Visual Literacy in Teaching and Learning: A Literature Perspective

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Abstract

Research reported in educational literature suggests that using visuals in teaching results in a greater degree of learning. The basic premise of this body of research is the concept of visual literacy, defined as the ability to interpret images as well as to generate images for communicating ideas and concepts. This paper provides an introduction to visual literacy and includes a review of studies that investigate the effects of instruction that incorporates varying degrees of visual components including no visual support, still visual aids, and animated visual sequences. The purpose of this literature review is to stimulate interest in using visual enhancements in teaching and to promote the development of learners' visual skills in combination with their development of verbal, reading, and mathematical skills.

During a rehearsal of Debussy's *La Mer*, Toscanini found himself unable to describe the effect he hoped to achieve from a particular passage. After a moment's thought, he took a silk handkerchief from his pocket and tossed it high into the air. The orchestra, mesmerized, watched the slow, graceful descent of the silken square. Toscanini smiled with satisfaction as it finally settled on the floor. "There," he said, "play it like that" (Fadiman, 1985, p. 548).

Visual Literacy from a Historical Perspective

The presence of visual elements in today's teaching and learning is increasing as the integration of images and visual presentations with text in textbooks, instructional manuals, classroom presentations, and computer interfaces broadens (Benson, 1997; Branton, 1999; Dwyer as cited in Kleinman & Dwyer, 1999). Although the educational community is embracing visual enhancements in instruction, the connection of visual and verbal information is evident throughout history. According to the poet Simonides, "Words are the images of things" (as cited in Benson, p. 141); similarly, Aristotle stated that, "without image, thinking is impossible" (as cited in Benson, p. 141). Characters in alphabets began as pictures with meaning (West, 1997). These symbols portray a man-made language with no distinction between words and pictures, just as musical notes convey the language of music. Only after the printing press was invented were illustrations and type separated, with illustrations often falling by the wayside. Recent history shows a reversal in this separation with greater reliance on visually oriented approaches

to information presentation. The results are leading to a visualization movement in modern computing whereby complex computations are presented graphically, allowing for deeper insights as well as heightened abilities to communicate data and concepts. Visualization helps make sense of data that may have seemed previously unintelligible. Leonardo da Vinci, in recognizing the impossibility of recording volumes of data, translated words into drawings from different aspects. As history repeats itself, we may find that a great deal of information is better presented visually rather than verbally.

A culture's predominant mode of literacy depends on the technology and mass media it embraces (Sinatra, 1986). In education's continuing mission of meeting the needs of learners, an apparent shift from the long-standing process of reading, writing, counting, and text memorization skills that may have been appropriate for the medieval clerk, are giving way to skills of analysis and innovation that are considered desirable in today's modern cultures (West, 1997). Proficiency with words and numbers is insufficient and must be supplemented with additional basic skills as new and emerging technologies permeate activities of daily living. Viewing change with fear and skepticism often accompanies shifts such as these that can revolutionize society. Even Socrates portrayed the new technology of the written word as dangerous and destructive, artificial and rigid, and unresponsive and insensitive. As more visual elements are incorporated to achieve an optimal balance between verbal and visual cues in education, interdependence between the two modes of thought will be fostered. Kellner (1998) proposes that multiple literacies are necessary to meet the challenges of today's society, literacies that include print literacy, visual literacy, aural literacy, media literacy, computer literacy, cultural literacy, social literacy, and ecoliteracy.

Learner Differences

Learning through orderly, sequential, verbal-mathematical, left-hemisphere tasks is a pattern seen frequently in education (West, 1997). Those whose thought processes are predominantly in the right-hemisphere where visual-spatial and nonverbal cognition activities rule frequently may have difficulty capitalizing on a learning style that is not compatible with their abilities. Liu and Ginther (1999, Introduction section, p. 2) define cognitive/learning style as "the individual's consistent and characteristic predispositions of perceiving, remembering, organizing, processing, thinking, and problem solving" and note that cognitive/learning style is an important factor in individual student differences. Instructional materials as well as teaching

styles should be matched with cognitive styles for greatest learner benefits. However, the extent to which individuals are polarized in their brain's abilities to deal with verbal and visual modes of thought is not fully understood, although it is rare for individuals to deal equally effectively in both modes (West). Most people have a tendency to think in words rather than in pictures, yet the use of visualization in thinking appears to be increasing. Tuckey and Selvaratnam (as cited in Chanlin, 1999) propose that most visualization skills can be developed by practice. Even so, both Cate (as cited in Chanlin, 1997) and Richardson (as cited in Chanlin, 1997) emphasize that students with limited domain knowledge may regard graphics as excess complexities and incomprehensible information if the connections with the concepts are not obvious to them. An additional variation in learners is present in those who may have difficulty with comprehending the spoken or written language, particularly those with language barriers, learning disabilities, and hearing disorders (Flattley, 1998).

Visual Literacy Defined

Wileman (1993) defines visual literacy as "the ability to 'read,' interpret, and understand information presented in pictorial or graphic images" (p. 114). Associated with visual literacy is visual thinking, described as "the ability to turn information of all types into pictures, graphics, or forms that help communicate the information" (Wileman, p. 114). A similar definition for visual literacy is "the learned ability to interpret visual messages accurately and to create such messages" (Heinich, Molenda, Russell, & Smaldino, 1999, p. 64). The ERIC definition of visual literacy is "a group of competencies that allows humans to discriminate and interpret the visible action, objects, and/or symbols, natural or constructed, that they encounter in the environment" (http://searcheric.org/). Robinson (as quoted in Sinatra, 1986) describes visual literacy as "an organizing force in promoting understanding, retention, and recall of so many academic concepts with which students must contend" (p. v). And lastly, Sinatra defines visual literacy as "the active reconstruction of past visual experience with incoming visual messages to obtain meaning" (p. 5), with the emphasis on the action by the learner to create recognition.

The use and interpretation of images is a specific language in the sense that images are used to communicate messages that must be decoded in order to have meaning (Branton, 1999; Emery & Flood, 1998). If visual literacy is regarded as a language, then there is a need to know how to communicate using this language, which includes being alert to visual messages and critically reading or viewing images as the language of the messages. Visual literacy, like

language literacy, is culturally specific although there are universal symbols or visual images that are globally understood.

Visual Literacy and Instructional Technology

Branton (1999, Abstract section, p.1) proposes the questions, "Does technology necessitate the need for Visual Literacy skills? Can this same technology be used to enhance our Visual Literacy skills?" Branton links visual literacy with constructivist learning through the role of each in acquiring knowledge in the information age. The ERIC definition of visual literacy given above and the ERIC definition of constructivism learning as a "viewpoint in learning theory which holds that individuals acquire knowledge by building it from innate capabilities interacting with the environment" (http://searcheric.org/) are merged by Branton as she explores the possibility that the visual arts taught in a constructivist learning environment can enhance visual literacy skills. Technology, particularly the graphical user interface of the World Wide Web, requires skills for reading and writing visually in order to derive meaning from what is being communicated.

Two major approaches have been suggested for developing visual literacy skills (Heinich et al., 1999). The first is to help learners read or decode visuals through practicing analysis techniques. Decoding involves interpreting and creating meaning from visual stimuli. The second is to help learners write or encode visuals as a tool for communication. Students develop their visual abilities through use. Sinatra (1986) compares the creation of visual messages to writing word messages, in that visual messages have a combination of objects, space, light, angle, and mood to suggest a particular message or effect just as the writer uses words, sentences, and paragraphs to achieve a particular style.

The use of visual literacy ideas and strategies to enhance verbal learning is important (Flattley, 1998; Sinatra, 1986). Because visual literacy precedes verbal literacy in human development, it is the basic literacy in the thought processes that are the foundations for reading and writing. Berger (1972) explains, "Seeing comes before words. The child looks and recognizes before it can speak" (p. 7). The Dale Cone of Experience model is based on the concept that learning evolves from the concrete to the abstract; visual symbols are nonverbal representations that precede verbal symbols (Sinatra, 1986). Action activities provide the concrete base for the abstract use of symbols in defining and explaining the action activities. These activities of action progress to activities of observation which then are followed by

abstract representations, a process that facilitates reconceptualization and understanding of the experience before describing it verbally. Because pictures or illustrations are analogs of experience and are only one step removed from actual events, these visual representations may be able to capture and communicate the concrete experience in various ways.

Visual Literacy Research

"A good picture is equivalent to a good deed" (Van Gogh, as cited in http://quoteworld.eilc.org/search.cgi). As studies show success in thinking and learning visually instead of or in addition to traditional lectures and verbal description, a shift in technique is required. Students need to learn visually and teachers need to learn to teach visually. West (1997) conveys an innovative mathematics approach whereby students "do" mathematics rather than "watch" mathematics. The technique emphasizes learning through interactive graphics without words. "The words go into an idea only after the idea has already settled in our mind"(West, p. 275).

Research suggests that using visual treatments in lessons enhances learning with varying degrees of success. Chanlin (1998) reports how lessons with no graphics, still graphics, or animated graphics influence students with different prior knowledge levels as they attain procedural and descriptive knowledge. When prior knowledge is low, graphics, either still or animated, are better for learning descriptive facts than lessons with text only, yet learning procedural facts does not appear to differ with the use of text or graphics. However, students with a high level of prior knowledge of the subject responded better with the animated form of graphics in learning descriptive facts, but responded better with still graphics when learning procedural knowledge. Chanlin's (1998) study suggests that students with different prior knowledge levels respond differently to contrasting presentation forms for achieving learning tasks, and that the effectiveness of visual design in learning is related to the prior knowledge of the students. Animated graphics are not superior to still graphics and may even be distracting to learning if the motions are inconsistent with how students process the visual information. An additional study by Chanlin (1999) suggests that providing visual control of animated graphics enhances learning, particularly in males.

Kleinman and Dwyer (1999) examined the effects of specific visual skills in facilitating learning. Their findings indicate that the use of color graphics in instructional modules as opposed to black and white graphics promotes achievement, particularly when learning concepts.

An earlier study by Myatt and Carter (as cited in Heinich et al., 1999) suggests that most learners prefer color visuals to black and white visuals, but that no significant difference in the amount of learning occurs except when color is related to the content to be learned. In addition, the study indicates that young learners prefer simple visuals and older students prefer complex visuals, yet simpler visuals are usually more effective regardless of the age group. Additionally, students do not necessarily learn best from the kinds of pictures they prefer to view.

Mayer, Bove, Bryman, Mars, and Tapangco (1996) compared the use of a multimedia summary comprised of a sequence of annotated illustrations depicting the steps in a process, with a 600-word text summary of the process. Also compared were the multimedia summary plus different amounts of text in knowledge retention and transfer. Results suggest that the multimedia summary is more effective than the verbal summary, and that the multimedia summary alone is more effective when it contains a small amount of text rather than a large amount of text. Their conclusions are that students can learn more effectively from a more concise summary, particularly when words and illustrations are presented together. However, the subjects in this study had a low level of knowledge of the subject; the researchers note that they would not have expected the same result with experienced learners. The results of this study parallel those of Chanlin (1997, 1998) in that the effect of visual treatment is more evident in students inexperienced in the subject domain, and that integrating visual and verbal elaboration strategies facilitate mental connections in learning.

McKay (1999) considered the learners' cognitive styles as well as their experience in the subject matter in a study comparing the use of text-only instructional materials with text-plus-graphics instructional materials. Subjects categorized as novice learners with verbal cognitive styles performed best with text plus graphics, while the novice imagery participants did better with the text only material; these findings were contrary to the expected outcomes. However, learners as a whole showed more improvement in test scores when using the text-plus-graphic format. Furthermore, novice learners from both learning style categories showed a greater improvement in scores than the experienced learners. The differences in responses by the novice and experienced learners are similar to reports from other studies (Chanlin, 1998; Mayer et al., 1996).

Variations in the types of still graphics used in instruction were investigated by Roshan and Dwyer (1998) who found no significant difference in achievement by students exposed to

different graphic mapping strategies. However, the time that students were exposed to graphics-enhanced instructional treatments affected learning outcomes. Students who were exposed to self-paced modules performed better than those who were involved in a structured time frame format, even though the self-paced group required less time to progress through the modules.

Variations in Visual Elements

Many forms of graphics for instruction and enhancing understanding exist. Visual organizers that incorporate illustrations and text to depict patterns of concepts and ideas serve as organizational frameworks to promote thinking and learning (Tarquin & Walker, 1997). Frameworks assist learners in visualizing how ideas may be related to prior knowledge, subordinate ideas, and information from other sources. Story maps that can be depicted as vertical or horizontal flow maps, Venn diagrams that prove useful in analyzing similarities and differences between two or more concepts, and frameworks for webbing that encourage thought regarding the whole and its parts are examples of visual organizers. KWL frameworks link prior knowledge with what the learner wants to know and with what the learner has learned; the framework can be expanded to address what the learner still wants to learn, serving as a catalyst for further research. Feature analysis frameworks use a grid design to represent the relationships of concepts within a category.

Problematiques use graphics as a language to identify complex and challenging problems by expanding the linear style traditionally used in teaching and learning to a non-linear format that expands the processing of information in a way that minimizes cognitive overload (Warfield & Perino, 1999). Other visual organizers include cause and effect frameworks, flow charts, and various types of charts such as checklists and scoring tools (Tarquin & Walker, 1997).

The use of visuals in education, although consistently shown to aid in learning, must be carefully planned. The use of visuals that steer the learner to the exciting or entertaining aspects of presentation rather than encouraging thoughtful analysis of the underlying meaning may interfere with the intent of the lesson (Sherry, 1996). In addition, Dwyer (as cited in Williams & Dwyer, 1999) suggests that visuals must be properly used in the educational setting since visualization alone does not function to maximize student achievement. The study by Williams and Dwyer of the effect of metaphoric strategies in the achievement of learning objectives indicates that the use of verbal and visual metaphors to complement visualized instruction is not always an effective instructional strategy.

Conclusions

The literature suggests that using visual elements in teaching and learning yields positive results. In order for visual enhancements to be used most effectively, teachers should possess skills that include the language of imagery as well as techniques of teaching visually; therefore, guidance in the area of visual literacy for instructors is warranted. Results of the impact of visual literacy in the classroom can be explored further through teachers examining their current use of visual elements and comparing visual content of lessons with student achievement. Additional research to develop tools that measure an individual's degree of visual literacy, including skills of creating and interpreting visual language, is important in evaluating the overall impact on student learning. Additionally, the identification of possible relationships among other factors such as learning styles and demographic characteristics is desirable for a comprehensive study of the concept of visual literacy.

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