
Digital Image Tagging: A Case Study with Seventh Grade Students

Zorana Ercegovac
Drexel University, USA

Results of this exploratory study suggested engaging students in digital image tagging can have analytical and educational importance. The study was designed to gauge middle school students' capacities to describe digital images from two digital libraries that they used in an information literacy activity. When describing the image attributes, students (N=81) freely chose single words and multi-word phrases to describe the interpretations, feelings, and questions evoked by the images. These descriptors were used to derive conceptual categories for the seventeen digital images. Results demonstrated that students acknowledged the responsibility of indexers to choose index terms for objects in collections that enable identification, organization and retrieval. The study sheds light on the potential to improve age-appropriate access to images by means of offering a multi-tiered approach to image representation. It also introduces a transparent approach to teaching information literacy concepts through creative thinking about the meaning of resources and their relationship in a broader information cycle context.

Introduction and Motivation for the Study

Writing about the subject matter of images has been the focus of discussion for quite some time in art history and scholarly communities (Baca, 2002; Grant, 2011; Panofsky, 1972; Shatford, 1986; Svenonius, 1994). To use Panofsky's well-known analysis of a man removing his hat, multiple layers of meaning may be identified in a given image (Panofsky, 1972). For example, at one level there is a person, his hat, lines, colors, and shapes. To that, Panofsky adds another level that is emotional or expressional meaning. For example, a man may appear friendly, happy, or hostile as he lifts his hat. Finally, there is a symbolic meaning in the act of "hat removal." Conventionally, it represents an act of polite greeting, a form of salute (Panofsky, 1972). The hat becomes a symbolic presence for the conventions that are understood in place and time.

Respecting these perspectives, the researcher designed this study to listen to young adolescents' voices (rather than art historians' or indexers') and to the ways they describe and experience meanings in the presented images. The researcher sought to discover whether students would identify multiple layers in the images beyond purely formal perception (human face, house, blue sky), if they would be affected emotionally by the presented images, if they would concur with some of the different levels of meanings that Panofsky was describing, and the range of tags that the students will be using to describe the images. These questions represented the initial framework for this study's research.

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This study demonstrated to the middle school students the importance and responsibility indexers have in their choice of index terms they assign to objects in collections for the purposes of identification, organization and retrieval. The students under study, and by extension many naïve searchers, are not aware of indexing and its importance in searching and information retrieval and that indexing and tags are essential components of location via searching. These two terms were used for the same activity, and the word tagging was the preferred term in the context of the participating students. The students also learned that what they were about to do with images (describe and tag), could be applied to other objects such as music, text, coins, cartoons, bugs, museum artifacts, and other resources, both physical and digital. Finally, the students also understood that not all tags were of equal quality and that the more tags are given to describe any given object, the better chances they would have in finding these objects in the process of searching library catalogs, databases or search engines. This explanation produced an “aha” reaction; they were impressed!

Consistent with Information Literacy (IL) goals, we wanted the students to become better in searching and more sophisticated in their critical thinking skills. If they could describe digital images in writing at different levels of abstraction and detail, they might also understand why it would be important to think of multiple search alternatives when looking up objects in large collections. This teaching approach is very different from the traditional IL units on searching for items without ever linking the processes of searching with indexing.

Today’s teens, defined as those born after 1994, prefer to view images and videos, and listen to music clips rather than to read texts. They search, locate, and create hundreds of images daily. However, many have problems in finding images that they once retrieved from vast collections on the Web, in discovering them from their own downloads, and organizing images into meaningful personal collections (Bilal, 2005). When presented with a task to find digital images of people, artifacts, or concepts, they typically turn to Google Images and searching under a single word or a phrase (Ercegovac, 2008). They prefer rapid retrieval (high efficiency) rather than high retrieval effectiveness (proportion of relevant items retrieved from a given collection of items) (Griffiths & Brophy, 2005).

Anecdotal evidence suggests that students are not concerned about any particular manifestation or rendition of an image as long as it looks reasonably close to the sought after image. For example, any of the Sheeler’s landscapes would be acceptable to most teenagers. While they use many Web.2 tools (e.g., Facebook, blogs, texting, YouTube), few participants in this study ever heard of social bookmarking, also known as collaborative tagging, such as diigo <<http://www.diigo.com/>> and StumbleUpon <<http://www.stumbleupon.com/>> services. From this researcher’s experience with teenagers since 1998, she has concluded that they lack a mental model of the inner workings of organized collection of objects and how individual objects in these collections might be described for the purposes of identification and discovery.

Since this study was carried out in the natural classroom setting during regular digital media literacy classes, described shortly, it was framed in the context of information literacy (AASL, 2009) and the National Educational Technology Standards for Students (NETS•S) (International Society for Technology in Education [ISTE], 2007). Both standards, initially originating from different traditions, have agreed to view technology as a tool for developing higher-order thinking skills, creativity and innovation, communication and collaboration, research and information fluency, critical thinking, problem solving, and digital citizenship.

Educational Urgency for this Study

While many digital collections are now accessible to secondary school students, and teachers are expected to integrate digital materials into their curriculum, there are no classroom tested children-friendly tools to help them find, discover, or suggest images in digital collections (Abbas, 2005). For example, although the Online Archive of California (OAC) has developed a dual capabilities that allow users to search the collection of images alphabetically or by broad classes (e.g., history, nature, people, and places) and subclasses (e.g., discovery and exploration, expeditions and surveys, frontier pioneer life, political

campaign, slavery), most users, like the students who participated in this study, ignore the lists, preferring to type in words and natural language phrases in order to find their images. They try to apply search processes from the search engines to everything else.

Ineffective information seeking has become a more serious problem with the rapid growth of non-textual resources on the Web and with the proliferation of Web users who lack expertise in both searching and in content domains. Perhaps in an effort to improve findability, Web technologies now allow people to describe objects by using social tagging. Together with professional indexing, social tagging may improve the potential to access objects in many innovative ways not previously possible.

Metadata standards and controlled vocabularies for indexing visual resources have existed for some time now. Typically, indexing is done by professional indexers for professionals such as art historians rather than elementary and secondary school students. Examples are *Art & Architecture Thesaurus* (Baca, 2002; Soergel, 1995), *Categories for the Description of Works of Art* (Library of Congress, 2011), and Dublin Core Metadata Standards (Sutton, 1999; Zeng, 1999). Useful metadata is appropriate to the materials digitized and their current and likely use; should support exchange of descriptions between collections; should use standard controlled vocabularies to populate description elements where appropriate; should include a clear statement on the terms of use of the digital object; should support the long-term management of digital objects; and should be persistent and verifiable (Arms, 2000).

However, metadata is not always useful for capturing contexts of use, and this quality is often left to professional art historians rather than other potential users such as elementary and secondary school students and teachers. For example, most of the standards include metadata categories for creator(s) of their work, object/work, date(s), subject categories, orientation, physical state, provenance, relationship to similar images owned by different collections, physical description, materials and techniques; there are no metadata for affective responses. However, these are often the main attributes especially evoked by novices when they view non-textual artistic expressions.

This purpose of this study was to engage students in augmenting metadata by describing attributes for images that were meaningful to them. Since students used their own unrestricted vocabulary in terms of usage and semantics, the language reflected levels of their capacity to think of different types of image attributes perceptually, emotionally, and interpretatively.

Previous Research

This study examined middle school students' capacity to describe digital images at different levels. Image indexing has been studied from various scholarly perspectives including psychology, information studies, art history, computer science and sub-disciplines of computer graphics, classification research, and computational linguistics. In the context of this study, literature has related to social tagging or folksonomy, especially related to digital images, was especially relevant. Because this study's participants were middle school students rather than domain experts or image indexers, the focus of the literature review was considerably narrowed down. The researcher sought publications at the intersection of the following three areas: changing notions of information and digital media literacies for students; descriptive practices for digital images, pictorial materials, visuals, graphic materials, pictures, and photographs; and social tagging, folksonomy, social bookmarking activities relating to image attributes and image metadata for young adolescents and grades 7-12 secondary school students. While literature relating to each of the separate areas was plentiful, very little research at the intersection of the three areas has been reported.

Embracing Multiple Literacies: A Paradigm Shift

Learning multiple literacies has become the main tenet of 21st-century IL skills (AASL, 2009). Since IL is focused on learning how to find, locate and use a variety of resources as well as to create new products, from the outset of this project we wanted to include a range of

exercises with equal attention to textual and non-textual sources (e.g., images, maps, videos). In parallel to learning how to search and access various materials, students were presented with digital images and asked to describe them. For the first time, the processes of tagging and searching were linked together.

An earlier exercise that asked students to describe musical sources in writing, describing non-textual works textually, provided a starting point for this study. The researcher directed school-wide information literacy programs and taught an upper-school elective seminar, *Understanding Music in Cultural Contexts*. One in-class exercise asked students to write down their experiences as a response to listening to several short music pieces. Describing non-verbal works such as music and pictures in words is not an easy task. Svenonius (1994) maintains that oftentimes non-book materials are used for non-documentary purposes and do not have “aboutness” comparable to that one finds in verbal languages. In the music exercise, this researcher found that even those students with a music background struggled to express music experiences into words; with a few exceptions, students’ descriptions were broad and brief, without references to possible repetitive melodic and rhythmic patterns, styles, or forms as potential subjects.

In the early 90s, very few digital collections of non-book materials existed, and those were not accessible to secondary school students. The textual printed medium was the source of choice in information literacy lessons. Nearly twenty years later, with Pandora on iPhone, we search music on numerous attributes or “genes” (artist’s name, genre, melody, lyrics, arrangement) to create unique music stations that stream the music of our choice. The same goes for digital images, maps, and movies. All of these resources are now available free of charge to searchers of all ages; however, the question arises, how well are they searching these resources?

This paradigm shift made it possible for anyone to search a variety of resources anywhere and anytime. As a result, this researcher looked at alternative approaches to helping students become proficient searchers and users of digital multimedia. One such approach to information literacy was to understand the life-cycle of sources, how these are written down, described for the purposes of identification and retrieval, and how they can be located and used in students’ own work. The opportunity to understand the life cycle of works in multiple formats is the first step in embracing multimedia literacy: that is, to describe works and think critically; to search and locate; to ethically use sources; and to create new products using the available Web 2.0 tools.

According to the teaching and learning standards included in the school librarians’ professional guidelines, *Empowering Learners* (AASL, 2009), in the International Society for Technology in Education’s National Educational Technology Standards for Students (2007), and in content frameworks, more emphasis is currently being placed on higher-order thinking processes (e.g., interpretation, evaluation, analysis) rather than on the tasks of browsing, finding, locating and using items in various collections. Higher-order thinking tasks have already been applied in English language classes and social studies assignments. Examples include advertising a story on a poster to make people want to read it, writing the text for a comic, and transferring a main character to different cultures. Clearly, students’ projects must be made more consistent with the shifts in emphases of current standards (AASL, 2009) and content frameworks.

Descriptive Practices for Digital Images

For analytically developed image attributes, Shatford’s (1986) study drew on Panofsky’s iconographic work. The picture might be of a house as a concrete object (e.g., Panofsky’s first level of meaning); at another level, the same house in the picture may be about loneliness, sadness, alienation, emptiness, and bleakness.

Jørgensen’s work (1996, 1999) was used as an initial framework for extending Shatford’s classes. Jørgensen produced twelve classes based on her participants’ forty-eight attributes of images. All of her subjects were adults from an academic setting. Jørgensen noted that the four most typical attributes were perceptual in nature and included literal objects, people, color, and location. Recently, there has been an increasing interest in user generated social bookmarking or tagging as an alternative to indexing resources by professional indexers (Furner, 2007; Trant, 2006). Jørgensen (2007) added social tagging as a

possible way to index images. In contrast to content-based indexing (automatic feature extraction) and concept-based indexing (manual assignment of textual attributes from thesauri and classification systems), social tagging offers some advantages as well as weaknesses, such as loss of 'ofness' and 'aboutness' (Shatford, 1986). According to Weil (2002), cultural heritage objects acquire meaning by invoking specific memories, viewpoints, assumptions, and associations. Is it possible, then, to index subjective associations and emotions consistently so that users can retrieve images that cause specific emotions? This question, studied by Schmidt and Stock (2009), found that collective intelligence of study participants (n=763) produced consistent indexing results, especially on anger and fear, rather than on happiness or sadness.

Social Bookmarking and Tagging of Images for and by Adolescents

To date, little attention has been given by researchers to understand how young adolescents describe images. In the absence of age-appropriate controlled vocabularies for use in creating metadata in general, "what might yield the best possible results is to continue working with the children themselves" (Abbas 2005, p. 314). Related studies are those on information seeking behavior of young adolescents in general (Bilal 2005; Dresang 2005; Dresang, Gross & Holt, 2003; Kuhlthau 2004). However, few and scattered reports suggest that the affective component in system design is essential for successful children interfaces. The *International Children's Digital Library* (<http://www.icdlbooks.org>) offers the following access points: one can find books by color, shape, and feelings, in addition to subject, genre, and date (Reuter & Druin, 2004).

Professionally developed and applied metadata have assumed the expert in mind and an object in hand. As more digital collections are being made accessible to classroom settings, children are encouraged to search, find, evaluate, and use all kinds of resources. To be effective at this, they need to be taught that high quality digital assets are available in large libraries outside of Google images, Youtube, and Wikipedia; described and identified with many different keywords and phrases for the purposes of retrieval; and accessible by means of searching under many of these keywords that were used to describe them. The opportunity to explore these learning moments that are transferrable to different educational and life-learning contents was timely. If students could understand that indexers have the responsibility of tagging these resources, they too might be equally responsible in finding potentially relevant search words during their search process.

Our project's orientation has been the flip side of that domain-expert and known-item tradition. In the process of working with young adolescents, this study sheds light on the ways they are capable of describing images at many different levels.

Methods

In this study, we asked the students to describe digital images from the Online Archive of California and from NEH's Picturing America. When the students searched for pictures, they invariably had issues finding what they wanted, could not repeat their search processes, and used few and broad search words. The researcher began wondering whether students would have difficulties in describing images with words and what types and how many attributes they would use to describe images. These issues led the researcher to explore the following questions:

1. What was the range of tags that the participants chose to describe a set of digital images?
2. Were the students under study able to identify different meanings in the selected set of images?

Setting

As a part of an information literacy class mandatory for all seventh grade students in an independent school in Los Angeles, digital media literacy components consisted of six 45-minute hands-on units designed around the following themes:

1. Information access through searching encyclopedias (printed and digital), online library catalogs, periodical databases (e.g., EBSCOhost, ProQuest), and search engines for texts, images, primary sources, and articles;
2. Critical thinking skills;
3. Evidence-based research process and ethical use of sources; discussion on intellectual property and plagiarism prevention techniques; and
4. Creative learning tools.

All digital media literacy students were asked to complete a survey at the beginning of the class on their utilization of Web 2.0 technologies. While the students used cell phones, social networking tools, chatting, and the Web technologies for locating texts, music and images, we found that they were mostly users rather than creators of sources. The goal was to have them engage in innovative learning experiences that were relevant, interesting, and transferrable to social studies, the sciences, health and fitness, and the arts.

Students in the first two quarters (Q1-Q2, 2008) were presented with eight digital images of photographs from various California-based archives, libraries, and museums hosted as part of the Online Archives of California (OAC). Students from the last two quarters (Q3-Q4, 2009) were given digitized images from the *Picturing America* collection by the National Endowment of the Humanities (NEH). Different sets of digitized images were introduced to Q3 and Q4 students to compare if the type-of-image variable would influence students' indexing in terms of the number of terms assigned per image, amount of detail, and the language used in their narratives. The OAC images were digitized black and white photographs; the NEH images were digitized color paintings from collections of American artists and from museums around the U.S.

Participants

The researcher examined a convenience sample of available of seventh grade students (N=81) from an independent school in Los Angeles. For the purposes of confidentiality, student' names were not linked to their responses.

Students were all enrolled in the Digital Media Literacy (DML) class in the 2008/2009 school-year. During the first two quarters, 39 students participated in the study. They were presented with a packet of eight images to describe, all from the OAC collection of digital photographs. During the other two quarters (2009), another 42 (Q3=19 + Q4=23) seventh grade students participated in the same experiment but with a different set of images, all from the NEH's *Picturing America*. Each packet during Q3 and Q4 included nine images, as illustrated in Table 1.

Table 1. Summary of quarters, participants, sources, images and entires during the 2008-2009 school year.

Quarter	Students (N)	Image Source	Number of Images	Entries
Q1 Fall	20	Online Archive of California	8	160
Q2 Winter	19	Online Archive of California	8*	152
Q3 Winter	19	Picturing America	9	171
Q4 Spring	23	Picturing America	9*	207
Total	81		17	690

* Students examined the same images from each archive.

Since the students were not familiar with Flickr tagging services on the Web, Flickr was described to all students. All images were put on the school server, and all students took notes on the steps they would take to find images on that server. However, since some were a bit timid in using the new application, all students were given the opportunity to either use Flickr for tagging the images on the server or to use the same color printed images on paper. This author didn't want to introduce technology as another variable. Their preference to use either Flickr or paper printed images would not affect their grade.

Data Collection

The project was introduced as an information literacy component of the DML class. Students were given two days to complete the project and turn it in for class discussion. Shatford's (1996) different levels of meaning in describing an image helped frame specific instructions given to the participants in this study on how to tag images. The task was to provide self-selected single words, multi-word phrases, narratives, and ask questions about each of the images. Therefore, descriptions could vary widely including single words, multi-word phrases, and sentences.

The purpose was to give students the opportunity to look at each of the images and reflect upon it using their own wording. Since information literacy did not introduce visual literacy elements (e.g., color, perspective, composition, texture, shape, style, technique), there was no expectation to find references to any of these features. There were no right or wrong answers; students were graded on punctuality and the amount of detail they provided for each image. Specifically, the instruction next to each image read: "describe picture to your left with as many words and phrases as you can." There was also space provided for students' questions and narratives if they wished to provide this information. This encouraged students to spend some time studying and reflecting on each of the images rather than having them index the same image with a single general word or a phrase as many did in similar assignments years earlier.

Selection of digital collections and images. We used two digital collections of images in this project; the Online Archive of California (OAC) and Picturing America from the National Endowment for the Humanities (NEH). Both collections contain images of Americans and American culture, some of which originated around the time of the Great Depression. The NEH pieces were created between 1923 (Tiffany's leaded glass window "Autumn Landscape") and 1964 ("The Dove" by Bearden). Eight OAC digital photographs and nine images from the Picturing America collection were included. The images were age-appropriate for the attention span of thirteen years old students. While many images were of concrete man-made objects (e.g., farm, house, factory, bridge) and people, the participants were intrigued by the multi-layered symbolism behind their abstraction as expressed in their vocabulary and narratives. All images were stripped of the accompanying metadata. For a list of images from Picturing America, see Table 2.

Eight digitized photographs were selected from the OAC. The images were simple in content, all taken about the same time frame, black and white, and evoked something that the students would possibly be familiar with from their social studies classes (e.g., the Depression years; faces of immigrants in the 1920s; native plants; cities; technology). While all artistic in nature, some photographs were documenting the dispossessed during the Depression (e.g., Dorothea Lange's photo in Figure 1), or the American West. The eight digital photographs studied by students are listed in Table 2.

Table 2. List of Studied Images by Collection, Number, Artist, Title, and Date

Image Number	Artist	Title	Date
<i>Picturing America Images (NEH)</i>			
1	Richard Diebenkorn	<i>Cityscape I</i>	1963
2	Paul Revere Jr.	Silver teapots	ca.1750
3	Charles Sheeler	<i>American Landscape</i>	1930
4	Edward Hopper	<i>House by the Railroad</i>	1925
5	Frank Lloyd Wright	<i>Waterfall</i>	ca. 1935
6	Romare Bearden	<i>The Dove</i>	1964
7	Louis Comfort Tiffany	<i>Autumn Landscape – The River of Life</i>	ca. 1923
8	Grant Wood	<i>The Midnight Ride of Paul Revere</i>	1931
9	Walker Evans	<i>Brooklyn Bridge, New York</i>	1929
<i>Online Archive of California (OAC)</i>			
1	Dorothea Lange	<i>Lynn Neagle</i>	ca. 1953
2	Johan Hagemeyer.	<i>Billboards – San Francisco</i>	date unlisted
3	Artist Unlisted	<i>Joshua Trees on Mohave Desert</i>	1945
4	Johan Hagemeyer	<i>Telephone Line Men Near Coit Tower</i>	ca. 1948
5	Dorothea Lange	<i>Around the Cotton Wagon</i>	1940
6	George Lewis	Title Unlisted (image of seals swimming)	1931
7	Guillermo, Bert	<i>... And His Image Was Multiplied</i>	1990
8	Author Unlisted	<i>Earthquake ruins, McAllister and Fillmore Street, San Francisco</i>	1906

For each image, the researcher created a pair of two separate files: one for images and the other for metadata records representing respective images. For the purposes of this project, metadata were not provided to students. For example, in Figure 1, next to the image, there was an accompanying metadata from OAC which was parsed into two separate files:



Title: Lynn Neagle
Creator/Contributor: Dorothea Lange
Date: 1953
Subject: Toquerville, UT; Lynn Neagle (Household Art); canned food; canning; shelf;
Contributing Institution: Oakland Museum of California California Digital Library
Collection: Dorothea Lange Collection of Photographic Essays (1953-1959). *Three Mormon towns.*
 Copyright 2007 by The Regents of The University of California

Figure 1. Sample image and metadata. Source: Online Archive of California

Data Analysis

The source of data included a total of 690 collected entries ready for coding and analysis. The process involved first transcribing students' responses from each of these 690 entries. Next to each image, each occurrence of a term (phrase, narrative) was marked and coded. The emerging patterns were iteratively compared and grouped into tentative conceptual categories without trying to fit them into pre-existing classes.

The qualitative portion of this study used the coding features of Grounded Theory to combine the richness and depth of qualitative approaches and the rigor and systematic analysis of quantitative research (Corbin & Strauss, 2007). Open and axial coding allow for

simultaneous data coding and analysis as the researcher constantly queried, "What is this a conceptual category of?" Each code was validated by the students' teacher.

The quantitative portion of this study included counting the frequency of assigned terms and their resulting categories.

Results and Discussion

In this section, the researcher will explore the data in the context of each of the research questions. The data are interpreted as they are presented.

Research Question 1: Range of Tags that the Participants Chose to Describe a Set of Digital Images?

With respect to the range of tags that the students chose to describe a set of digital images with, this study demonstrated that the number of terms given to images ranged from 2 to 17 with a normal distribution concentrating between 4 to 7 terms per image.

The most frequently noted categories in the nine NEH images that the 42 students were presented with were objects, both man-made and natural (farms, streams, forests, mountains, clouds) and affective responses. Examples of man-made objects were concrete things such as factories, houses, roads, bridges, stained glass, and a silver teapot set. The students also used tags as qualifiers of main objects; examples are parts of objects (e.g., chimney, windows, portico, and columns for the image of the Hopper's house seen Figure 2 below); time-period (e.g., Victorian, 18th Century, and "faded out"); size (tall, grand, wealthy); and place (England, France, East Coast). They also saw the railroad as well as the sky, the light, and clouds.



Figure 2. House by the Railroad by Edward Hopper (1925). Source: National Endowment for the Humanities.

These categories speak strongly of students' capacity to find different layers of meaning in the presented images. Hopper's *House by the Railroad* is of a house in general, and of the house by the railroad specifically. It is also about loneliness, alienation, and bleakness of modern life during the 1920s.

The affective category was used to reflect students' emotional reaction toward a picture as a whole or of its parts. Specifically, 50% of the participating students saw loneliness in the Hopper's *House by the Railroad* and 40% of students saw a concrete object, that of a house. Their emotional reaction was further described with tags such as "eerie," "spooky," "mysterious," "serene," "creepy," "scary," and "haunted mansion."

The next most frequently found category was students' story about the presented images. They needed to make sense of images and tell a story of what they saw and how they experienced visual cues. For example, students described the house in the following narrative: "It looks more cartooned and more drawn." Another student wrote, "It looks like a huge house in a more deserted area."

The next most frequently chosen category was subdivided into four different art history components, including style (e.g., described by students as modern, abstract, Victorian); technique (e.g., pastel; watercolor, acrylic, oil painting, pencil drawing); color (color names, “colorful”); and medium (metal, glass). Students were able to recognize type of art (e.g., decorative, architecture, stained glass). Each of the nine images was characterized with a particular technique and color.

One student wrote of her experience with Diebenkorn’s *Cityscape I* (1963) depicted in Figure 3, “This picture looks like a little town on the left and the country side to the right. I think, half a farming area and half town area.”

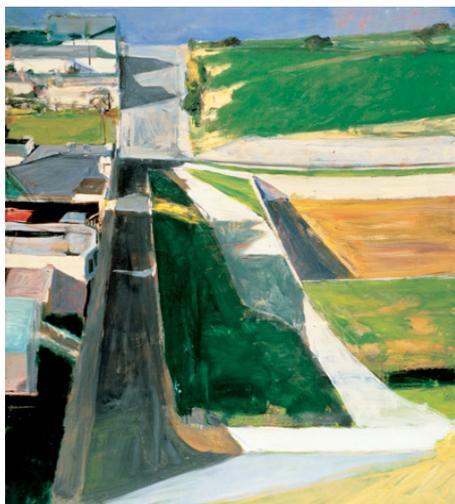


Figure 3: *Cityscape I* by Richard Diebenkorn (1963). Source: National Endowment for the Humanities.

The artist’s name was mentioned in tags by four students for three images from the OAC. One student mentioned a possibility of Matisse as the artist of brightly colored *Cityscape I* by Richard Diebenkorn (1963). Finally, title was mentioned in tags only for two images, for Brooklyn Bridge, and for the *Midnight Ride of Paul Revere*. Date was also mentioned. For example, it was suggested by the phrases Harlem Renaissance and Civil Rights Movement, both in the sixties. Place was mentioned, such as “New York” for Bearden’s *Dove* (1964), or “east coast” for Hopper’s *House by the Railroad*. Place was typically included in their inquiry, and expressed with uncertainty. Associative linkages were mentioned for three images. For example, the image *Dove* evoked many interesting associations to “fight for equality,” “Harlem Renaissance,” “a cultural movement,” as well as “poverty,” “sadness,” and “African Americans.”

Students used synonymous words for any single concept-category. For example, Hopper’s *House by the Railroad* was described as a “house,” “(haunted) mansion,” “tower,” “building,” “hotel,” “portico,” “bed & breakfast,” and “home.” They noticed another layer in that painting, and described the general impression of the house as “lonely” (by five different students), “alone,” “lost,” “eerie,” “isolated” (tagged by three students), “deserted” (tagged by three students); “alone in a field,” “dreamy,” “peaceful,” “scary,” “big” (tagged by three students), “abandoned,” “quiet,” “faded out,” “serene,” “creepy” (tagged by two students), “strange,” “alone” (tagged by two students), “abandoned” (tagged by two students), “spooky” (tagged by two students), “lonely,” “mysterious,” “solitude,” “solitary,” “old style,” “grand,” “spooky, deserted lonely,” “rich” (three tags), “wealth” (two tags), “pearls,” “expensive,” “untouchable,” “beautiful,” “well-known,” “dainty,” “high class,” “fancy,” “pretty,” “beautiful but isolated mansion.”

Research Question 2: Were the students under study able to identify different meanings in the selected set of images?

With respect to the question 2, “Are the students under study able to identify different meanings in the selected set of images,” this study demonstrated that the participating

students connected with the presented NEH images perceptually and emotionally. Since none of the students had art history, they described what they saw and felt about images. For example, they saw a house (i.e., Hopper in Figure 2, but it was loneliness that was experienced by most of them; they saw factories (like those depicted in Figure 4) but felt the stillness and saw no people.

Sheeler's painting, *American Landscape* 1930, seen below in Figure 4, was described by one student as, "It looks very foggy with smoke. It blends with the clouds; it looks like a more industrial area with factories and bigger buildings." Another student added, "I see a lot of industrial factories with pollution coming out of the factory river. It is a piece of art; people work here." Similarly, Sheeler's *American Landscape I* is about the industrial world and polluted canals surrounded by factories and smokestacks.



Figure 4. *An American Landscape* by Charles Sheeler (1930). Source: National Endowment for the Humanities.

Students provided much information about visual components that they saw and emotionally experienced in addition to others that they did not know about. Students asked questions when they couldn't interpret meaning. For example, For Hopper's *House*, they asked: "Is anyone living there?" and they asked questions like "Where is it?" "What was the inspiration?" and "What is the message?" about other images. This researcher called this group of questions collectively *inquiries*. The specific types of questions related to an artist's name and title, date and place, described next.

The eight images from the OAC were all black and white digital photographs, mainly about life in California, by American artists. Due to the nature of the images in the OAC collection, information about art history elements such as style, color, techniques, and medium, are not emphasized as much as in the previously described high-quality color images from the *Picturing America* collection.

In contrast to the metadata provided by professional indexers (see Figure 1) who gave data on an artist's name and title, subject, contributing institutions, collection, and copyright data, the students provided again as with NEH images, rich data especially in the objects/people and affective categories; they told a story for each of the OAC images. For example, for the Lange's portrait of *Lynn Neagle* (Figure 1), students (n=39) characterized her as being "simple, quaint, sad, scary, boring, conflicted, helpful, resourceful, prepared, and organized." They were very perceptive of her as a person, and described her as a "female worker," "nurse," with "pride," "bittersweet," and "smiling woman." In the story category, students wrote, "This is a woman standing in front of shelves filled with jars. I think that she owns the store because the smile on her face is a proud one." Another student wrote, "The woman looks tired, but content, like she has just finished a lot of work." "The jars look like maybe they are rations during a war." The category of "inquiries" is as elaborate as in the

previous set of descriptions for NEH images. They asked questions for Lange's *Lynn Neagle* such as "Where is she and why," "which country," "what date is it," "what is your job," "what do the bottles contain," and "where do you live?" Some students noted that the images were photographs of the photographs, and some commented on the poor quality of photographs. Man-made objects were also described in depth and often counted, like "68 jars," "many jars of different colors"; some counted nine shelves, canned goods, pickles, and a pantry full of preserves.

Specifically, students in this study had a capacity to think at different levels of abstraction about visual sources. Students' tagging of images was more consistently about concrete things, both man-made and natural, than about affective or subjective impressions of the same image. For example, in the image of Lange's *Lynn Neagle*, they all saw a person rather than shelves with many jars in the background. However, their impressions of the photographed person vary. Some descriptions were elaborate and included inferences, impressions, and interpretations; others were sparse and less impressionistic. Overall, no patterns emerged in response to the question: some students gave numerous pictorial features while others were more selective.

Conclusion

This study revealed that some, but not all, middle school students have the capacity to think abstractly about the images in terms of types of vocabulary chosen and their ability to articulate levels of meaning for each of the presented images.

At the outset of the study, the researcher had only a vague idea of students' abilities to describe the presented images using words. As a result of this study, it is clearer that the participating students had the capacity to identify various meanings in the selected set of images; they also began to appreciate the importance and responsibility indexers have in their choice of index terms they assign to objects in collections for the purposes of identification, organization, and retrieval. Although the task of searching was not studied here, it did appear that their skills in tagging the images resulted in better searching. They understood why it was important to think of multiple search terms and alternatives rather than just a single word as they invariably did prior to this project. They became better at organizing images in labeled folders for personal resource rediscovery and future use. Finally, the digital media literacy teachers gained a better understanding of the importance to link the life cycle of multimedia resources with information literacy units.

Further Research

This author does not generalize results of this study to other populations of middle school students. While the participating students were sufficiently diverse, it would be useful to replicate this study with students from different schools outside the metropolitan Los Angeles area. For example, would the students from rural areas in different regions be as specific and perceptive as the students in this study? Would the students who rarely or never go to museums be as descriptive in indexing their images as these students? This study's exploratory findings shed light on possible ways to further study young adolescents' preferences and capabilities to express visual resources in many different ways.

Future areas of research may include adding clouds of tags empirically developed by students to those provided by professional indexers and investigating how students' access to desired images changes or differs. For example, access to a specific image could be enhanced by adding concepts from the category objects with cloud tags that the students would select from pull-down menus. Personalized retrieval of images for different populations will be more effective in future user-centered architectures, if we account for their preferences. There is a proliferation of digital images on the Web created by a wide variety of users for a wide variety of purposes. User tagging offers a possibility to extend metadata schemas in order to improve the quality of users' access to and retrieval of non-textual resources.

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Acknowledgments

This author thanks Allyson Carlyle for reading an earlier version of this article and her comments. Thanks must go to Una E. Makris for editing this article and recommending improvements. Vuk Ercegovac also offered useful comments.

Author Note

Zorana Ercegovac is on the faculty at Drexel University and the founder of InfoEN Consulting, a firm specializing in customized information literacy design and assessment programs. Her research has been supported by NSF, OCLC, EiF, and Library of Congress. Her book, *Information Literacy: Search Strategies, Tools & Resources for High School Students and College Freshmen*, is used worldwide.