Digital Literacy: A Demand for Nonlinear Thinking Styles

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Abstract: This paper makes a case for a direct relationship between digital literacy and nonlinear thinking styles, articulates a demand for nonlinear thinking styles in education and the workplace, and states implications for a connection between nonlinear thinking styles visual literacy, and intuitive artistic practice.

In July of 1945, Dr. Vannevar Bush wrote an article for *The Atlantic Monthly* titled "As We May Think." In this article, Bush discusses the huge amounts of information and knowledge being obtained and stored by humanity. He argued that the process society promoted of obtaining information was set to a linear manner or what he called "the artificiality of systems of indexing" (p.11). This system was defined as artificial because it went against the natural associative/nonlinear process of the human mind for accessing information (Bush, 1945). The Internet, a construct that is designed to be accessed and comprehended in an associative/nonlinear manner, provides the system Bush so much desired. As a result, the Internet has created a demand for nonlinear thinking styles. The literature states that nonlinear thinking styles are a necessary skill within the larger theoretical framework of digitally literacy (Eshet-Alkalai & Chajut, 2009; Lambert & Cuper, 2008; Leu et al., 2011). Nonlinear thinking styles are defined as using intuition, insight, creativity, and emotions when comprehending and communicating information (Vance, Groves, Paik, & Kindler, 2007). This paper defines nonlinear thinking styles, makes a case for a direct relationship between digital literacy and nonlinear thinking styles, articulates a demand for nonlinear thinking styles in education and the workplace, and states implications for a connection between nonlinear thinking styles, visual literacy, and intuitive artistic practice.

A Lack of Integration of Nonlinear Thinking Styles

Currently, there is a lack of integration of nonlinear thinking styles found in training pre-service teachers and in preparatory management curricula for working professionals (Vance et al., 2007). Effective planning, thinking, and problem solving in today's business world requires the inclusion of nonlinear approaches (Buenger, Daft, Conlon, & Austin, 1996; Sternberg, 2002; Zaccaro, 2002). Furthermore, there is a limited amount of research that exists concerning nonlinear thinking styles (Vance et al., 2007). Although the study of linear and nonlinear thinking styles has gained increased popularity among management scholars, there remains little attention to nonlinear thinking styles in student populations and whether such thinking styles are affected by particular contextual variables. Such findings would raise a variety of implications for training pre-service teachers, curriculum developers designing instructional materials, and educational leaders developing ICT policy for schools.

What are Linear and Nonlinear Thinking Styles?

Groves, Vance, Paik, Kindler (2007) propose that linear thinking styles are a "preference for attending to external data and facts and processing this information through conscious logic and rational thinking to form knowledge, understanding, or a decision for guiding subsequent action" (p. 5). Vance et al. (2007) define nonlinear thinking styles as a "preference for attending to internal feelings, impressions, and sensations when comprehending and communicating

information" (p. 5). These definitions are based on two fundamental dimensions creating a theoretical framework. The linear dimension involves rationality, logic, and analytical thinking concentrating on external factors for comprehension and communication. The nonlinear dimension is related to intuition, insight, creativity, and emotions, concentrating on internal factors for comprehension and communication.

A Direct Relationship between Digital Literacy and Nonlinear Thinking Styles

With new demands for meaningful and contextual application of technology in classrooms, there is an increasing demand for teachers to integrate digital literacy skills and nonlinear thinking styles into curriculum development (Lambert & Cuper, 2008). Online media challenges the learner to organize and compose information in a nonlinear manner, demands user interactivity, and allows for control of progress and choice in the construction of knowledge (Lambert & Cuper, 2008). These shifts pose new challenges for individuals in evaluating and understanding information and necessitate additional skills for effective literacy. Increasingly, this skill set is being called digital literacy.

The growth of technology has brought about a number of important shifts of emphasis in terms of literacy over the past two decades. One of the most important has been the shift from fixed to fluid texts where reading and writing paths have become nonlinear in contrast to linear historical texts (Merchant, 2007). These shifts also pose new challenges for individuals in evaluating and understanding information and necessitate nonlinear thinking styles for effective information and communication processing in the larger realm of digital literacy (Coiro, Knobel, Lankshear & Leu, 2008).

A Demand for Nonlinear Thinking Styles in the Workplace and Education

Pink (2005) has said we are "moving from the Information Age to the Conceptual Age" (p. 33). Rapid technological change and increased competition abroad has placed an emphasis on the skills and preparation of people entering the workforce. In particular, people need to be able to adapt to changing technologies and shifting product demands. Today, businesses cannot just create functional and reasonably priced products, they must create products that are unique, enticing, and meaningful (Pink, 2005). These shifts in the nature of business are demanding and putting a focus on non-routine cognitive skills, such as abstract reasoning, problem solving, creativity, nonlinear thinking, communication, and collaboration on all levels of employment (Karoly & Constantijn, 2004). Currently, the United States standardized K-12 school curriculum does not teach to these skills, nor are they advanced in most colleges and universities. The nation's approach to learning in schools and training for work are mismatched to the demands of our new technological environment (Davidson, 2011). Educational environments and the workplace have been and are still primarily designed to reinforce our attention to regular, systematic tasks that are approached in a purely linear fashion (Davidson, 2011). Linear thinking is built into people's everyday lives, governing how they go about learning, creating, buying, and even rewarding one another. Due to its efficiency, linear thinking styles have become an almost universal characteristic affecting our social lives as much as our educational and professional ones (Bratianu & Vasilache, 2009).

The history of American education and its workplace has relied on linear concepts of learning and output, but today there is an ever-increasing demand for nonlinear thinking styles and highly creative output (Carlson & Kaiser, 1999; Gupta & Govindarajan, 2002; Hitt, 2000; Hitt, Keats, & DeMarie, 1998; Kedia & Mukherji, 1999). The current curriculum in the United States has become restricted to what can be tested, encouraging schools to separate the cognitive from the affective, defining thought as being either qualitative or quantitative as opposed to both

and denying the important role of the senses in concept formation (Dorn, 1999). This leaves little room for creative nonlinear components within curriculum development. Yet, in today's age of access and relative abundance, the only way to distinguish one's output is to appeal to the emotional side of people, not just the rational, logical, and functional needs (Pink, 2005). The workplace demands productivity infused with creativity on all levels. The creative process is nonlinear, deductive and iterative at the same time. One finds their way to an end by using a series of complex cognitive demands. Today's cognitive demands for creativity can be met with nonlinear thinking styles that take advantage of insight, intuition, and emotion, all of which are inherent in the creative thinking process (Dorn, 1999; Eisner, 2002; Vance et al., 2007).

The National Association of Colleges and Employers (NACE) Job Outlook 2012 survey states that the ability to make decisions and solve problems, and the ability to obtain and process information, are two of the top four most important candidate skills/qualities employers are looking for. Problem solving can benefit from nonlinear thinking styles. Nonlinear thinking styles solve problems through an indirect and creative approach, using reasoning that is not immediately obvious and involving ideas that often are not reached by using only traditional step-by-step logic. Nonlinear thinking styles allow users to arrive at novel and unexpected conclusions from multiple perspectives (Sternberg, 2006). The second ability mentioned by the report, the ability to obtain information, is a foundational skill of digital literacy often called information literacy. Information literacy is defined as the ability to consume information critically and sort out false and biased information (Eshet-Alkalai & Chajut, 2009). Nonlinear thinking styles take advantage of today's nonlinear multimedia tools of the Internet (such as hyperlinks) to conquer such tasks. The inclusion of nonlinear thinking styles leads to effective skills in desired areas by employers. To prepare future workers for the new demands of the workplace, professionals in the field of education need to develop assessment tools and design curriculum that builds nonlinear thinking style skills.

Implications: A Relationship between Nonlinear Thinking, Visual Literacy, and Intuitive Artistic Processes

Along with the demand for nonlinear thinking styles, the Internet demands users to be visually literate to advance critical thinking, decision making, communication, creativity, and learning on the web. With much of today's media delivered in visual form, students need visual literacy and artistic skills to understand, interpret, and create information (Lambert & Cuper, 2008). We have shifted from a culture that passively received information from the Web to one that is asked and encouraged to actively participate by augmenting or generating new content (Bonk, 2009). Information now integrates images, video, sequences, design, form, symbols, color, 3D, and graphic representations. Users need to know how to interpret visual messages and obtain deeper meanings from those images on a constant basis (Lambert & Cuper, 2008). The graphic user interface of the World Wide Web is only part of the visual world people must navigate. It is no longer the province of advanced professionals to use visualization tools to represent information. Dropping costs and improved technologies have placed powerful multi-media tools in the hands of the average populace. People are now expected to interpret and communicate in multi-modal fashion. Visual literacy has become a necessary skill for the 21st century.

Visual literacy increases observation skills, evidential reasoning, speculative abilities, and the ability to find multiple solutions to complex problems (Yenawine, 1997). Visual literacy can be defined as a set of abilities that enables an individual to effectively find, interpret, evaluate, use, and create images and visual media (ACRL, 2011). Non-linear thinking and intuitive

artistic processes common to the visual arts and visual literacy may be useful to the development of digital literacy skills. Eisner (2002) says the arts teach us qualitative relationships, complex forms of problem solving, how to celebrate multiple perspectives, that the limits of our language do not define the limits of our cognition, and that small differences can have large effects, all ideas that are linked to nonlinear thinking styles. Eisner (2005) goes on to discuss how the arts teach us to act and judge in the absence of rule, to rely on feel, to pay attention to nuance, to act and appraise the consequences of one's choices, and to revise and then make other choices. Vance et al. (2007) consider intuition, insight, creativity, and emotion as four cognate but distinct approaches that are interrelated forms of nonlinear thinking. Eisner's concepts of what art can teach relates to the approaches of interrelated forms of nonlinear thinking proposed by Vance et al. (2007). To rely on feel is a form of intuition and emotion; to pay attention to nuance and appraise the consequences of one's choices is a form of insight. Creativity is foundational to the arts and nonlinear thinking styles. The interrelation of these theoretical concepts leads to the possibility that engagement in the arts could promote particular nonlinear thinking styles and therefore digital literacy skills.

Conclusion

The literature states that nonlinear thinking styles are a necessary skill within the theoretical framework of digital literacy. This paper made a case for a direct relationship between digital literacy and nonlinear thinking styles, articulated a demand for nonlinear thinking styles in education and the workplace, and stated implications for a connection between nonlinear thinking styles and intuitive artistic practice. The theoretical significance of this area of study is to create a new theoretical framework for indentifying nonlinear thinking skills. The practical significance to this area of study is to begin the development of an instrument designed to measure nonlinear thinking styles in students and permit educators to design curriculum and developmental approaches that are effective for increasing nonlinear thinking styles, teaching toward the effective use of technology and the comprehension of information through technology. Advancement in this area of research would raise a variety of implications for institutions training pre-service teachers, curriculum developers designing instructional materials, and educational leaders developing ICT policy for schools.

The challenge for educators, administrators, and policy makers is to accurately diagnose individuals' thinking style and provide the correct development opportunities that address their less preferred thinking modality to achieve a synergistic pattern that fully uses their strengths.

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