




# eLASTIC: Pulling and Stretching What It Means to Learn, Know, and Assess Art and Educational Progress

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**eLASTIC: Pulling and Stretching  
What It Means to Learn, Know,  
and Assess Art and Educational  
Progress**

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The problematic issues related to standardized assessment of the nonstandard and to multiple ways of knowing in the visual arts motivated the research and first phase development of eLASTIC: electronic learning and assessment tool for interdisciplinary connections. In this article, the author describes the evolution and implications associated with this research centering upon the edifying nature of student-initiated links and connections. Using experiences from a 3-year study in Doha, Qatar, this eLASTIC research promises to inform the development of tools that compel students to learn beyond the curriculum while at the same time offering embedded assessments that yield ample data for demonstrating what art students know and are able to do.

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**A**lthough education pundits agree that students and teachers learn in multiple and differing ways (Gardner 1983/2003, 2000; Jackson, 2005), assessment and evaluation of that learning tends to be standardized and broadly scaled (e.g., SOL tests, SATs, and GREs<sup>1</sup>). Examining sophisticated and higher-order learning activities associated with the traits of innovative and critical thinking so valued in art education is rarely, if ever, a consideration for large-scale assessment and evaluation. Problematic too is the appreciable time that evaluative test preparation and administration takes away from teaching and learning in schools. At a local meeting about testing sponsored by Richmond (Virginia) Teachers for Social Justice, a concerned parent said:

At a so-called low performing school, children take practice tests, benchmark tests, and hear from their teachers the constant refrain that another year of low SOL test scores will surely result in the school being taken over by the state or closed. During practice testing, children sit in the cafeteria or go to gym for two periods to accommodate the testing schedule, sacrificing learning time for testing accommodation. An elaborate reward system is in place involving prizes for high scores on individual tests or the ultimate—a pizza party for children who pass all of their benchmark tests. (H. Elliott, personal communication, May 21, 2012)

Other problematic features of standardized testing include high stakes consequences of low scores (school closings, teacher and administrator relocations), test-taking anxiety, test data tampering, readiness, and lack of commu-

nity relevance in test content (Meador, 2012). Concern for this trend toward assessment and evaluation of nonstandard ways of knowing and the resulting pilfering of learning/teaching time motivated the research and development of an alternative in process and connective approach to gathering and analyzing learning data. The title of the project, eLASTIC, is designed to reflect the idea that learning is—and assessment and evaluation should be—about stretching, compelling, and valuing multiple and flexible approaches to knowing.

In this article, I will describe the evolution, testing, and implications associated with the first phase of the research and development of eLASTIC: electronic learning and assessment tool for interdisciplinary connections. I use experiences from a 3-year study in Doha, Qatar, to share the ways that this progressive and complex research served to inform and provoke further questions regarding what it means to learn, know, and assess art and educational progress. As this article reveals, much is left to do in this quest for developing valid assessment and evaluation tools for visual arts. My hope is that this account will serve to rally a collaborative effort in our field to tackle this difficult task before other methods are forced upon us.

### **Transforming Web Connections With Lasers**

The eLASTIC research is an extension of a hypertext-based art education study involving high school students who collected and represented their learning experiences in interactive computer webs (Taylor, 1999). In that study, the art students created virtual boxes in which they placed images of their art, research, notes, peer comments, video clips, music, and other information they linked or applied to what they learned in the class. They created links between

specific areas of these virtual boxes (like parts of images, phrases, and words) and attached explanations of their linking choices. Lines and arrows depicted the links creating a visual tangled web of learning. The hypertext-based art education research confirmed that students who based and connected their study in the interactive/connected computer webs were compelled to learn and know beyond the curriculum content and guidelines (Taylor, 2000).

Although we know that learning, knowing, and creating are complicated and messy, the entangled visual of hypertext connections also can be dizzying (see Figure 1). Consequently, the idea was born to design an interface that transformed the generic box-filled space into a

recognizable visual metaphor of a 3-D area (such as an artist studio, laboratory, or gallery space). The hope was then to gather and analyze the data from everyday learning and growth in such a connective environment for large-scale education assessment and evaluation.

The first year of the research project involved art and English teachers in four high schools in Doha, Qatar, working to formulate visual metaphors/objects. These objects represented areas within the virtual environment where students placed images, media, and other information. Basically, instead of pasting an image in a simple virtual box, in eLASIC students import images into frames on the wall; movies are housed in video monitors; sounds are stored and played

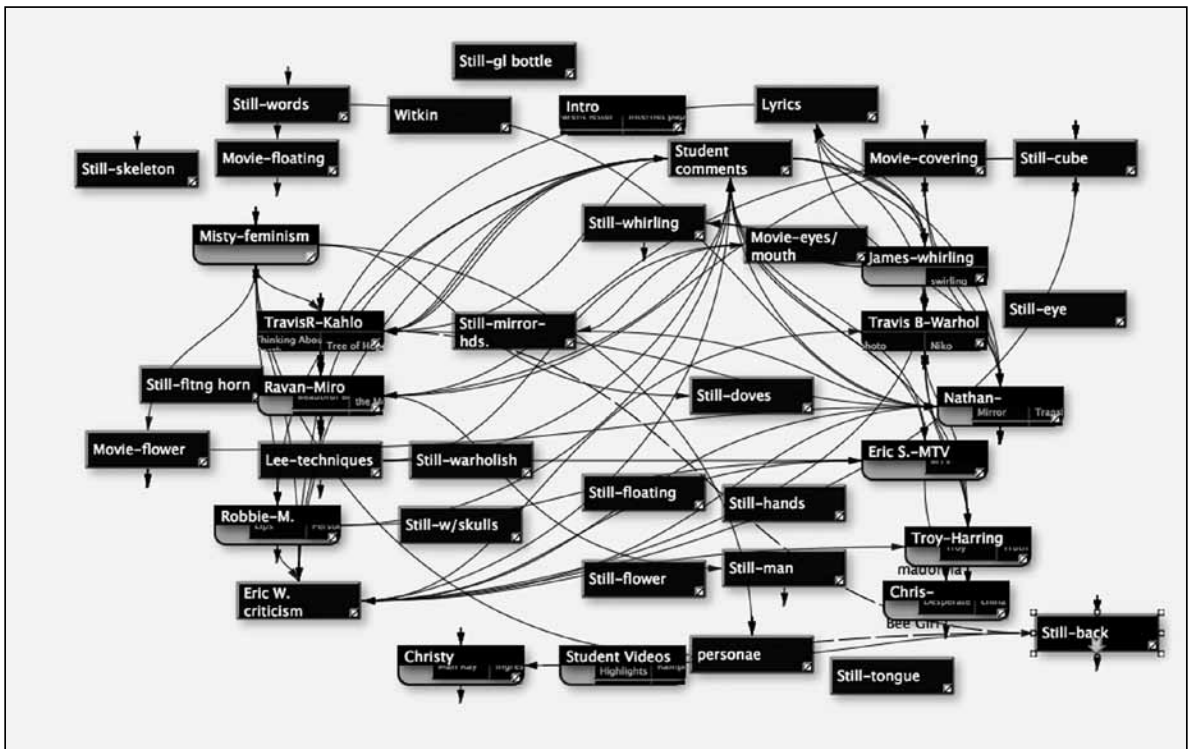


Figure 1. Although we know that learning, knowing and creating is complicated and messy, the entangled visual of hypertext connections can be dizzying and daunting.

through speakers; and text is placed in various notes.

The software developing aspects of the project and testing of beta versions of eLASTIC took place during the first 2 years, with the final year reserved for data collection. Introductory workshops involved research participants in deliberate connective discussions mapped on white boards using lines and arrows to connect various aspects of the conversation. Participants reviewed these discussions easily by following and tracing the multidirectional lines. They then practiced this connective activity by creating webs of thought on the computer. Throughout this activity, the teachers remarked upon how important this approach could be in under-

standing their students' learning processes and how such information could inform their teaching. When the students began using the eLASTIC software, they said that the interface provided a space that felt much like wandering around in their own heads.

Such wandering or maneuvering through eLASTIC's 3-D space is accomplished with a computer mouse and/or directional keyboard strokes. Each object within the space (e.g., a frame, title card, notebook, speaker, and monitor) holds an image, text, sound, or video clip. Selected portions of the information placed in these objects can be linked and the links are depicted as lasers (color-coded according to student-specified paths such as technique, idea,

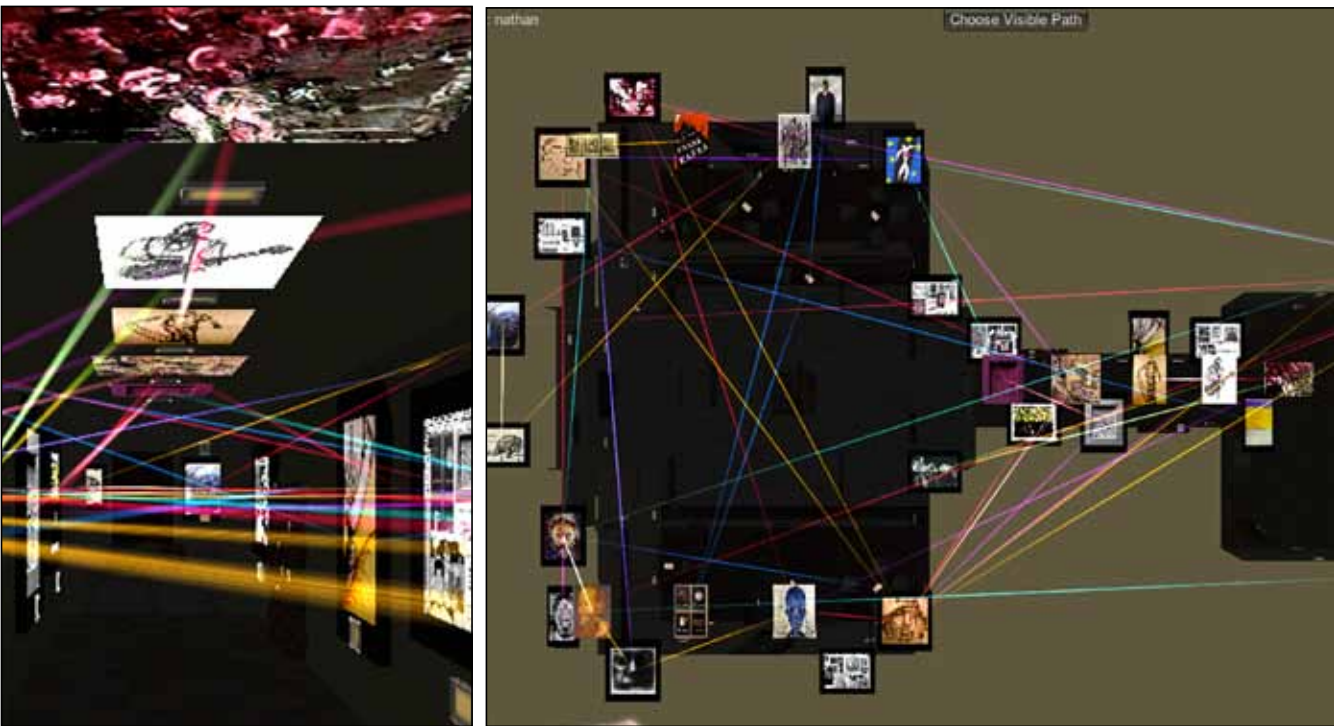


Figure 2. eLASTIC view and overhead view. The overhead view allows students to see the bigger picture of their learning. Colored links represent differing paths of thought within a student's eLASTIC environment.



Figure 3. eLASTIC all or radial and explorer view. Differing paths can be isolated and searched to more closely scrutinize trails of thinking.

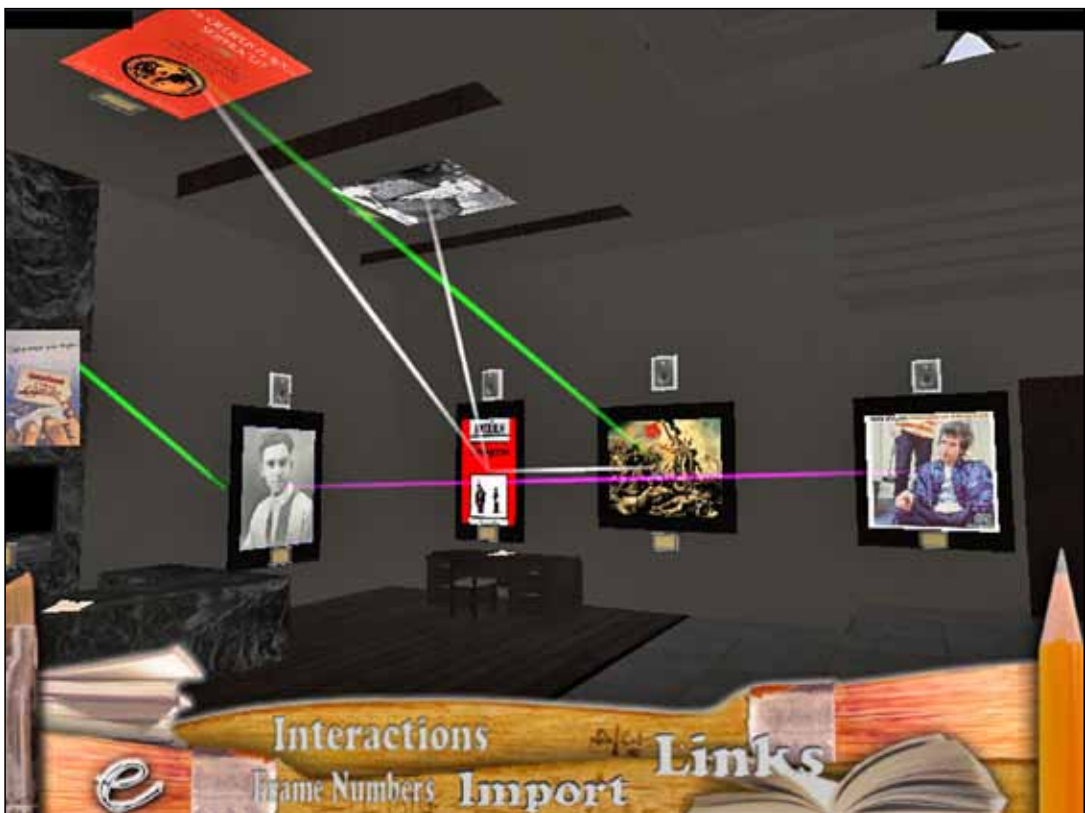


Figure 4. Student A explores the idea of rebellion by making connections among Juan Anouilh's *Antigone*, Bob Dylan, *Delacroix's Liberty to the People*, the movie *Up in Smoke*, and Tunisian poet About-Qacem Echebbi.

and/or context). There is an overhead view that looks much like a map, an explorer view that mimics a diagram, and 3-D room views (see Figures 2 & 3). It is hoped that a game-like interface will engage student attention both in and outside of school.

### Sample View of the Way Student A Stretches His Point in eLASTIC

Student A<sup>2</sup> was part of the research in Qatar during the 2011-2012 academic year. Although his eLASTIC virtual world was created to be dynamic and changeable, for the purposes of this writing, I describe only one room and series of links based on his study of Juan Anouilh's *Antigone* in English<sup>3</sup> class. Inspired by Sophocles' original Oedipus Greek tragedy, Anouilh's play premiered in 1944. In one of Student A's eLASTIC virtual galleries were images of the playbook's cover, a photograph of Anouilh, The "Highway 61" Bob Dylan album cover and accompanying sound file, a copy of Eugene Delacroix's painting *Liberty Leading the People*, a video clip from the movie *Up in Smoke*, and a photograph of Tunisian poet Aboul-Qacem Echebbi. (See Figure 4.)

Student A included a video clip from the *Up in Smoke* movie featuring a father berating his slovenly dressed son for not having a job. The student explained his link from the video to the image of Dylan's album cover and sound file (represented by a speaker above the image) saying:

I link the line from Dylan's "Like a Rolling Stone" that says, "When you got nothing, you got nothing to lose" with the spirit of Antigone's realization that although she is royal and lives in a palace, she believes that she has nothing. What she really wants is her freedom. She is at a stage in life where she (like high schoolers) doesn't have freedom to do what SHE wants, feeling that she has nothing. And at that instance, it makes sense that she would rebel and go against everything. (Student A, personal communication, 2012)

Student A linked this idea with the Delacroix painting that later inspired the Statue of Liberty, saying:

This painting and I believe Antigone herself symbolizes the French Revolution... and is the soul of the ever-revolting French... this is a two-sided coin... Antigone revolted and succeeded in getting out her message, but in the end the villain Creon won. And the poor—represented by Antigone, her soul, her revolution, and her message—simply died. I believe there is definitely some connection to this whole idea of revolution, France, and the socio Baltic states at the time. (Student A, personal communication, 2012)

The final link in this particular area of Student A's virtual room was to a photograph of poet Aboul-Qacem Echebbi. Student A explained his link to a line in Echebbi's poem entitled, "To the Tyrants of the World," below:

This line is one that my grandfather would often say. It is included in the Tunisian national anthem and I translate it as, "if the people ever wanted life or freedom... so destiny must respond." This quote has been used several times in Tunisian history and most recently during the revolution in 2012. It shows that the spirit of revolution can never die as long as you have a cause and are willing to fight hard enough for it. (Student A, personal communication, 2012)

Even this small disparate view of Student A's thinking compels the fundamental eLASTIC research question—what if there was a way to document and follow student thinking and connecting? According to the teachers involved in this study, understanding and indeed charting learning and innovative processes was extremely important in evaluating student progress. The act of making meaningful and relevant connections among learning inside and outside of school represents and contributes to higher-order thinking. Students must understand information to make connections and put

ideas, facts, and visual clues together in credible and innovative ways when making and studying visual art. What if we could document such thinking and learning so that connections can be made and understood across years, classes, and other realms of experience? Indeed, what if these kinds of activities could be linked with assessment?

### **Tugging at Authentic, Performance, and Formative Assessment Models**

This research has been greatly informed by the call education theorist Grant Wiggins (1989) made for a multifaceted, contextualized, intellectually complex assessment approach that, like portfolios, has been somewhat self-regulated and may reveal the coherence of student knowledge (p. 711). It could be said that the ill-structured nature that is inherent in the linked environments of eLASTIC (and the original 1999 student hypertext webs) represent Wiggins' (1993) idea that testing and authentic performance assessment should be linked to real world "challenges—in all their messiness" (p. 200).

The eLASTIC research project has been designed to connect and represent a flexible balance of formal (summative) and informal (formative) assessment strategies that focus on both products and processes in art (Beattie, 1997). Such an idea that sufficient data can be generated and captured from ongoing and compelling learning for large-scale assessments could represent education theorists Lorna Earl and J. Bradley Cousins' (1995) dream of a time:

When assessment and evaluation are not viewed with foreboding and terror; not separated from teaching and learning; not used to punish or prohibit access to important learning; and not seen as private, mystical ceremonies. Instead, assessment and teaching/learning will be reciprocal, each contributing to the other in ways that enhance both. Assessment will reveal not only that students know and understand, but will also capture how that new learning came about and will provide a range in variety and quality

of work that show the depth, breadth and growth of each student's thinking. This wealth of information will, in its turn, be used to provoke further leaning and focused instruction. (p. 57)

In all fairness, another illustration of Earl and Cousins' imaginings occurred a full decade earlier with Harvard's Project Zero, the Education Testing Service, and the Pittsburgh Public Schools' ARTS PROPEL process portfolio project (Gardner, 1989). With the ideal of enhancing art student learning, teaching, and assessment, the ARTS PROPEL project began with delineating competencies around the domains of production, perception, and reflection. Assessment strategies related to the ARTS PROPEL project continue to evolve and grow but primarily involve evaluation of varied components related to the domain of learning artifacts. The eLASTIC research project incorporates many of ARTS PROPEL researchers' principles of learning, including: student-constructed learning; motivation and active pursuit of understanding; open-ended thought provoking questioning; structured and ill-structured activities to promote ownership of learning; and the value of art production, perception, and reflection processes (PROPEL Researchers, 1992). eLASTIC has proposed to go further by incorporating advanced computer technology to chart, compel, and assess learning and teaching processes.

Assessing the nuances of artmaking processes as art educators, Richardson and Walker (2011) explained that artmaking requires a way to capture the "multiplicity of relationships in constant flux [that are] at the intersection of thought and action" (p. 9). Indeed, connections that represent such constant flux in art student thinking were one unwavering value of the many different people involved in the eLASTIC research. When students can see, make, and/or be compelled to build connections among their studies and realms of experience, their learning, knowing, and artmaking are enhanced.



### Connective, Critical, and Visual Art Thinking Extends Assessment

One of the most eloquent passages regarding the value of connective learning and thinking is included in the Preface of *The New Humanities Reader* written a decade ago:

The creative aspect of thinking emerges when connections are made between the texts you've read; between what you've read and your own experience; and between what you've read and thought in the past and what you're coming to think now. By learning how to make connections, you will learn how to make ideas mobile and active and this is the habit of mind that is most highly rewarded both inside and outside the academy. (Miller & Spellmeyer, 2003, p. xiii)

Linking and connective thinking are at the heart of this research and development of eLASTIC. But, simply linking one area to another does not indicate connective thinking. Learning is all about making meaning—personally significant meaning. The way we do that is by connecting what we see, hear, and read with something we already know, something we want to know, or something that greatly affects us. Higher order learning involves connecting with the purpose of meaningfully and relevantly questioning; visualizing; inferring; determining the importance; and synthesizing. Creative and innovative thinking relies upon connective pondering to risk imagining in ways that link the improbable with the feasible (Vareli, 2012). Paths of connections that meaningfully associate, categorize, group, conceptualize, and otherwise make learning personally relevant and meaningful represent a natural and scaffolded approach to learning. In eLASTIC, the higher ordered connective thinking is demonstrated through paths of links made between and among specific areas of images, text, video, and notes within the environment that are meaningfully explained.

How can such meaningfulness be measured in a large-scale assessment?<sup>4</sup> Analysis of links

may include the ability to follow the time, order, and path of a student's thinking process; the significance of linked areas; the contextual information directly and indirectly implied; and the depth and breadth of connective thinking.

Data retrieval and analysis attempts throughout this process have been fraught with both failures and successes. One problematic data retrieval process was the pre- and post-Visual Art Critical Thinking Test (VACT) used as a research instrument. eLASTIC student users' performances on this assessment were compared with each other and with a control group of students who did not use the software. Test questions centered upon a work of art that students in each particular school and class studied (see Table 1). The questions addressed an original goal of the software development that included the ability to measure students' proficiency levels and connections among skills, knowledge, and dispositions associated with visual arts learning.

To begin addressing the issue of large-scale analyses, I chose to use the qualitative software analysis tool Atlas Ti.<sup>5</sup> I loaded all VACT student responses into the software and then ran the search and compilation tools to determine student uses of particular indicator words and phrases associated with connective thinking, critical thinking, and visual art (see Tables 2 & 3).

Due to teacher and, ultimately, their classes' attrition<sup>6</sup> in the research study, the final year resulted in only four classes and one control group completing the pre- and post-VACT. Extent of use was also an issue as only one of those four teachers (M) actually taught and used the software in his classes for a significant amount of time. Three of the four teachers (R, S, and H) taught in schools that limited their time using the software because of frequent strictly mandated standardized testing. Language issues accounted for some of these teachers' lack of complete participation. The lack of participation by the other art teachers could be indicative of what I consider to be at the crux of the assessment in the arts conundrum—that

## Visual Art Critical Thinking Test

1. Describe the work of art and explain what you think it means and why.
2. Describe the process in which you believe this work of art was made.
3. If you could challenge the artist of this work with another media, what and why would you choose it to enable the artist to continue his or her direction of meaning?
4. What questions does this work of art provoke in your mind and how could you find the answers?
5. What questions do you believe your teacher would ask about this work of art and why? Another student in your class? A member of your family? Someone from another country (which country and why)?
6. Explain how your study of this work of art may inform your own art making and/or writing?

Table 1. Visual Art Critical Thinking test questions.

<p><b>Connective Thinking terms &amp; phrases</b></p>	<p>ink connect associate similar different maybe seems relation association relationship linkage tie bond join unite bond attach hook sssign link up with stick together adhere partner mix correlate bracket together compare show a relationship relationship contrast match up to balance judge against dissimilar disparity difference similar distinction moreover besides so hence thus additionally therefore accordingly consequently first secondly as a general rule generally for this reason that is frankly but  nevertheless however on the other hand or metaphor same like sort of</p>
<p><b>Critical Thinking terms &amp; phrases</b></p>	<p>therefore hence thus so accordingly consequently as a consequence shows that indicates that we may infer that we can now infer let us infer that we may conclude it follows that it means that implies that as a result because for since as inasmuch as whereas in that may be inferred from seeing that for the reason that assuming that as shown by as indicated by given that why</p>
<p><b>Visual Art terms &amp; phrases</b></p>	<p>draw paint sculpt MonaLisa Leonardo daVinci Picasso abstract acrylic paint airbrush animation architecture art artgallery artist artistic artist's bridge artwork assemblage bas-relief batik blending bridge brightness brush calligraphy canvas cartoon carve ceramics casting  chalk charcoal chisel clay cloisonné collage color colored pencils color wheel compass composition contrast craft crayon critique crosshatching decorate decoupage depict design draw drawing easel egg tempera enamel encaustic engraving erase eraser etching exhibit exhibition film form frame fresco gallery gesso gilding glass glassblowing glaze goldleaf gouache graffiti graphic design graphite hammer hatching high-relief hue illustrate illustration image ink installation kiln landscape latex paint line liner brush linseedoil lithograph lost wax method low-relief mahl stick maquette marble marbling perspective photo photograph pigment porcelain portfolio portrait portray poster pottery pounce primary color print printing proportion quill quilt quilting realism ruler scale screen printing sculpt sculptor sculpture seascape secondary color shade silkscreen sketch sketchbook solvent stained glass stencil stilllife stippling stone stonecutting style tempera template textile arts tole painting tools trompe l'oeil t square tube turpentine varnish vellum video visual watercolor wax wheel wood woodcarving woodcut wood cut print wood engraving</p>

Table 2. Terms associated with connective thinking (Vareli, 2010), critical thinking (Critical thinking, 2008), and visual art (Col, 2010).

Group	Fall 2011				Spring 2012			
	# taking test	Connective thinking	Critical thinking	Visual Arts	# taking test	Connective thinking	Critical thinking	Visual arts
M	8	52 (6.5)	45 (5.6)	0 (0)	10	83 (8.3)	79 (7.9)	57 (5.70)
R	10	13 (1.3)	3 (3.0)	0 (0)	8	9 (1.1)	10 (1.2)	8 (1)
S	27	43 (1.5)	99 (3.6)	0 (0)	25	74 (2.9)	54 (2.16)	75 (3.0)
H	23	25 (1.0)	81 (3.5)	122 (5.3)	23	45 (1.9)	52 (2.2)	55 (2.3)
S Control	31	38 (1.2)	28 (-3)	74 (2.3)	24	24 (1.0)	26 (1.0)	34 (1.41)

Table 3. Visual Art Critical Thinking Test results.

is, art teachers' belief that what they and their students do cannot be authentically measured, especially not through any large-scale assessments. I understand this. Assessment is difficult at best and assessing the kind of connective, critical, and creative processes and thinking inherent in the study of visual art requires a great deal of time, discussion, and thoughtful consideration. These problems are precisely why it is so important that this and other art assessment research projects work with artists, teachers, students, and others to push, pull, stretch, and challenge in order to formulate effective strategies to prove what art students know and are able to do (Armstrong, 1994; Beattie, 1997; Boughton, 2000; Dorn, Madeja, & Sabol, 2004; Gardner, 2000; Myford & Sims-Gunzenhauser, 2004; Popovich, 2006; Sabol & Zimmerman, 1997; and Soep, 2004).

Determining results from the frequency ratings of indicator words and phrases on the VACT proved difficult due to the fluctuating numbers of students taking the pre- and post-test and the sporadic use of the software. Although some growth was indicated when calculating the average number of markers per student, I am reminded that the initial grant reviewers' comments clearly stated that traditional forms of testing may not be appropriate to determine effectiveness for such an emerging assessment project as eLASTIC. More nuanced assessment strategies are needed.

### Pushing Art and Assessment Boundaries With Emerging Technologies

An alternative and controversial possibility for technology-enhanced art assessment came to my attention in a 2012 *New York Times* article reporting on Robo-Reader, an innovation involving Automated Essay Scoring (Wineripe, 2012). According to Justin Reich (2012), Harvard doctoral researcher at the Berkman Center for Internet and Society, Automated Essay Scoring has involved the computer in comparing essays with other essays scored by human beings. The comparisons may be through word and phrase searches similar to my VACT work, but they go beyond this through the use of algorithms designed to, as Dr. Mark Shermis<sup>7</sup> (2012) described, "faithfully replicate" human scores (Reich, 2012, para. 5). In their current state, computers cannot "read" essays in the same way as humans. Computers are programmed with varied and seemingly endless algorithms. "The output of the model is a score—again, not a score originally generated by the machine, but a prediction of how a human would have scored the essay" (Reich, 2012, para. 12).

So, the question now becomes, how would a human score a student's art learning in eLASTIC? What specifically would indicate that a student had achieved a proficiency level associated with national, state, district, school, and class expectations or standards of learning?

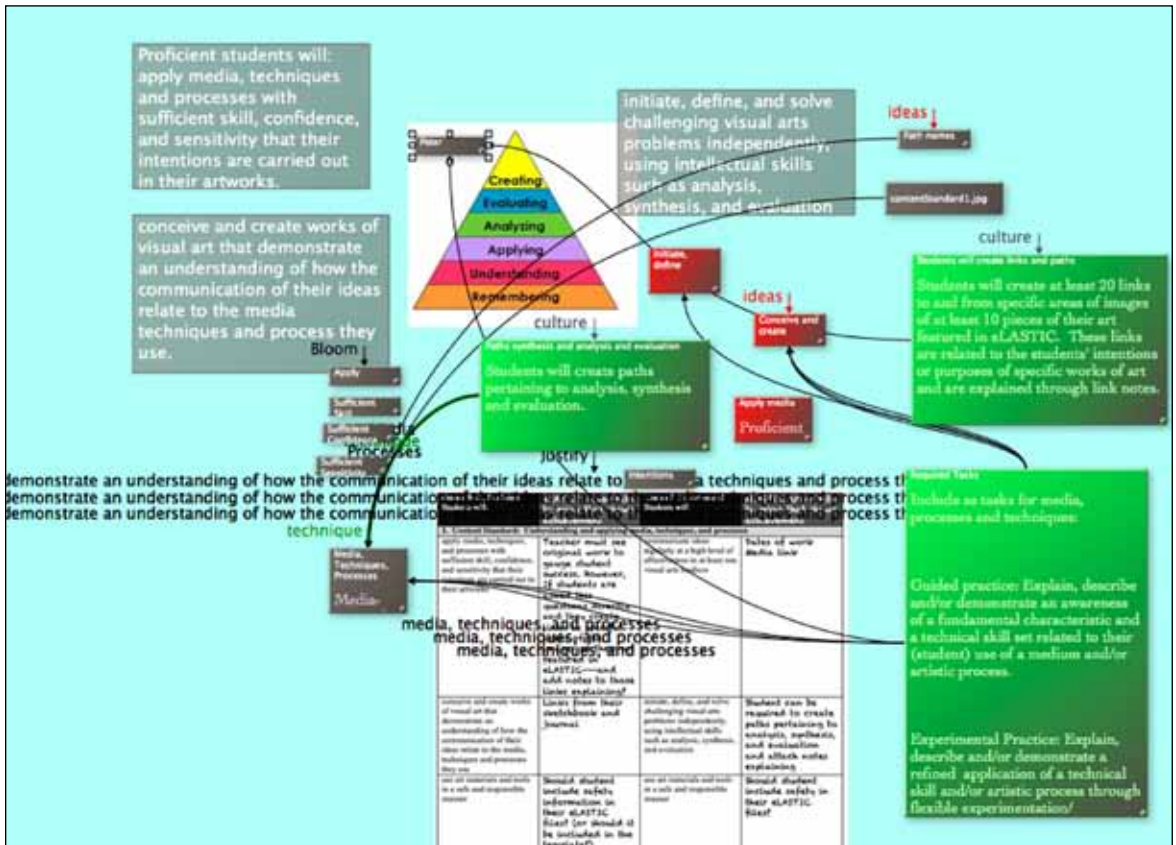


Figure 5. Notes from the eLASTIC indicators of learning meetings were captured using the software Tinderbox to represent the linking and connecting among the varied standards and curriculum driving the project.

### Identifying Indicators of Learning in eLASTIC

In addition to the teachers in Qatar, four United States art educators<sup>8</sup> involved in the research developed working drafts of indicators of learning. Their efforts were informed by standards associated with Qatar Supreme Education Council, International Baccalaureate, and the National Association of Education Progress along with Harvard's Project Zero and ARTS PROPEL (see Figure 4). Here, I share a few

of the eLASTIC indicators identified and linked directly to the United States Content Standard of Learning #1 for Visual Arts, grades 9-12:

Students understand and apply media, techniques, and processes. Proficient students: (A) apply media, techniques, and processes with sufficient skill, confidence, and sensitivity that their intentions are carried out in their artworks; (B) conceive and create works of visual art that demonstrate an understanding of how the communication of their ideas relates to

the media, techniques and processes they use; (C) use art materials and tools in a safe and responsible manner. (National Art Education Association, 1994, p. 22)

The team of teachers determined that indicators of these proficiencies might include the creation of a certain number of links, link notes, media, process, and technique paths related to student and other art, literature, visual culture, and additional realms of experience included in their eLASTIC world. Similarly, for analysis, synthesis, and evaluation, links should be made to other visual culture, literature, theatre, music, and/or other examples along with minimum numbers of media, technique, and process links/paths with explanatory notes (see Figure 5).

When determining indicators of quality and effective evaluation, researchers looked for ways that students justify a stand or decision according to some set of criteria such as number and quality of resources—or multiple resources by a single author, theorist, or topic—to indicate a deeper contextual understanding. Did the student understand, paraphrase, and/or quote the resource they included? Did they connect it to something else and write a convincing explanation? What constitutes convincing?

By way of example, assessing Student A's eLASTIC response to his study and response (claim) to Anouilh's *Antigone* would render three connections (supportive evidence) made meaningful through research and personal explanations. A closer look would reveal Student A's comparison of Anouilh's play with the original Greek tragedy; an in-depth analysis of the movie *Up in Smoke* along with information from reviews and blogs; and more contextual information related to Bob Dylan's song, album, and life.

The General Certificate of Secondary Education<sup>9</sup> has included descriptions related to differing levels of artistic and thinking practice using such descriptors as awareness; refined, flexible experimentation/exploration; and self-initiated and connective explanations (OCR, 2011). What would a "refined application of

technical skill" look like? What do educators look for when determining flexible experimentation and exploration? In an attempt to answer these questions, suggestions were made for tasks, problems, and challenge based-learning activities to include inside eLASTIC. Education pundit Wolpert-Gawron (2010) wrote that alternative ways to measure such student collaboration, connections, synthesis, and critical thinking would be to analyze ongoing reflection and journaling; this could also be accomplished through open-ended tasks such as writing an eLASTIC exhibition catalog that includes historical, cultural, visual, spatial, functional, and temporal differences, or including theories of aesthetic and criticism in virtual books from which to draw ideas and connections. Other considerations included attaching a requirement to an object, such as the need to identify and comment upon a work of art or image before it is successfully displayed. A map or globe could be used to challenge students to link to and identify geography and social studies issues (i.e., certain social issues or problems that they wish to address or explore in their art and writing).

Admittedly, this way of developing indicators of learning is tedious at best. This research is not about teachers or students laboriously and continually identifying such gauges of proficiency. Nor is it about students repeatedly explaining and justifying their artmaking and thinking processes. On the contrary, the hope is that the computer can be programmed to mine or gather assessment data from the images, sketches, links, videos, text, and so on that students already do and house or connect with<sup>10</sup> in their eLASTIC environments daily. The challenge and ultimate question now is how (or admittedly if) a computer can be programmed to allow for and deal with such nuance as multiple meanings of words, innovative approaches that risk breaking rules, and many of the other distinctive subjectivities associated with art thinking and learning that teachers and students seemingly intuitively perform and gauge. Attempting programming to "faithfully repli-

cate” then begs the question: how do art teachers and other evaluators, judges, jurors, and reviewers understand and assess and/or trace artistic expression? Art teachers, like all human beings, rely upon their knowledge base to guide them in everything that they do—from looking both ways to cross a street to what and how they value works of art (Walker, 1997). Of course, art educators have varied and richly connected experiences, wisdom, and culture that are based on education, continual professional development, travel, and relationships. All of that makes up their knowledge base and the expertise that informs and thus assures that their evaluation, assessment, and judgment of student work is valid, reliable, and takes into consideration the nuances and values of the art world. What if that kind of knowledge base could be translated into computer algorithms that could inform a software program to faithfully replicate the ways an art educator would evaluate a process portfolio? With the assistance of additional art educators, the next phase of the research will concentrate on this and other computer programmable ways to mine and reliably assess sufficient data that can demonstrate what art students know and are able to do.

### Propelling Plans and Implications for/of eLASTIC

The goal of this and continuing phases of the research has been to present a case for feasible and reliable evaluation and presentation of art student learning through authentic, performance, formative, and connective assessments. In this article, I have shared the development aspect of this research project and acknowledged that there is a great deal left to do both in the continued development and testing of its implications for large-scale assessment. I have recognized that this is a difficult and complicated process that will involve much more time, involvement, and critical approaches to technology and assessment theory and research. The study and making of art is a delightfully rich and unique way of learning to think and reflect on the world. Representing that learning is not impossible. I have chosen to report on this initial phase of the research with the hope that others in our field will join in pulling and stretching what it means to learn, know, and assess educational progress.

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## ENDNOTES

- 1 SOL (Standards of Learning) tests are national tests in the United States based on discipline-specific state and national standards of learning for elementary through high school level education. These tests are touted as high stakes due to the punitive nature associated with not passing (Chapman, 2005). SATs are the Scholastic Assessment Test (formerly the Scholastic Aptitude Test), a test used for some college admission standards. GREs are Graduate Record Examinations used for many graduate school admission purposes.
- 2 As identifiers linked with student names are not permitted to be used in any reports or publication of this research, Student A refers to one of the students in Doha, Qatar, who used eLASTIC in his class.
- 3 Because eLASTIC is based upon the idea of interdisciplinary connections and that this student included many art-based connections, I purposefully shared his English class-based environment.
- 4 Although this particular question, along with usability, will drive the next phase of eLASTIC development, the 2009-2012 study made preliminary attempts to mine learning data. Although initially only providing shallow data related to numbers, the eLASTIC software included a "statistics" feature to gauge quantity of links, images, videos, and sounds to determine activity. Calculating averages along with attached notes, comments, and word and phrase searches provided introductory, albeit nominal, indications of student use.
- 5 See [atlasti.com](http://atlasti.com)
- 6 Teachers left the research project because of schedule changes in their schools, maternity leave, retirement, and personal/professional relocation.
- 7 Dr. Mark Shermis (2012) is the Dean of the College of Education at the University of Akron. He authored the study that assessed a number of different automated scoring programs against human scorers. He is quoted in Reich (2012) interview.
- 8 United States art educators who worked to identify indicators included eLASTIC project manager Jan Johnston, Virginia Art Education Association (VAEA) past presidents Pearl Quick and Dr. Charles Bleick (also Qatar consultant on the project), VAEA executive secretary Peggy Wood, and VAEA newsletter editor Kathy Barclay (all former K-12 art teachers).
- 9 British academic qualification required of one of the participating school in Doha, Qatar.
- 10 eLASTIC will include web browser plugins that can directly link to and from student data on existing and heavily used networks such as Facebook, Pinterest, Tumblr, and so forth.