Chapter 87
What Does Learning Look Like?
Data Visualization of Art Teaching and Learning

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ABSTRACT

Drawing upon the data visualization work of Lev Manovich and Manuel Lima, in this chapter the author discusses ways for envisioning and representing the complex teaching and learning that is associated with the visual arts. Experiences and examples are shared that use new and old technologies to create and make connections among critically reflective collections of student learning artifacts such as research, journals, preliminary sketches, work in other classes, and realms of experience outside of school. Instead of relying on one final art product, the author explores embedded data mining and visualization as a viable approach to gauging student learning. Following the lead education notables Elliot Eisner (2002, 2004), John Dewey (1934), and Howard Gardner (1985), this research positions the visual arts as a common thread throughout disciplines. Such inherent and fundamental visual arts practices as portfolios, project-based instruction, and exhibition continue to expand instruction and learning in such classes as English, math, science, and history. The implications include the possibility that art education will lead the way to implementing authentic embedded assessment processes across education disciplines and grade levels.

INTRODUCTION

Most every art teacher and artist knows that a work of art is not simply one work of art. It is a combination and progression of many and varied ideas, influences, research, dreams, risks, and other life and learning experiences too numerous to mention. What if there were a way to critically capture and actually represent this process of learning and making art? How would it work and what would it look like? These questions guide and challenge this evolving research that actually began in 1999.

Drawing upon experiences from a 2-year computer hypertext-based high school art study[1] (Taylor, 1999) and a 3-year beta software development study of a virtual 3-d linking environment[2] (Taylor, 2014),

this research is challenged and extended through data visualization theory and practice. Specifically, this chapter will focus on data visualization principles (Lima, 2011; Manovich, 2012) and design thinking methods/categories (Berger, 2009) as possible approaches for mining and representing new and old technological data associated with teaching and learning in the visual arts. Additionally, critical and valuable social aspects of data visualization theory will be shared to represent as well as problematize sample visual representations of learning.

UNDERSTANDING DATA VISUALIZATION THROUGH AN ARTIST'S EYE

Much like the typical pie charts and bar graphs seen in math class and political analyses, data visualization functions as a way to visually represent data sets. Supposedly, such visualizations provide a clearer way to see and understand data analyses than through a narrative explanation alone. The idea of representing data in illustrative ways actually dates back to Prehistoric art with cave paintings, as well as to the carvings, scrolls, story vases and petroglyphs of ancient Egyptians, Greeks, Mayan, and Native Americans. Human beings have a strong need to see and understand data visually. Be it to provide directions, explanations, plans, strategies, or proof of an argument, more often than not a pen, pencil, computer stylus or touch pad is used to further an explanation. In the case of such artists as Leonardo da Vinci, the data visualized and indeed discovered stands the test of time. Cases in point may include the *Vitruvian Man*, images of flying machines, and the *Mona Lisa's* androgyny (Boucher, 2003).

A leading voice on information visualization, Manuel Lima is a Senior UX Design Leader at Microsoft Bing and founder of VisualComplexity.com – a visual exploration on mapping complex networks. His 2011 book entitled *Visual Complexity: Mapping Patterns of Information* is a compilation and critical representation of the processes, ideas and concepts of making data comprehensibly, logically, and beautifully visual. Lima's interests in this line of research began with his MFA thesis at Parsons School of Design in 2005. His *Blogviz* project mapped the structure of popular blog links. Looking at the idea of a meme (a culture or behavior passed from one to another), Lima began by charting the citation frequency of URLs on various blogs. Rather than represent this information as mere points on a map, Lima wanted to understand and visualize the flow/influence/connection that such frequency suggested. He studied the structure of blogs and the WWW realizing that the network of blogs is of a similar structure to most natural and artificial systems that are represented through diagrams made of nodes and lines that connect and highlight relationships between the nodes. As Lima (2011) explained, "networks are an inherent fabric of life and a growing object of study in various scientific domains....This genuine curiosity quickly turned into a long-lasting obsession over the visual representation of networks, or more appropriately, network visualization" (p. 15).

Lev Manovich, professor of computer science at the City University of New York, teaches and does extensive research on new media theory. Of late, his work has focused on data visualization and specifically searchability and findability. Manovich (2012) extends the work of Mark Wattenberg who visualized such culturally significant data as a history of net art (Miranda, 2013), Wikipedia (Viégas & Wattenberg, 2010) and most watched *YouTube* videos (Matheson, 2013). With the support of grants from the Digging into Data 2011 Competition, Manovich (2013) and his team used open source image processing software designed for use in medical research and other scientific fields to design a set of tools for media visualization of large sets of images. Projects include pages of *Science and Popular Science* magazines published 1872-1922, video game-playing recordings, all paintings by van Gogh, and

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