

## Using Visual Learning in A & P Textbooks

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### Abstract

A new Anatomy and Physiology textbook uses a visual learning strategy to address the needs of students deficient in academic literacy skills, replacing most of the traditional textual narrative with illustrations and annotated labels. Although visual learners may benefit from this new approach, the lack of a textual narrative reduces the effectiveness of the textbook for non-visual learners. Additionally, this approach is more effective for anatomical structures, and less so for physiological processes.

### Introduction

For the past year our department has been using a novel and perhaps even radical Anatomy and Physiology textbook that emphasizes a visual learning mode, and replaces the traditional textual narrative with extensively annotated illustrations. Some colleagues joke that our new textbook is little more than a “comic book,” but other colleagues suggest that the book is perfectly acceptable and that, indeed, it represents the avant-garde of textbooks in the future.

Whether we like it or not, it appears that this book is in the vanguard of a new generation of textbooks that will emphasize visual learning. It is therefore important that we examine the strengths and weaknesses of the visual learning mode used by this textbook, both as a specific way to teach Anatomy and Physiology and as a general pedagogical strategy applicable to other disciplines.

The new textbook, *Visual Anatomy and Physiology* (Martini, Ober, & Nath, 2011), appears to be a response to a new environment—the brave new academic and technological world in which we find ourselves. Academic deficiencies are found throughout the United States: in 2011, only a quarter of high school graduates met all four of the ACT College Readiness Benchmarks, in math, science, English, and reading (Redden, 2011). At my college, a large proportion of the students who take the Anatomy and Physiology course enroll with academic deficiencies in science and literacy skills, including reading comprehension. Many of these students are emerging English language speakers, but even native speakers of English have trouble with the difficult textual material in the course.

Technological change is also shaping this new environment. Higher education faces a confluence of factors that are changing teaching and learning. Societies around the world are shifting from

paper-based information delivery (e.g., letters, newspapers, traditional books) to digital electronic transmission (emails, websites, ebooks). The digitization of textbooks—accessed via tablets, smartphones, and laptops—is predicted to accelerate, reaching approximately 50 percent of the entire United States higher education textbook market by 2017 (Reynolds, 2011). There is an overall decline in newspaper and magazine readership (Zacks Equity Research, 2012), and evidence of a decrease in book reading (Flood, 2012). Digital modes are increasingly more visual and less text-dependent (e.g., Facebook, YouTube), and hardware can easily display colorful graphics, photos, and videos.

### **Visual Learning in Anatomy and Physiology**

Within this new academic and technological environment, the traditional Anatomy and Physiology textbook seems anachronistic—printed on paper, 1,000 pages in length, with paragraph after paragraph of dense textual narrative—but has survived because it adequately handles the inherent difficulties of the course. Students who take Anatomy and Physiology must learn a large vocabulary of anatomical terms, while simultaneously gaining an understanding of the complexities of body processes. Even above-average students, proficient in English language skills, find this material to be quite daunting. Unsurprisingly, students deficient in these skills will find the textual narrative to be a high hurdle to overcome, especially in the current digital visual information age, where text is de-emphasized.

Could a textbook that emphasizes visual learning solve these students' reading and comprehension difficulties? It would seem so; a pedagogical strategy that emphasizes the visual, and eliminates a substantial portion of the narrative without sacrificing academic rigor, appears to be a promising solution. Anatomy and Physiology courses already depend heavily on non-textual modes of teaching and learning (oral lectures; photographs, illustrations and diagrams; videos and animations; laboratory kinesthetic activities), so a visual-mode textbook would merely be an incremental addition.

Furthermore, the visual-mode strategy used by this textbook is supported by an entire branch of pedagogical research devoted to learning styles, i.e., the idea that individual students have one or more preferred learning styles (Dunn, 1984; Felder & Silverman, 1988; Dobson, 2009; Hawk & Shah, 2007). One of the most influential categorizations of learning styles—the VARK model—divides learners into four groups based on their sensory learning styles: Visual, Aural, Read/Write, Kinesthetic (Fleming, 2001). Visual learners prefer charts, diagrams, and pictures; aural learners like lectures and discussion groups; read/write learners prefer text materials such as books, manuals, and handouts; kinesthetic learners like hands-on activities, laboratory work, field trips, collections of samples, and manipulation of objects.

Students appear to favor visual learning over other learning styles (Dobson, 2009). However, because students vary in their preferences, it is obvious that not all students will benefit from a visual learning style. Complicating the matter, many students favor two or more learning style modalities (Lujan and DiCarlo, 2006; Fleming, 2001).[1] Additionally, preferences can be affected by gender (Dobson, 2009; Wehrwein, Lujan, and DiCarlo, 2007) or by the subject matter that is being studied (Lujan and DiCarlo, 2006).

The learning style paradigm has been criticized as a hypothesis that remains statistically unproven: according to critics, no study has ever been done that actually measured the comparative learning success of students matched or mismatched with their presumptive learning style (Pashler, McDaniel, Rohrer, & Bjork, 2009; Mayer, 2009). Advocates respond that, nevertheless, instructors and students have benefited from the notion of individual learning styles, and that the different learning style categories are not mutually exclusive but rather are preferences within a multi-dimensional continuum (Felder, 2010).

### **Applying Visual Learning to an A & P Textbook**

Despite the caveats to learning style theory, there is an intuitive logic in the use of a visual approach for a student population that has difficulty with text. A major textbook publisher, Pearson, took this approach in *Visual Anatomy and Physiology*, and used the learning style paradigm to emphasize the visual while de-emphasizing the textual narrative. This radical text is based on images—anatomical and physiological illustrations. The textual narrative is almost entirely limited to annotated labels and captions, thereby slashing the total text word count by perhaps a quarter or a third. Another important design aspect of the textbook is its modular format: each module is laid out on two facing pages, and covers one mini-topic. The student therefore sees the entire mini-topic in a single glance, like viewing a computer screen.

To understand how radical this format is, let us compare how a traditional textbook and this new visually-oriented textbook differ in their handling of heart anatomy. A representative traditional Anatomy and Physiology textbook would describe heart anatomy with one or two pages of narrative text, and with a labeled heart diagram on the same page or on an adjacent page. In contrast, *Visual Anatomy and Physiology* essentially eliminates the separate narrative text. Aside from an overview of eighty words on the top of the page, all other text is associated with, and subservient to, a single illustration of the sectioned heart that is centered on the page. Annotated labels are arranged in text boxes on either side of the heart diagram, with a pointer line running from each text box to its associated heart structure. For example, the right ventricle (the heart chamber that pumps blood to the lungs) is described by a ninety-three word annotation within a text box next to the image of the structure it describes, and connected to the image by a pointer line. In some sense, therefore, *Visual Anatomy and Physiology* is indeed like a comic book—or to be more generous and accurate, it is like a graphic novel.

Although we cannot compare the narrative content of the two textbooks precisely, because each book provides a slightly different emphasis, one can still get a sense of how the two books handle text by looking at the word count. Unsurprisingly, the traditional Anatomy and Physiology textbook uses 692 words to describe the anatomy of the heart and its valves, whereas *Visual Anatomy and Physiology* uses 458 words for essentially the same description.[2] This is obviously a substantial reduction in words.

### **Analysis of Visual Learning as a Strategy in Textbooks**

The visual format seems to favor students with academic deficiencies in literacy skills, because it eliminates a substantial amount of text narrative. Additionally, this format likely favors visual learners. Furthermore, unlike standard textbooks, the student does not have to search on adjacent

pages for diagrams that match the text, since text and the matching diagrams are on the same page. This format also facilitates the student's ability to follow the lecture by focusing attention on each sub-topic under discussion, making it easier to find the exact diagram or topic being discussed.

But how effective is this new approach? Unfortunately, no statistically significant studies are available to compare the efficacy of the new visual text to a traditional text. The lack of data is a common difficulty in pedagogy; in this case, an adequate test would require comparing the test scores of two student groups that differed only in the textbook they used (Willingham, 2012). Such a comparison is difficult in practice. Furthermore, there are many reasons why grades might fluctuate between two groups, including random variation in the level of student performance, differences between teachers, etc. However, a survey questionnaire, completed by my lecture students after using a sample chapter from the visual textbook, provides a qualitative comparison. Most of the students reported that they would prefer using the visual textbook, rather than the traditional textbook, to help them study for an exam. Additionally, the students overwhelmingly reported that they preferred illustrations and diagrams, rather than narrative text, to use as their key resource in learning anatomy and physiology information.[3] From this qualitative survey it would appear that for most students the new visual approach might be more effective than a traditional narrative text.

However, the heavily visual emphasis in the new textbook creates several new problems. First, even though many students prefer visual learning, a substantial residuum will prefer other strategies, such as a text-based approach, and may be poorly served by a visual emphasis. Second, although the visual emphasis unifies the information within each module, it leads to a lack of narrative continuity between modules; the text remains isolated within individual modules, and cannot flow from page to page. Third, images are not always the best pedagogical means to convey information. The heavily visual approach in *Visual Anatomy and Physiology*, with its minimal text, works best for anatomical structures, and not as well for physiological processes (e.g., muscle contraction, heart function, nerve impulse conduction, etc.), which are better served by a narrative—or by a video, for that matter. This is a major flaw in the book's implementation.

## **Conclusion**

A visual learning approach has the potential to assist students who have deficiencies in academic literacy skills, particularly when this approach is used in *Anatomy and Physiology* textbooks. However, this strategy is more readily applicable to anatomical structures than to physiological processes, and may actually impede learning in students who are not visual learners.

## **Endnotes**

[1] Fleming (2001) suggests that in practice, an individual student might prefer one (41 percent), two (27 percent), three (9 percent), or all four (21 percent), learning styles.

[2] The representative traditional textbook used in this comparison is *Hole's Anatomy and Physiology* (Shier, Butler, & Lewis, 2010), pages 555 and 557. The new visual textbook is *Visual Anatomy and Physiology* (Martini, Ober, & Nath, 2011), page 634.

[3] The students in my lecture classes were given a survey questionnaire immediately after they used a sample chapter on the topic of muscle structure and physiology from the Visual Anatomy and Physiology textbook (N=54). Asked about their learning style preference, they responded as follows: 48 percent of the students preferred illustrations and diagrams; the remaining students preferred lectures (20 percent), text-based explanations (11 percent), animations and videos (11 percent), or labs (9 percent). Regarding their preference in textbooks, 56 percent of the students reported that they preferred the *Visual Anatomy and Physiology* textbook to help them study for an exam, while 44 percent preferred the traditional textbook, *Hole's Anatomy and Physiology*.

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