Proportional fonts are easier to read because they present a more uniform spacing around each letter. Examine the examples in Figure 6 again. Observe that the spacing around each individual letter is only large enough to accommodate the letter. Without the "hole" created by the larger spaces around narrow letters, it is also easier to find the ends of sentences. Single spacing at the end of sentences with proportional type maintains the reading flow and is less distracting when reading for long periods. Therefore, the rule that should be applied when spacing sentences is to single space at the end of a sentence when using proportional type and double space when using monospaced type (Alder, 1991; Graham, 2002, Shushan & Wright, 1989; Williams, 1990).

Justified Text

Another problem is the eyestrain created when reading justified text, particularly in narrow columns. Justification is less of a problem when using a wide column of text, but probably should be avoided when creating long documents. Notice that, although the lines of text in this paper are justified, it is not a huge hindrance for readers, since the lines of type are long. The difficulty in reading justified text relates to the uneven spacing of words, which is tiring to read over a long period of time. When reading justified text, the eye has to constantly adjust to a new word spacing for each line. This effect is very obvious in narrow columns of text. In particular, larger fonts (12 point and higher) acerbate the problem because less words can be placed on each line in narrow columns (Adler, 1991; Bergsland, 2002; McWade, 1993; Sushan & Wright, 1989; Williams, 1990). See Figurers 7 and 8.

This is an example of smaller text that has been placed in narrow columns of text. Notice the irregular spacing between of text from one line to another. This irregular spacing creates what is referred to as "riverlets." When reading long documents, the eye quickly tires from having to adjust to a new pattern of spacing on each line. Although people have been reading justified text for years, there is no reason why we should add additional strain on individuals when it can be avoided. The roll of instructional documents, in particular, should provide the highest quality document for students to use so that they can get the maximum benefit from the instruction.

FIGURE 7: Three Columns, 9 Point, Times, Justified

This is an example of text that has been placed in narrow columns. Notice the irregular spacing between of words from one line to another. This irregular spacing creates what is referred to as "riverlets." When reading long documents, the eye quickly tires from having to adjust to a new pattern of spacing on each line. Although people have been reading justified text for years, there is no reason why we should add additional strain on students to read this type of text when it can be avoided. The roll of instructional documents, in particular, should provide the highest quality document for students to use so that they can get the maximum benefit from the instructional material we produce.

FIGURE 8: Three Columns, 14 point, Times, Justified

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Irregular gaps that tread down the length of justified text in narrow columns are referred to as "riverlets." Riverlets create special problems for students with reading disabilities. Some of these individuals may experience situations where the text appears to move on the page or the white space appears to "crowd out" the black of the letters. Riverlets increase these effects and paragraph formatting that eliminates riverlets should be selected for instructional material (Irlen, 1991).

Line Lengths

When lead type is combined into a line of type, the lines are measured in picas, which is still the standard unit for measuring line length in the printing industry. Picas can be defined in two ways, either by their relationship to inches or their relationship to points. There are six picas in one inch, and 12 points in one pica (Beeching, 1974).

Research demonstrates that line lengths has an impact on the speed that individuals read material. When individuals read, they focus on words in clusters, staying on a cluster of words until they understand it, and then jumping to the next cluster of words. Researchers call these saccadic jumps (Manousos & Tilden, 1990). Text lines that are too long make the eyes work harder, and may cause individuals to accidentally stray to the wrong line of text. (Garzia, 1995; (Manousos & Tilden, 1990; Spiekerman & Ginger, 1993). Lines that are too short also can slow reading. When reading text, it takes additional time for the eyes to move to the beginning of the next line, and short lines increase the number of times that this eye movement occurs. In a study at the University of Minnesota, the researchers found that the optimal line length for 10 point type is 18.9 picas, which is equal to 3.15 inches. When the line length was set at only 13.9 picas (2.3 inches), the average reading rate was slowed by 7 percent. When the line length was set to 43.9 picas (7.31 inches) the reading rate again was slower, but by 11.4 percent (Manousos & Tilden, 1990).

Line Spacing

Line spacing also has an impact on student reading speed. A rule of thumb for line spacing is that as lines of type get longer, then the spacing between lines should increase. The ability to set line spacing is somewhat limited in low-end word processor programs, which are usually limited to single spacing, line and a half spacing, or double spacing. However, programs like Microsoft Word provide greater control over line spacing through its Paragraph Format dialogue box. By selecting spacing based on point size or multiples, there is a great deal of line spacing control.

The issue with line spacing is that as lines get longer, close-set text may cause the reader's eyes to drift to a line adjacent to the line they are reading. For students with poor reading skills, this breaks their concentration and reduces their ability to understand the meaning of the material they are reading. For normal readers, this is merely an inconvenience that slows reading. For individuals with poor reading skills or reading disabilities, they are already exerting a considerable effort to simply read the words. Therefore, any disruption in the flow of their reading further reduces their ability to comprehend the material. Examine Figure 9, which illustrates how an increase in the line spacing improves the ability to stay on the line currently being read (Spiekerman & Ginger, 1993).

> These lines are set so that each line is spaced increasing wider that the previous line.
> With long lines of type, the spacing between the sentence impacts a reader's ability
> to stay on the correct line. For students with reading disabilities, this can be a
> significant problem. They are already stretched to their limit, so any added strain
> on their reading can distract them from comprehending the material. To

> improve students' ability to read material faster and not become frustrated, a rule of thumb for line spacing is that as lines of type get longer, so should the spacing
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> between the lines of type. This creates enough separation between the lines so that the
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> eye does not tend to drift from one line to the next. Notice that as the line spacing gets
>
> wider, your ability to stay on the correct line improves.

Figure 9: An Illustration of the impact of line spacing on reading long lines of text.

Organizing Material

Providing information to students also requires that it be organized so that students can instantly locate the important elements and make connections between main ideas and information related to them (Adler, 1991; Irlen, 1991; Parker, 1988). To accomplish this, documents should have clearly defined hierarchies of information. Selecting different font sizes, typefaces, and bolding words are some of the easiest ways to create informational hierarchies (Donald, 1992; Graham, 2002; Lamar, 1992).

Providing a hierarchy allows an instructor to control the importance of information and allows students to locate important points and levels of detail (Donald, 1991; Irlen; 1991). According to Irlen (1991), research "provides evidence that the organization of text, students' awareness of that organization, and students' strategic use of text organization affect their comprehension," p. 244. This is especially important when reviewing instructional material for tests and activities. A clear structure helps students work through sequential instructional material and located salient points.

Creating a Document Hierarchy

Hierarchies are established by using contrast. Contrast can be achieved by differences is shapes, size, weight, location, and form (Lamar, 1992). Understanding how contrast works in establishing a hierarchy of information is as simple as understanding that people look at the elements on a page in the order of their size or dominance. This allows the creator of a document to control the eye movements of people viewing their document fairly precisely (Donald, 1992; Graham, 2002).

Heading
Creating a hierarchy of information allows
students to locate information more easily
and defines the important information for
the students. This is an example of a poorly
defined hierarchy.

Heading
Nortice how hard it is to separate the heading
from the remaining information. The heading
and the bodytext have the same weight and
size of letters, which makes the two tend to
blend.

Figure 10: Example of a Poor Hierarchy

The example in Figure 10 lacks a good hierarchy. Locating information with this type of formatting is hard for students, reducing their ability to mentally organize the material (Irlen, 1991).

In comparison, Figure 11 demonstrates that by simply enlarging the heading size and bolding it, and then indenting the body text slightly, the headings stand out clearly from the body text. This is using contrast by size, weight, and position to improve the hierarchy of the information presented (Donald, 1992; Graham, 2002; Lamar; 1992).

Heading

Creating a hierarchy of information allows
students to locate information more easily
and defines the important information for
the students. This is an example of a well
defined hierarchy.

Heading

Nortice how easy it is to separate the heading
from the remaining information. The heading
and the bodytext have a different weight and
size, which creates constrast between the two.

Figure 11: Example of Good Hierarchy

Indenting and Drop Caps

Indenting the first line of a paragraph is another simple way in of improving the organization of a document for students. Indentions makes locating paragraphs easier so that students can identify the breaks in the instructional material (Manousos &Tilden, 1990; Parker, 1989). A second way to can add emphasis to introductory paragraphs is to use drop caps. A drop cap is larger than the letters in the body text and extends into several lines below it (Manousos & Tilden, 1990; Parker, 1988; Shushan & Wright, 1989). In the past, drop caps were only available to users of page layout programs like Quark Express, PageMaker, and Publisher, but are now available in some of the newer versions of word processing software. Figure 12 illustrates the look of a cap that has been dropped over two line of text.
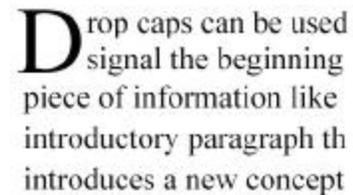
Drop caps can be used signal the beginning piece of information like introductory paragraph th introduces a new concept

Figure 12: Example of a Drop Cap

Conclusions

The format of a document can improve the speed at which students' comprehend the instructional material or it can get in their way. In particular, this is true for students who have reading disabilities. Research has demonstrated that choosing appropriate typefaces, line spacing, and line lengths increase students' reading speed. It has also demonstrated that establishing a clear hierarchy of information helps them organize material and increases their comprehension. With the tools provided by computers and word processing programs, there is no reason not to create instructional materials that look good and function well. An understanding of some of the concepts used in the publishing industry to create textbooks and other printed material can also help instructors in the selection of purchased instructional materials. This author would like to see teachers at every level of education provided with instruction in appropriate formatting techniques. Instructors have a duty to their students to provide them with the best instructional materials they can produce.

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