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What We See and Why It Matters: How Competency in Visual Literacy can Enhance Student Learning

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Abstract

WHAT WE SEE AND WHY IT MATTERS: HOW COMPETENCY IN VISUAL LITERACY CAN ENHANCE STUDENT LEARNING

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In today's world, we use more visuals than ever before. Research suggests that the balance between words and images has shifted considerably calling for new forms of literacy (Brumberger, 2011). Visual literacy goes above and beyond the traditional concepts of reading and writing, expanding literacy to include visuals. The analysis and review of current visual literacy research suggests teaching visual literacy is necessary for students to become capable of navigating the visually driven world in which we live. The research highlights the importance of incorporating visuals into the literacy curricula and explores practical uses of visual literacy in present day society. Findings suggest that developing the ability to create images will help students better learn to decipher, understand and communicate with images. If there is a better understanding of how and why visuals are developed, then the use of visuals can become more effective, ergo enhancing student learning.

Keywords: visual literacy, visual communication, graphic design, visual literacy

competency

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Introduction

Background

It has always been apparent to me that I had affinity with children. How that would translate into a career was not always as apparent. The obvious choice when one wants to work with children is to go into teaching. That was my original plan, but something was holding me back. I was also interested in graphic design and did not want to fully commit to either discipline.

As a student, I have always preferred projects over other kinds of assignments. I felt that I came to master whatever I was studying when I could create something to "show what I know." I have always been curious whether this preference is just the way I think and process, or if all students could benefit from creating projects. I chose to research the intersections of my design skills and knowledge of educational practice.

Graphic design is all about a clear and concise way of visually communicating information. What drew me to graphic design was the constant challenge of thinking and problem solving that is needed to decide how to best represent the message. Much more goes into the creation of something than most people realize; there are endless factors that determine the final product. Graphic Design involves a lot of preparation, and research; one has to master of the content being presented, or it will not be effective. The process of producing a visual involves thinking about how others will interpret what you are presenting and trying to make the content accessible to everyone. Producing visuals is a way of connecting people with thoughts and ideas. In this respect, graphic design is just

like teaching. The core values and goals of the two disciplines–graphic design and education–are the same. I was determined to find the perfect blend as a course of study. When I stumbled across the concept of visual literacy, I completely immersed myself in the idea and spent days and nights researching my new interest. I learned that visual literacy goes above and beyond the traditional concepts of reading and writing and expands literacy to include visuals, or images. In this way, the field is the perfect combination of the elements I loved most about education and graphic design. I realized that I had found my passion, but how was I to pursue it?

My background in design and my knowledge of the role of cognitive processes in education have strengthened my learning experiences, and so I wanted to explore how I can help others achieve this same skill set (visual literacy). I developed visual literacy skills because I studied education and design, and the connection between the two. I honed in and worked on these skills on my own; I was never formally taught them in school. I believe, however, that visual literacy needs to be addressed and taught in schools because it can enhance how students learn through critical thinking and can be immediately applied in their lives.

With the help of a faculty advisor who seemed both a little baffled and impressed by my enthusiasm, I created an interdisciplinary major that would allow me to pursue a course of study in the field of visual literacy. What I have learned has led me to the pursuit of a way to better integrate visual literacy into school curricula.

Problem Statement

More visuals are used now than ever before, in the form of charts, graphs, pictures, or even the colors and design we select solely to create interest (Brumberger, 2011). A number of studies suggest that the balance between words and images has shifted considerably calling for new forms of literacy (Brumberger, 2011). Unfortunately, visual literacy receives relatively little attention in today's curricula (Brumberger, 2005; Yeh & Lohr, 2010). Elkins believes that "visual studies is poised to become one of the most interesting and conceptually challenging subject that has emerged in academic life in the last several decades" (2003, p. vii). He further points out that visual study as a field is barely more than a decade old. For this reason, most of the literature on the subject is in the exploratory stages, surveying existing programs, evaluating their effectiveness and searching out and testing new methods.

In schools, we focus primarily on the reading, writing and verbal forms of communication and neglect the form and quality of a student's visual skills in favor of his or her verbal skills (Yeh & Lohr, 2010). Visual skills include the ability to interpret, comprehend, and express ideas using or creating visuals, just as verbal and writing skills are the ability to interpret, comprehend and express ideas verbally or through writing. Brumberger suggests that "written and oral language must be complimented by proficiency with visual language" (2005, p. 320). Yeh & Lohr (2010) state that since the beginning of the 21st century, there has been growing documentation supporting the importance of visual literacy in education.

The importance of understanding how visuals are created and how to read them is relevant to students and anyone looking to expand their knowledge. This is especially true when one considers the growth of visual communication in the world. David Lewis put it best: "Their world is saturated with images, moving and still, alone and in all manner of hybrid combinations with text and sounds …Competence with images is now a prerequisite of competence in life." (2001; as cited in O'Neil, 2011, p. 222). The ever growing use of visuals accompanying new technologies means that visual literacy skills–being able to understand the how and why of visuals–are needed now more than ever. However, the research on the connection between the design of information, visual literacy, and education is limited. Therefore, it is necessary for everyone–especially students in schools–to acquire an understanding of what we see, and how it affects our learning and communication; in other words, "what we see, and why it matters." If there is a better understanding among us all of how and why visuals are developed, then the ways in which they are used can become more effective. Thus, the purpose of this inquiry is to explore the concept of visual literacy, what role it currently plays in education, whether we are prepared as individuals to keep up in a world that has come to rely on the many facets of literacy that go beyond reading and writing, and how educators can work to better prepare students for visual competency.

The research questions that have guided this study are as follows:

1. What is visual literacy, and why is it important?
2. How does visual literacy align with Best Practice Principles in education and the framework of levels of thinking presented in Bloom's Taxonomy?
3. To what degree is the "digital native" generation of students visually literate?
4. What teaching strategies might be used to enhance visual literacy and critical thinking?

Defining Visual Literacy

In order to assess visual literacy, one must first define the term. The term "visual literacy" was first introduced in 1969 by writer John Debes (Brumberger, 2011; Riddle, 2009; Yeh & Lohr, 2010). The International Visual Literacy Association has adopted Debes' definition of visual literacy:

> Visual Literacy refers to a group of vision-competencies a human being can develop by seeing and at the same time having and integrating other sensory experiences. The development of these competencies is fundamental to normal human learning. When developed, they enable a visually literate person to discriminate and interpret the visible actions, objects, symbols, natural or man-made, that he encounters in his environment. Through the creative use of these competencies, he is able to communicate with others. Through the appreciative use of these competencies, he is able to comprehend and enjoy the masterworks of visual communication (International Visual Literacy Association).

Even though Debes was the first to define and label "visual literacy," the use of visual cues or representations to communicate and interpret messages has been around since the dawn of human civilization (Burmark, 2002; Riddle, 2009; Yeh & Cheng, 2010). Once the ability to reproduce images for distribution became available, the use of visual imagery grew exponentially (Burmark, 2002; Riddle, 2009). Dastani (2002) explains that "visualization has become an important way for human beings to learn and perceive things" (as cited in Yeh & Cheng, 2010, p. 244) The importance of visuals as a

means of learning, perceiving and communicating has continued to grow even more with the advancement of new technologies such as computers, televisions, tablets, and smart phones.

The literature on visual literacy come from a wide variety of studies extending from mass communication, art and aesthetics, education, philosophy, psychology, linguistics, all the way to archeology (Moriarty & Kenney, 2005). The coexistence of so many disciplines at the foundation of the concept of visual literacy creates a major obstacle towards a unanimously agreed upon definition of the term (International Visual Literacy Association).

There are numerous definitions of visual literacy, each emphasizing various unique characteristics (Brumberger, 2011; Northcut & Brumberger, 2010; Yeh & Lohr, 2010). The various definitions range from unequivocally theoretical to highly pragmatic (Brumberger, 2011). Each author of documentation on visual literacy produces his or her own meaning of the term (International Visual Literacy Association) typically stemming from the concept of textual literacy.

Traditional textual literacy involves both reading and writing skills, which leads most visual literacy experts to interpret the concept of visual literacy in a similar manner. The growing trend in visual literacy definitions is to incorporate both an interpretative and a productive component (Brumberger, 2011). Visual literacy, in most cases, has come to include the capacity to understand, apply, analyze, evaluate and create visual material as essential parts of a whole. While not clearly stated in Debes' definition, many of the most recent studies show an overwhelming acceptance of this view. Yeh and Lohr

(2010) cites Braden's (1996) interpretation which includes the ability to think, learn, and express oneself in images. Brumberger (2011) cites Bleed (2005) who describes visual literacy as the ability to both interpret and create visual material. More recently, Yeh (2008) defined visual literacy as "the learned knowledge and skills needed to accurately understand, interpret and analyze visual messages and to create visual messages" (Yeh & Lohr, 2010). Brumberger (2011, p. 21) states that the best definitions "stipulate that the ability to analyze and interpret images, and other visual material, although critical, is not by itself sufficient for full visual literacy; it must be accompanied by some ability to create visual material" as well.

Visual Literacy and Educational Objectives

In 2003, the North Central Regional Educational Library prepared a list of specific visual literacy objectives for use by educators that incorporates analysis, interpretation and creation of visuals. The list specifies that visually literate students:

- Understand basic elements of visual design, technique and media
- Are aware of emotional, psychological, and cognitive influences in perceptions of visuals
- Comprehend representational, explanatory, abstract, and symbolic images
- Are informed viewers, critics, and consumers of visual information
- Are knowledgeable designers, composers, and producers of visual information
- Are effective visual communicators
- Are expressive, innovative thinkers and successful problem solvers

(North Central Regional Educational Library, 2003)

These objectives align with the educational theory of Benjamin Bloom as represented in his Taxonomy of Learning (1956) and Principles of Best Practice (Zemelman, Daniels & Hyde, 2005).

Bloom's Taxonomy was first written in 1956 as a classification for the cognitive domain of educational goals (Krathwohl, 2002). It served as a common language for educators to assess the breadth and depth of their curriculum (Krathwohl, 2002). Krathwohl explains that "the categories were ordered from simple to complex and from concrete to abstract. Further, it was assumed that the original Taxonomy represented a cumulative hierarchy; that is, mastery of each simpler category was prerequisite to mastery of the next more complex one" (2002, p. 212-213). Since its inception, the framework has been accepted worldwide. It has been translated into 22 languages and is frequently cited (Krathwohl, 2002). Forty-five years later, the Taxonomy was revised and the wording was changed in order to represent a fuller range of cognitive processes (Krathwohl, 2002; Mayer, 2002) and promote meaningful, rather than rote, learning (Mayer, 2002). Meaningful learning can be defined as is the ability to remember material, and use what was learned to solve new problems (Mayer, 2002). The new categories of the Revised Taxonomy are *Remember, Understand, Apply, Analyze, Evaluate,* and *Create* (Krathwohl, 2002; Mayer, 2002).

In order to support the concept of meaningful learning, educators utilize what they believe to be the Best Practice Principles of teaching and learning. The term "Best Practice" originated in medicine, law, and architecture to indicate when a professional is aware of current practice and offers clients the benefits of the latest knowledge, technology, and procedures (Zemelman, Daniels & Hyde, 2005). Educators have adopted

this term to indicate what they believe to be the Best Practice methods of teaching. Ultimately, their philosophy is a movement towards a classroom that promotes student autonomy, creativity and community through non-traditional methods. The principles were first introduced in 1993, and stemmed from leaders in the American education system–professional groups, researchers, and content area authorities–and draws from scientific research that is both experimental and qualitative in nature (Zemelman et al., 2005). There are a growing number of educational texts which adopt these practices. (Bizar & Daniels, 2005; Zemelman et al., 2005).[1]

The definition of visual literacy that resonates most with me encompasses the stipulations set forth by the North Central Regional Educational Library (NCREL) and by Brumberger (2011) because they are aligned with Bloom's Taxonomy and the Best Practice principles, particularly the cognitive and student-centered sets of principles. Mayer points out that, "if you wish to expand your focus by finding ways to foster and assess meaningful learning, you need to emphasize those cognitive processes that go beyond remembering" (2002, p. 228). Early definitions of visual literacy focus primarily on the lower cognitive levels of Bloom's Taxonomy: remembering and understanding. The objectives proposed by the NCREL are more extensive and encompass the idea that visual literacy is more than just the basic levels of cognition. In my limited experience and research, I have found that incorporation of visual literacy into instruction is quite possible. Incorporation also easily aligns with Best Practice and Bloom's Taxonomy to create meaningful learning experiences.

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[1] For details of the Best Practice Principles, Bloom's Taxonomy and visual representations of the overlap between education and graphic design, and visual literacy and meaningful learning, see the Appendix.

First Introduction to Visual Literacy: Remembering

At its most basic level, deriving clues from a picture is no different from how a child observes and reacts to his or her own surroundings (O'Neil, 2011). Some, but not all, of the modes of acquiring visual literacy proficiency can be developed through social interaction and observation (O'Neil, 2011). However, leaving the achievement of visual literacy to chance can lead to gaps in the knowledge and comprehension of students (O'Neil, 2011).

When children are first introduced to literature, it is often in the form of picture books. Children learn to associate the pictures with meaning because they cannot read the words on the page. The illustrations or imagery help guide the understanding and foster a comprehension of the story being told. Authors and illustrators utilize the interaction of the words and pictures to enhance the telling of a complex and meaningful story (O'Neil, 2011). Wolf explains that "from the very first look at a [picture] book, you get a message about its content" (2003, p. 234, as cited in O'Neil, 2011). Borgia and Owles (2010) point out that even for young or new readers, visual text and the visual arts play an important role in reading and writing.

O'Neil (2011) believes that there may be hesitation to teach visual literacy in the classroom because teachers themselves feel that they are inadequately trained in visual literacy strategies. O'Neil suggests that many familiar reading comprehension strategies, such as text-to-text connections, inference, visualizing, determining the main idea, and questioning can be applied to pictures in order to teach visual literacy in a more relatable manner for teachers and students alike (2011). For that reason, when one teaches children

to read using picture books, one should also teach them to read images. There are ample opportunities for beginning readers to develop basic visual literacy skills using picture books. In addition to what is obviously depicted, the pictures implicitly provide information to be inferred and understood (O'Neil, 2011). This implicit knowledge can be discovered through visual literacy skills.

Although integrating visual images into existing reading comprehension is a step in the right direction, it only addresses the first half of the definition I have come to accept as my own. Reading comprehension instruction only addresses the lowest cognitive functions of remembering and understanding. In order to be literate, in both traditional text and in visuals, higher cognitive functions must be addressed and applied. "Ultimately visual literacy must be included within all school curricula if teachers want to adequately prepare students for a world that is surrounded by and driven by images (Seglem & Witte, 2009)

Science Diagrams: Understanding

Authors McTigue and Flowers (2011) examined the use of visuals in science texts. Prior to this article, very few studies had been conducted to investigate the role of visuals in science texts and whether students were actually utilizing them and understanding them. The same applies to mathematics and visual literacy–the literature is not readily available and I found no specific studies in this area. In general, the literature focuses mainly on the use of visual literacy in regards to language arts, literature, and social studies. According to McTigue and Flowers (2010), when preparing students to read science texts, the main focus is on the vocabulary and words with very little

attention given to visual diagrams. The purpose of McTigue and Flowers' 2011 "exploratory study was to better understand elementary students' perceptions of science diagrams and their skills related to diagram interpretation" (p. 579). They believed that "diagrams found in science texts can be complex repositories of meaning and students can benefit from instruction in how to unlock them" (p. 578). Their study revealed insights from students as to how diagrams are used, their purpose, and strategies for utilizing the diagrams (McTigue & Flowers, 2011). The authors concluded that diagram interpretation skills are not intuitive to students, and suggest, like O'Neil (2011), that the visual literacy skills needed to interpret science diagrams should be integrated into existing reading comprehension instruction in order for students to better understand and interpret the diagrams.

Visuals and Vocabulary: Applying

The visual elements of a text can help develop vocabulary skills as students connect the visual concept with words. As their vocabulary increases, they begin to make connections to the concepts being explored as well (Borgia & Owles, 2010). The connection between is an example of how visual data can be used at application level of Bloom's taxonomy. However, it is not representative of the Best Practice Principle of active learning.

Visual Thinking Strategies: Analyzing

Pardieck (2012) focuses not only on reading visuals, but also analyzing them, a step up in Bloom's Taxonomy of higher order thinking. In a collaborative effort with the Teaching with Primary Sources (TPS) consortium, Pardieck worked with pre-service and

in-service teachers in an effort to develop learning activities for students, pre-Kindergarten through high school. Pardiek believes that an effective strategy is encouraging students to view the image as a whole and describe what they see. From there, they can begin to analyze specific details of the image to further interpret it and assign meaning to it as a whole (Pardieck, 2012). When students are asked questions as they view artifacts and objects, they reflect on their prior knowledge and experiences to interpret and analyze new visual material. This practice of questioning aligns with Best Practice Principles in that it is reflective, holistic and cognitive. "Modeling question asking and discussing the meaning of photographs, images, and graphics helps students to use and demonstrate their thought processes as they view and validate visual images" (Allington, 2012; as cited in Pardieck, 2012, p. 29). By using these strategies in a social studies setting, for example, students can connect prior knowledge and past personal experience to the artifact and formulate their own questions and express their thoughts (Pardieck, 2012).

Often, this approach to questioning and learning is called "Visual Thinking Strategies" (VTS). VTS is an inquiry-based approach to questioning that utilizes the basic questions "what do you see in this picture?", "what makes you say that?" and "what else do you see?" Rawlinson et al. (2007) claims that VTS is a learner-based method that helps to build fundamental visual literacy abilities and sets a foundation upon which to build more complex critical thinking and reasoning skills.

Rawlinson et al. (2007) studied how effective VTS is as a foundational strategy to build critical-thinking skills, similar to the processes of Bloom's Taxonomy. From there, a multi-modal, or Best Practice, approach that integrates visuals and promotes creative,

artistic responses (Rawlinson et al., 2007). Their study identifies the interconnection between visual literacy and critical thinking (Rawlinson et al., 2007). Their study follows the Artful Citizen project, a museum-school partnership funded by the U.S. Department of Education. The Wolfsonian Museum education staff worked with the Miami-Dade County Public Schools, the fourth largest public school system in the United States. More than 25% of its 400,000 students are immigrants, and 68% of the children come from non-English speaking homes. In addition, a large number of children come from low-income homes. "Artful Citizenship was designed to target critical thinking as well as visual literacy skills of low-performing third- through fifth-grade students" (p.157). The program was intended to increase a student's ability to identify social, personal, or political conflict; use cultural or historical context to analyze the problem and culminate in creating design solutions for the socially-focused issue (Rawlinson et al., 2007), thus engaging all levels of Bloom's Taxonomy.

The program was structured as a journey along which the students created a travel log of their activities and experiences. On the surface it seems counter-intuitive to Best Practice and the philosophy of VTS, however, the way in which the activities were designed not only for delivery of information, but to record their own responses, allowing for ownership. Rawlinson et al. (2007) states that "the VTS process models positive teaching skills for the teacher such as:

- shifting the learning process from the teacher relating expertise to passive students, to one where the students are actively engaging in an empowering discovery process

- stressing active and respectful listening, not just by the teacher, but also among the students
- modeling positive student behavior and a way for students to voice diverging opinions in a constructive way
- challenging the teacher to remain neutral in response to all student opinions, which encourages increased participation from all students, not just "right answer" students
- and positioning learning as serious, but still engaging and even "fun work"

This process addresses Bloom's Taxonomy as well as many of the Best Practice principles and methods (Rawlinson et al., 2007). "Teachers commented that students were more engaged by the visually-appealing workbook and VTS discussions than other classroom activities" (Rawlinson, et al., 2007) Findings from their three-year study indicated that students with increased visual literacy also had improved scores in state assessment.

Visual Literacy from the Student Perspective: Creating

Benson and Lunt claim that most perceptions and documentation of visual literacy efforts are from the perspective of the educators. Very rarely are the students' perceptions of their own learning and skill sets considered as primary research (Benson & Lunt, 2011). Benson and Lunt (2011) note that "children naturally have very particular and important insights to offer in helping us to develop our understanding of teaching and learning" (p. 679). Although this study was conducted in England, the indications correlate with similar findings in the United States. Benson and Lunt based their findings on 15 years of educational research and three separate reviews by members of the

Department for Education and Skills in London (Benson & Lunt, 2011). In 1990, the National Curriculum in England added the subject of Design and Technology (D & T; Benson & Lunt, 2011). Although there is no specific mention of how often the class meets, it can be assumed by the title *We're Creative on a Friday Afternoon* that they met at least once a week and were allowed creative control in how they complete their projects. Before then, practice in primary school merely encompassed arts and crafts rather than engaging students in their own creating, designing and evaluating of work (Benson & Lunt; 2011).

> Essentially Design and Technology is concerned with designing and making a quality product/s for a specific need with a particular user in mind. The children develop their capability through product analysis and evaluation, the development and use of appropriate knowledge and understanding, the development of their practical skills as they work with a variety of tools, equipment and materials, the links made with other relevant subjects, and investigating cultural, social and environmental issues. The children are involved in this holistic, iterative, not sequential, process, operating in real life contexts. (p. 680)

When the children were asked what they thought of the D & T program, 85% agreed that they learned how to be creative by "thinking up ideas in different ways" and "trying out different ways of using materials" (2007, p. 682). In the D & T program, the children felt empowered by taking ownership of their work – a goal of Best Practice. Children are rarely given the opportunity to take control of the activities in which they engage (Benson & Lunt, 2011). The key elements of the program emphasized ownership

and control, relevance and motivation, and interaction with others–all of which are Best Practice principles (Benson & Lunt, 2011).

Degree of Visual Literacy

Current data shows that by the time students reach the post-secondary level, they are still lacking the skills to be considered visually literate citizens (Brumberger, 2011). It is assumed that today's students are particularly visually literate because they are "digital natives" or "millennial learners" (Brumberger, 2011). Digital natives are defined as students who have grown up surrounded by new technologies such as computers, video games, and cell phones (Brumberger, 2011). According to Mark Prensky, who coined the term digital native, the repeated exposure to these technologies has resulted in "enhanced thinking skills in several areas; many of which are visually oriented" (Brumberger, 2011, p.29) therefore having implicit visual literacy skills. Oblinger and Oblinger support this theory and suggest that "digital natives have an inherent ability to read images; that [they] are 'intuitive visual communicators' who are 'able to weave together text, images and sound in a natural way" (Brumberger, 2011). They further insinuate that the digital native generation is more visually literate than any other generation that precedes it (Brumberger, 2011).

This argument is not uncommon. It is supposed that because, as a generation, students are constantly bombarded with visual information, that they are inherently visually literate. Brumberger (2011) believes that advocates of this notion rarely provide empirical evidence or classroom studies to back up or support this claim. As a whole, students themselves think this generation is more visually literate than the data suggests.

Brumberger (2011) set out to discover if students were visually literate by examining their use of, and proficiency with, technologies that are visually-oriented, and the skill sets that they use to interpret the images. One question revealed that respondents preferred verbal directions and very few relied on visual displays offered by Mapquest or Google Maps. This seems "contradictory to the notion that they prefer visual material over text" (Brumberger, 2011, p. 28).

The same study by Brumberger indicated that students are "not particularly adept with video production technologies" (2011, p. 29). Although many of the respondents considered themselves skilled with presentation software, the study revealed that many do not use visuals within their presentations. Only 38% considered themselves skilled with photo/image editing software. The survey data is consistent with other studies that indicate graphics usage is one of the weakest skills among students using software (Brumberger, 2011). Furthermore, web authoring skills were also lacking among the students surveyed.

Brumberger's data shows that, when asked to analyze and interpret images, students were unable to recognize the authenticity of Pulitzer Prize winning journalistic photographs, and considered many of the images to be altered (Brumberger, 2011). Respondents were unable to pick up visual clues from the photographs that give information as to event, location, or even the decade in which the photo was taken. Even when multiple choice textual answers were given as aids, less than half of those surveyed were successful at correctly interpreting the images (Brumberger, 2011).

"Given the tendency for students' to overestimate their technology skills," Brumberger's study suggests that students' visual literacy skills are even weaker than they think. Ultimately, the focus should not be on how proficient students are at interpreting images, but on how proficient they need to be" (Brumberger, 2011, p. 44). The ability to create and/or interpret visual images is becoming more important, regardless of academic or professional discipline. It would be invaluable for educators to have an empirical foundation on which to base strategies for improving student skills as we teach them to become "more informed and critical consumers of visual materials" (Brumberger, 2011, p. 45).

Visual Literacy, Design Principles and Pre-service Teachers

With a full understanding of the importance of visual literacy and recognizing that there is still a gap between actual competency in visual literacy and perceived competency, it becomes the task of educators to stay current with Best Practice and formally incorporate visual literacy skills into the mainstream of school curriculum, instruction, and assessment (enGauge: 21st Century Skills, p. 10).

In essence, the process behind designing something and the process behind learning something have the same goals and outcome. Both designers and educators work to create a mutual understanding of the material being delivered (Adiloglu, 2011). Just as showing one's work in a math problem, not just the answer, the sketch and finished work of a designer might have a clear connection, but the process of design often reveals more than the finished work in regards to the thought processes used to problem solve. According to Milton Glaser, an esteemed graphic designer, "design is a process of

searching and seeking . . . the sketch or rehearsal reveals the thought process of the creator in a way that a finished work is unable to" (as cited in Adiloglu, 2011, p. 984). Design, like education, works to create a unique approach to problem solving (Adiloglu, 2011). Design involves many different problem solving skills (Adiloglu, 2011) and challenges its user to think beyond just one method and answer prompting him or her to think critically, using multiple levels of Bloom's Taxonomy. It establishes the critical thinking skills that teachers want to foster in the classroom. Learning through design benefits observation, cognitive reasoning and/or communication (Adiloglu, 2011).

Thus it becomes necessary to evaluate how pre-service[2] teachers define visual literacy, gauge if they can accurately interpret instructional materials, and most importantly, suggest improvements to make the materials more clear and concise. Yeh and Lohr (2010) describe how eight pre-service teachers fared at understanding and interpreting using design principles. The teachers were given a handout of visual design principles focusing on contrast, alignment, repetition, and proximity (CARP) and four visuals: a Venn diagram, an algebraic equation, a bar graph, and a map of the U.S. circa the 1760s. The pre-service teachers were able to analyze and reproduce the visuals. Although their degrees of visual literacy skills were not measured prior to the study, the similarities in their responses imply that the knowledge of visual design principles (CARP) can be an effective framework for teaching these same skills (Lohr, 2008; Williams, 2008; as cited in Yeh & Lohr, 2010). A further study of the influence of design principles on the visual literacy skills of pre-service teachers by Yeh and Cheng also concludes

[2] I contend that it is necessary to assess all teachers' understanding of visual literacy, but in this review, I focus on pre-service teachers, in order to limit the scope of the study.

> that incorporating the instruction of visual design principles in the educational technology curriculum for pre-service teachers provided a good opportunity to improve their visual literacy. Living in this visual world, people need the ability to visually communicate with each other. Pre-service teachers will become those who influence the next generation to survive the future. Therefore visual literacy is suggested to be included in the curriculum in order to equip pre-service teachers with the competence to create effective visual instructional materials, help students understand and analyze instructional visuals and pass on knowledge and skills of visual literacy to their students – the next generation (2010, p. 251).

Using Tools to Further Visual Literacy

Hyerle states that his introduction to visual literacy as a teacher began with mind mapping and webbing techniques in the early eighties. Since then, he has noted that various education professionals (e.g., teachers, administrators, curriculum designers, test makers) use visual representations of information to make connections and show relationships (Hyerle, 1996). He observed that though his students were able to display a wealth of knowledge, they were unable to further organize, analyze and evaluate their findings (Hyerle, 1996). In response, he developed eight types of mapping tools which he calls "thinking maps." These maps gave his students choices on how to organize their information based on the type of information they were evaluating. Certain maps were better suited for certain subjects. He concluded that using these mapping tools was a good first step to furthering visual literacy.

As we learn to use the various tools available in an effort to promote visual literacy we must also be cognizant of how these tools are being used and their effectiveness.

However, it must be noted that tools do not make the design (Northcut & Brumberger, 2010). Often times, the ability to use technology to create a visual gets mistaken for visual literacy, but one must also have the "understanding of why technology is used, how it supports the communication task, and how it shapes the final product" (Northcut & Brumberger, 2010, p. 461). Based on her years of experience as a teacher, Brumberger has observed that students often believe that tools should play a greater role in curriculum. She notes that when students become proficient with a tool, they assume that they have acquired a useful skill without recognizing that the theory and concepts being taught should weigh more and be considered more valuable. Northcut's account of her recent experiences in teaching echo that sentiment – students lose sight of the objectives in the face of interesting techniques. Both Northcut and Brumberger propose that "students need a carefully balanced mixture of hands-on experiences coupled with a large dose of critical thinking about the designs they produce. Both are essential to effective visual communication."

Conclusion

In each of the studies reviewed, whether implied or explicit, there was a call for additional studies; thus the conclusions presented here are tentative, to be revisited again. The literature shows that there is a growing interest in visual literacy and visual studies. Each author has a slightly different interpretation of visual literacy and what role it plays

in educational goal setting.

In some cases, only the very basic levels of cognitive functions are being utilized when teachers address visual literacy in the classroom, which means that visual literacy competency is not being reached. At the same time, I believe that teachers, whether consciously or unconsciously, and by varying degrees, align visual literacy concepts with Best Practice Principles and the cognitive process of Bloom's Taxonomy. However, at this point in time the connection has not been addressed fully and is not strong enough.

"Digital natives" do not inherently possess visual literacy skills and are not as visually competent as one would assume. If teachers utilize design principles with an understanding of tools and principles in their classrooms, they can help students achieve full visual literacy competency, implement the Best Practice principles, and take students skill levels to the top of Bloom's Taxonomy pyramid. The result would be enhanced student learning. When visual literacy competency is achieved, every student will be better prepared for the visually driven future they will inevitably encounter.

> We are not looking for a prescription that dictates what should be done…but rather map visual [literacy] teaching in ways that would allow teachers and researchers to see that territory more clearly, to convey more easily what they know, to ponder alternate routes, and to learn more readily from more experienced travelers (Hetland, Winner, Veenema & Sheridan, 2007).

Appendix

Best Practice Principles	
Student-Centered	The best starting point for schooling is young people's real interests; all across the curriculum, investigating students' own questions should always take precedence over studying arbitrarily and distantly selected "content".
Experiential	Active, hands-on, concrete experience is the most powerful and natural form of learning. Students should be immersed in the most direct possible experience of the content of every subject.
Holistic	Children learn best when they encounter whole ideas, events, and material in purposeful contexts, not by studying subparts isolated from actual use.
Authentic	Real, rich, complex ideas and materials are at the heart of the curriculum. Lessons or textbooks that water down, control, or oversimplify content ultimately disempower students.
Challenging	Students learn best when faced with genuine challenges, choices, and responsibility in their own learning.
Cognitive	The post powerful learning comes when children develop true understanding of concepts through higher-order thinking associated with various fields of inquiry and through self-monitoring of their thinking.
Developmental	Children grow through a series of definable but not rigid stages, and schooling should fit its activities to the developmental level of students.
Constructivist	Children do not just receive content; in a very real sense, they recreate and reinvent every cognitive system they encounter, including language, literacy, and mathematics.
Expressive	To fully engage ideas, construct meaning, and remember information, students must regularly employ the whole range of communicative media – speech, writing, drawing, poetry, dance, drama, music, movement, and visual arts.
Reflective	Balancing the immersion in experience must be opportunities for learners to reflect, debrief, and abstract from their experiences what they have felt and thought and learned.
Social	Learning is always socially constructed and often interactive; teachers need to create classroom interactions that "scaffold" learning.
Collaborative	Cooperative learning activities tap the social power of learning better than competitive and individualistic approaches.
Democratic	The classroom is a model community; students learn what they live as citizens of the school

From: Zemelman, S. D. (2005). *Best Practices: Today's standards for teaching & learning in America's Schools.* Portsmouth, NH: Heinemann.

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