In the Curriculum

Art & Science

From All Sides Now

Weaving Technology and Multiple Intelligences into Science and Art

By Carol Lach, Ellen Little, and Deborah Nazzaro

Subject: Science, art, multiple intelligences

Audience: Teachers, technology coordinators, library media specialists

Grade Level: 1–5 (Ages 6–11)

Technology: Internet/Web, digital camera, and word processing, draw and paint, and multimedia software

Standards: *NETS•S* 1, 3–5 (www.iste.org/standards). Massachusetts State Curriculum Frameworks Science MA 2.1–2.3, 2.5, 3.1; Art MA 2.1, 2.2, 2.4, 2.6, 3.7, 6.1, 6.2, 7.1, 9.4 (www.doe.mass.edu/frameworks/current.html).

Supplements: www.iste.org/L&L

Students demonstrate their interpersonal intelligence while creating a nature sculpture.

The power of technology lies in the ability to merge it with the curriculum and create unique learning opportunities. When students can take a digital picture of an arrangement of objects from nature and then create an abstract rendition of it or superimpose a pattern on top of it, they learn content in the art and mathematics curricula. The opportunity to view an artist's works on the Internet teaches art more effectively than trying to pass around a single book on that artist. That feeling of discovery students experience is more powerful than having material merely presented. They can proceed at their own pace and linger over the pictures that hold a special appeal for them.

The theory of multiple intelligences (MI) allows teachers to tap into the strengths of each student and to develop capabilities in novel ways. By weaving together technology, MI, and curriculum, we help students work in their own "magical learning environment" and accomplish the objectives of science and art units. Technology, by its very nature, uses and enhances the multiple intelligences. Bodily-kinesthetic skills are needed to use a keyboard and mouse; logical intelligence is needed for sequencing the steps in a program; and a visual-spatial sense is needed to process the information on the computer screen. When students assist their neighbors in the computer lab or work in pairs, the interpersonal intelligence comes into play. They use intrapersonal skills when they work individually to alter an image they have previously created collaboratively. This project was designed to teach the patterns and structures in nature along with symmetry, contrast, balance, and shape in art.

Hemenway is one of nine public elementary schools in Framingham, Massachusetts, a suburb of Boston. Four years ago, with the beginning of school choice in the district, each of the

schools chose a theme. Hemenway chose MI as a teaching theory and a learning environment. Our teachers work in grade-level teams with a culturally diverse and academically heterogeneous student population. Eight years ago, Hemenway became an inclusion school in which the standard program is designed to academically accommodate all students including those with special needs. The practice of MI theory supports our need for numerous teaching strategies. The specialists in art, literacy, music, physical education, and technology work closely with the classroom teachers to enrich and reinforce the Massachusetts State Curriculum Frameworks.

The Theory

Howard Gardner developed the theory of MI at Harvard University. He believes that each person has at least some degree of each of the intellectual competencies. He has defined these "frames of mind" as a means of mapping the range of abilities of the human brain. All of the MI meet these criteria:

1. Each person possesses all of them to some degree.
2. There are famous people who can be identified as highly intelligent in each intelligence and combinations of them.
3. Each intelligence is mapped to a specific part of the brain.
4. These develop naturally at different ages.
5. MI are inherited to the extent that certain individuals have a predisposition for a high degree of certain ones.
6. Multiple intelligences are developed; that is, with appropriate opportunities, they can be nurtured and expanded.

Initially, Gardner identified seven intelligences, then an eighth—the naturalist intelligence. Currently he proposes and is studying a ninth intelligence, the existentialist. The eight intelligences now recognized are summarized in Table 1 on p. 34. For readers with a higher degree of spatial intelligence, Figure 1 may be clearer. Gardner focuses primarily on MI as a cognitive theory and does not emphasize the application of MI to teaching *per se*. However, Armstrong (1993), Teele (1995), and McKenzie (2002) provide many examples and tools for the implementation of MI in classroom instruction.

The Plan

This lesson plan is for Grade 4 and covers art and science. Students learn about the naturalist artist, Andy Goldsworthy, while they are studying trees and structures in nature in science. They use his work as an inspiration to create their own nature sculptures, modify these in a paint program, write poems about them, and create an alternate art form based on their originals. They assemble a multimedia project using digital photos and other technology. MI is an integral part of this project.

The objectives are to observe and create compositions that show an awareness of patterns and structures in nature, as part of the science unit on trees; to use prior knowledge of the patterns in nature (packing, spiral, branching, explosion and meander); to create symmetry and balance, contrasting color and shape, and rhythm and movement; and to learn about Andy Goldsworthy.

The technology skills include using the Internet to gain information about the artist, creating a classroom multimedia presentation, and using a drawing and painting software program.

The Reality

This project actually started when Ellen, the art teacher, asked Carol, the computer teacher, if the students could combine learning about search engines with the investigation of the artist, Andy Goldsworthy.

"Who's that?" was Carol's first response, as she typed the name in the Ask Jeeves search engine. Immediately finding two excellent Andy Goldsworthy Web sites, Carol was so impressed she suggested putting this together ultimately as a multimedia project. (*Editor's note:* For these and other URLs, see Resources on p. 35.) When Deborah, the classroom teacher, became involved, she added a linguistic, poetry piece to be done in the classroom.

We believe that students require more than just directions telling them to look something up on the Internet. Scavenger hunts provide direction while giving students flexibility. The students first learned about Andy Goldsworthy by using search engines. They viewed several of his works in the computer lab while conducting their scavenger hunts. (*Editor's note:* The Scavenger Hunt worksheet is available as an online supplement.) Because of the diverse abilities within every class, one of our challenges is differentiation (i.e., to plan with the intention of having additional or bonus work for those students who complete tasks ahead of the others). Hence the last item on the worksheet afforded the chance to make more descriptive and/or visual notes about one of Goldsworthy's creations (Figure 2a, p. 35). One student showed exemplary spatial intelligence when she drew her own pencil sketch of Goldsworthy's Hollow Ice Ball (Figure 2b). Samantha did her drawing in less than five minutes!

In art class, Ellen asked the students to think about collections of their own. Many collected rocks, sea glass, shells, and autumn leaves. She asked them to bring in any collections that related to the environment. During class, Ellen showed additional examples of nature sculptures in Goldsworthy's book and

demonstrated how to approach creating them with collections of her own. Next, the students worked in groups of two or three outside to design their own nature sculptures. While some students were taking digital pictures of their works, others were using their verbal-linguistic skills, thinking up names for their masterpieces. Students had to work together to choose the elements in their sculptures and to decide how and where to arrange them. This required communication and interpersonal skills. Back in the computer room, Carol loaded digital pictures onto our server so students could open them in Kid Pix and experiment with special effects. One challenge was to save the interesting pictures before modifying them too much. Figure 3 on p. 59 is a good example of a computer rendition that shows a change in the tone and mood of a work achieved with technology.

In the classroom, students wrote couplets, haikus, or acrostic poems about their nature sculptures. This dovetailed with the language arts unit the students were doing.

Over the next few weeks, students converted their works to other art forms such as pastel pictures, paintings, clay works, and fabric pieces. They wer exploring the use of other art forms t express the same theme or composi

Using a template of four cards, the students assembled their digi photo of the original work, com modified picture, poem, and th ond art form into a HyperStudi Students added titles, chose appr fonts, and embellished the work had completed. Figure 4 on p. 59 shows the slides from a student-created stack.

Table 1. Description of the Multiple Intelligences

Bodily-Kinesthetic	Highly coordinated, often tactile, enjoy touching things, athletic, good fine motor skills
Interpersonal	Sensitive to and understanding of others, work well in groups, good leadership skills
Intrapersonal	Acutely sensitive to one's inner feelings, strengths, and weaknesses; enjoy solitude and activities like journal writing
Linguistic	Able to use words and language in many forms; reading and writing come easily; enjoy crossword puzzles, Scrabble, and other word games
Logical Mathematical	Able to discern patterns, logically approach problems, precise, methodical, good with calculations and scientific activities
Musical	Sensitivity to non-verbal sounds, rhythms, pitch, tonal patterns; likes to hum; remember melodies; easily turn sounds into rhymes
Naturalist	Environmental understanding and appreciation, distinguishes among living things, like classification, easily identifies features of the environment
Spatial	Able to form mental pictures and images, visualize things easily, excel at representative drawings, for example, reading maps

Figure 1. MI Wheel by Lori.

The Assessment

The students far exceeded our expectations in mastery of the curriculum content, the technology skills demonstrated, and the use of their MI. Because of our school's focus on MI, all

Figure 2a. Hollow Ice Ball by Andy Goldsworthy.

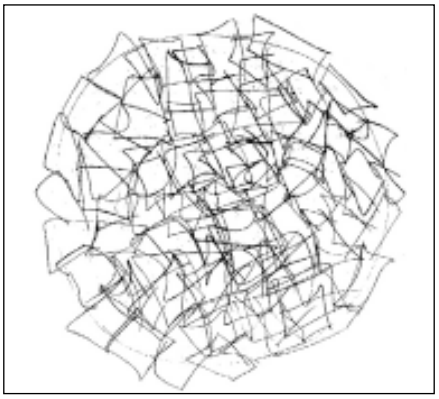

Figure 2b. Samantha's rendition.

of our students are introduced to this learning theory in kindergarten, and it is reinforced at every grade level. Students learn with pictures and simple words, such as "body smart" for bodily-kinesthetic and "word smart" for linguistic. The variation of the MI wheel shown in Figure 1 is prominently displayed in all of our classrooms.

In addition to being well-versed in MI terminology, our students are also familiar with rubrics and use them to help themselves understand goals and objectives and to keep themselves on track over the course of a project. (*Editor's note:* The assessment rubric used in this project is available as an online supplement.) We saw many examples of students understanding the patterns and structures in nature, as well as symmetry, contrast, balance, shape, and movement in art. Students showed a heightened awareness of nature itself with such lines in their poems as "Nature is awesome!" and "Nature's the best."

The measure of the success of a project in terms of technology is embodied in the standards for the state of Massachusetts. "If used appropriately, technology resources not only enhance learning of the curriculum concepts, but actually create opportunities for learning that simply do not otherwise exist." (Massachusetts Department of Education, 2001, p. 3.).

This project clearly created learning opportunities and enhanced motivation that would not have occurred without technology. Students who would have otherwise sat and sat attempting to think of something to write their poetry about, quickly jumped into the idea in their ongoing Andy Goldsworthy project, knowing they would be incorporating it into a multimedia show. Students learned to organize the various parts of their projects when making their stacks. The generation of additional patterns on the computer made the students conscious of the mathematical concepts often taken for granted around us. Because the students worked cooperatively on the computer, they often taught each other both interpersonal and technology skills. In addition, the technology skills acquired, such as cut-and-paste and assembly of a multimedia stack, carried over into the next grade. When these students became fifth graders, many of them did excellent research projects in multimedia programs with minimal assistance.

MI were used throughout this project. More important, we observed many examples of the growth of students' intelligences. One student, not particularly high in people smarts (interpersonal), became so involved, he forgot his reticence. Another student who normally does not enjoy using his spatial intelligence but loves the outdoors really enjoyed making the nature sculpture. By pairing the naturalist intelligence with the spatial, development of the visual intelligence occurred right before our eyes.

One of the most incredible examples of intrapersonal intelligence we have ever seen in a 10-year-old is a project called Me and My Shadow (Figure 5 on p. 59). It is unusual for students at this age to create literary pieces that show personification, yet here we see the sculpture personified as a reflection of one's self. This was also outstanding because of the intentional incorporation of light and shadow and complementary colors in her work.

According to Lorraine Munroe (1997), a teacher's job is "to plan and to do magic" (p. 119). MI celebrates each student as a unique mix of capabilities and when teachers tap into these, magic happens. We hope you have enjoyed this glimpse of magic!

Resources

Andy Goldsworthy

Center for Global Environmental Education: http://cgee.hamline.edu/see/goldsworthy/see_an_andy.html

Hemenway's Goldsworthy project site: www.framingham.k12.ma.us/hemenway/andy_goldsworthy_project.htm

Smithsonian Magazine: www.smithsonianmag.si.edu/smithsonian/issues97/feb97/golds.html

Multiple Intelligences

American Education Network Corporation: http://aenc.org/KE-Intelligences.html

Harvard University's adult MI study site: http://pzweb.harvard.edu/ami/mibasics

Surfaquarium's MI pages: http://surfaquarium.com/im.htm

Standards

Massachusetts Curriculum Frameworks: www.doe.mass.edu/frameworks

National Educational Technology Standards for Students—Connecting Curriculum and Technology: http://cnets.iste.org/students/s_book.html

References

Armstrong, T. (1993). *Multiple intelligences in the classroom.* Alexandria, VA: Association for Supervision and Curriculum Development.

Gardner, H. (1993). *Frames of mind.* New York: Basic Books.

Goldsworthy, A. (1990). *Andy Goldsworthy: A collaboration with nature.* New York: Abrams, Inc.

MI continued on page 59.

MI continued from page 35.

Figure 3. Morning and Night by David. The image on the right is the student's electronic rendition of his own original sculpture on the left.

Figure 4. Slides of Kara, Cady, and Cara's project.

Figure 5. Me and My Shadow by Alexandra.

Massachusetts Department of Education. (1998–2001). *Massachusetts State Curriculum Frameworks* [Online]. Malden, MA: Author. Available: www.doe.mass.edu/frameworks/.

Hadingham, J., Hargrave, S., Ciampa, J., Louie, C., Themson, C., & Stotsky, S. (2001, February 17). *Educational Technology Standards Draft*, p. 3.

McKenzie, W. (2002). *Multiple intelligences and instructional technology—A manual for every mind.* Eugene, OR: ISTE.

Munroe, L. (1997). *Nothing's impossible.* New York: Public Affairs.

Teele, S. (1995). *The multiple intelligences school—A place for all students to succeed.* Redlands, CA: Citrograph Printing.

Carol Lach is the technology specialist at Hemenway Elementary School in Framingham, Massachusetts. She has been instrumental in the integration of technology into the curriculum and currently co-teaches with a wireless "lab" in all the elementary classrooms. Thirty years ago, she was using punch cards on mainframe computers as a student at Purdue University. After completing her master's degree in science education at Cornell, she taught middle school in New York and Mississippi. Then she completed her PhD in the sciences and worked in cancer research until she entered the world of computer technology at a company that developed the first software for PCs in the biotechnology field.

Ellen Little has been teaching art for 31 years in both elementary and secondary schools. She received her degree in art history from Wellesley College and then continued her education at Massachusetts College of Art. Three years ago, she started working and planning a project that required extensive technology. The excitement it generated with the students convinced her to expand her own knowledge and use of technology from scanning to iMovies and complex multimedia projects.

Deborah Nazzaro is a Grade 4 teacher at Hemenway Elementary School in Framingham, Massachusetts, where she also taught in the gifted and talented program. Thirty years ago, she worked in the corporate world and remembers the refrigerator-sized reel-to-reel computer tape drives. She earned her master's of education degree from Cambridge College and did her thesis work on teaching and learning with the multiple intelligences. Deborah believes that technology brings a whole new exciting dimension to the exploration of multiple intelligences in the classroom.

Online Supplement #1

	Assessment Rubric			
	Science Curriculum	Art Curriculum	Technology	Multiple Intelligences
4	Uses at least three patterns of nature in sculpture and can find all five in Goldsworthy's works. Can easily identify the elements and interconnections of these. Identifies at least two characteristics in order to group objects.	Clearly shows multiple patterns, balance, dimension, and symmetry. Shows a sophistication in the choice of materials and how both materials and color complement the artwork. Demonstrates a knowledge of the effects of light, shade, and background in the composition. Is creative and shows an understanding of the creations of Goldsworthy's relative to texture, materials, color and design. Is able to translate the original sculpture into another media effectively.	Demonstrates ease in the gathering of information from Web sites. Effectively and efficiently uses basic computer skills. Shows ability to use all aspects of a drawing and paint program. Computer art is creative and evokes a different emotion than the original. Is able to complete a stack of at least three cards using the pull-down menus and shortcut keys.	Clearly demonstrates the use of at least six multiple intelligences. Cooperates and shares ideas and efforts. Poetry reflects intrapersonal and linguistic intelligences.
3	Uses at least two patterns of nature and can find four. Identifies elements of the structure and the connections among them. Groups objects using two characteristics.	Incorporates a pattern and shows some sense of balance in composition and color. Effectively uses light and contrast. Shows a thoughtful choice of background and originality of the work itself. Shows a similarity between the original composition and one done in a different medium.	Can obtain necessary information from the Internet. Is able to use basic computer skills. Shows an understanding of computer renditions of an original graphic. Completes three cards/slides.	Uses at least five intelligences. Shares ideas and effort. Poetry is reflective and demonstrates good language skills.
2	Uses and can identify at least one of the patterns of nature and can find three in other works. Can identify the elements used in the structures. Can relate characteristics in a group.	Uses some artistic sense of balance, materials, and background. Shows an understanding of the similarities and differences in the creation of artworks (e.g., techniques, design, materials and color).	Uses the Internet with minimal assistance to obtain required information. Can generate a computer picture from the original. Completes two cards/slides.	Uses at least four intelligences. Makes an effort to work with one or more classmates. Writes a poem with a good choice of words.
1	Can identify two or more patterns. Is aware of how elements make up a structure. Can find at least one characteristic within a group.	Can create a sculpture with elements from nature in three dimensions, and can relate this to Goldsworthy's works. Has some sense of the role of lines and texture in the techniques used.	Finds information on the Internet with assistance. Generates a computer rendition of the original photo. Can complete two slides with assistance cutting, pasting, and cropping as needed.	Shows a reasonable effort with interpersonal, naturalist, linguistic, and spatial intelligences.

Scavenger Hunt

Grade 4 ***Patterns in Nature***

NAME _____

1. Go to Internet Explorer
2. For the address, you may go to ask.com, yahoo.com, or google.com
3. Then search for Andy Goldsworthy.
4. Choose a category with Andy Goldsworthy as the title, or Andy Goldsworthy Landscapes of the mind.
5. Look at five or more pictures. Choose your favorite.
6. Answer the following questions:
   a. What is your favorite picture titled? If it doesn't give a title, what would you call it?

   b. What are the elements of nature in the picture you chose? (e.g., birch leaves, pebbles, feathers)

   c. What patterns can you identify (i.e., packing, explosion, meander, spiral, branching)?

   d. What did you especially like about this picture?

   e. Is your picture one that is ephemeral (will disappear quickly by melting, being washed, or blown away, etc.) or is it a sculpture that will last?

   f. What did Andy do when he was growing up that influenced or made him so aware of nature? (Obviously, he did not spend all his time on Playstation).

Make some notes or a sketch on the back of this sheet so that you will remember what your favorite picture looked like.

The stand-alone version of this supplement is offered in Rich Text Format (RTF) in order to provide flexibility in content and layout. The PDF of the article has an example of a finished version of this supplement that is not easily edited. The RTF file provides easy editing to meet your needs and has minimal layout treatment.