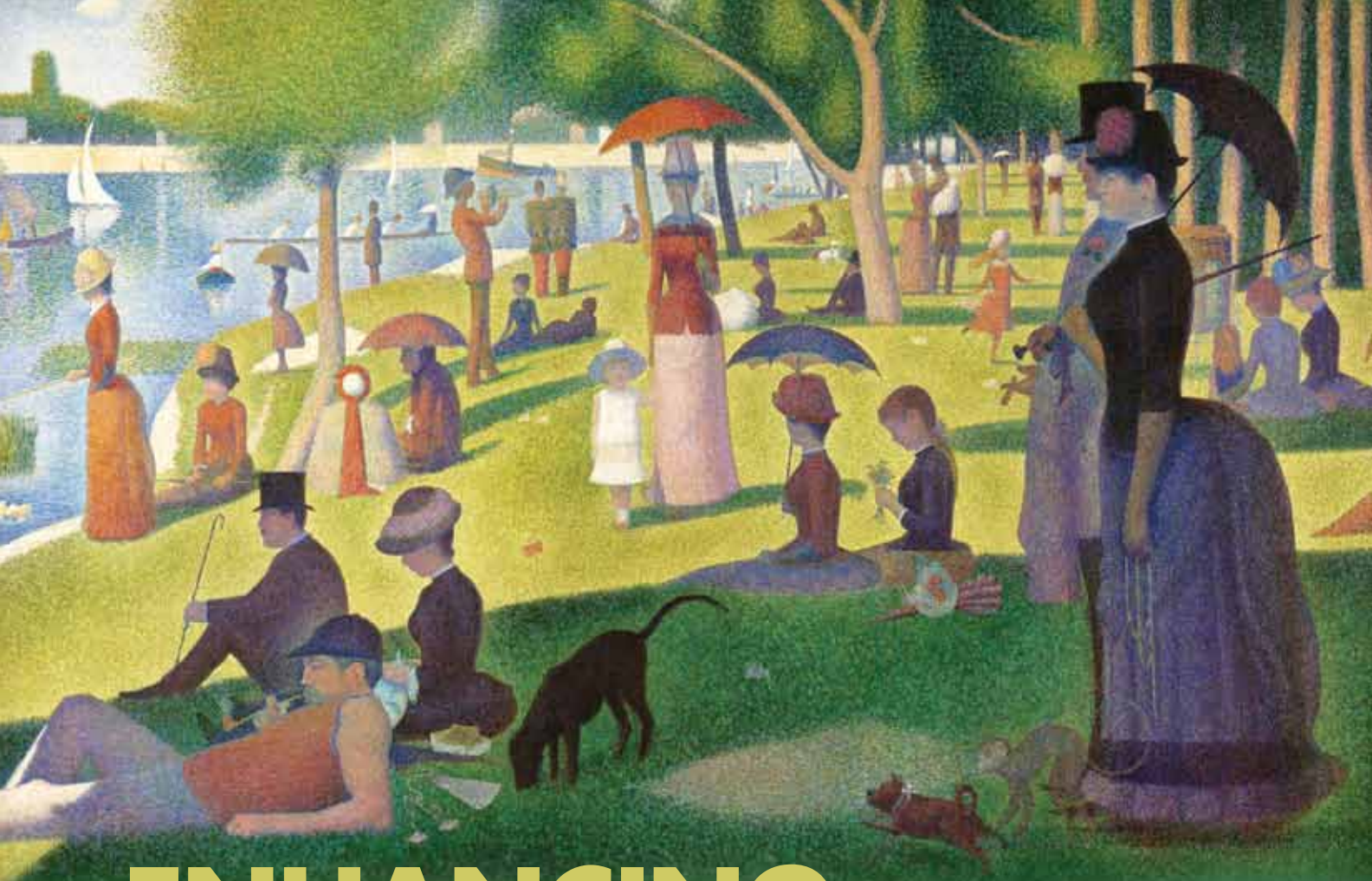

ENHANCING SCIENCE EDUCATION THROUGH ART

by Susan Merten

Augmenting science with the arts is a natural combination when one considers that both scientists and artists rely on similar attitudes and values. For example, creativity is often associated with artists, but scientists also use creativity when seeking a solution to a problem or creating a new product. Curiosity is another common trait shared among scientists and artists, who are both interested in finding answers to questions and wonder about the world around them. In science, students are encouraged to wonder and ask questions, seek answers, try new approaches, provide honest evidence for claims they make, and create new understanding about the world around them. Practicing these attitudes will help middle school students develop their critical-thinking skills along with science literacy.

Whether you have in-school resident arts teachers available to collaborate with, or you need to rely on your own creativity, the arts adapt easily to a middle school science curriculum. Below are simple art activities that allow students to express their science understanding and creativity in ways other than traditional paper-and-pen tasks.

FIGURE 1 Wind art by sixth-grade students

PHOTOS COURTESY OF THE AUTHOR

Introducing the relationship

Students new to middle school science often begin the year with a mix of anticipation and anxiety. To ease their transition and help students see the connection between science and art, I use one of the Benchmarks for Science Literacy, "habits of mind" (AAAS 1993), to link science to art early in the school year. The habits of mind are common values, attitudes, and skills necessary to promote science literacy and help students prepare for "life beyond school" (AAAS 1993, p. 281). In addition to "attitudes and values," habits of mind address "manipulation and observation," "computation and estimation," "critical-response skills," as well as "communication skills." I emphasize the natural connection between science and art by pointing to the values and attitudes employed by both: curiosity, observation, creativity, and skepticism with open-mindedness (NRC 1996). In class we discuss how both scientists and artists might use habits of mind in their work. Initially I ask students how scientists and artists might be alike, such as similar attitudes, similar values, or similar skills. This introductory activity can be done as a think/pair/share activity, in small groups, or as a whole-class discussion. After students have had time to brainstorm their ideas, we collaborate through whole-class discussion. I emphasize the natural connection between science and art by pointing to the values, attitudes, and skills employed by both scientists and artists, both of whom

- show curiosity and are observant of the world around them,
- value honesty and creativity,
- use tools to help them in their work, and
- use communications skills to express their ideas and record their observations.

Throughout the year, I refer to articles about art in newspapers and magazines. For example, articles

FIGURE 2 Pointillism paintings by middle school students

regarding masterpiece restoration may address chemical breakdown of paints or canvas, often employing a forensic approach. In my classroom, I display posters of art that are connected to science. For example, Katsushika Hokusai's "The Great Wave Off Kanagawa" is inspired by a force of nature, and art photographs of the Grand Canyon exhibit sedimentation, erosion, and rock age. Photographs of volcanoes can connect to plate tectonics, and those of lightning or storms can be connected to energy in the atmosphere. Watercolors can be used to discuss natural phenomena and energy found in nature as well as chromatography, light absorption, and reflection of pigment. There are many science-related art posters available to choose from and accessible through the internet or when visiting an art exhibit.

Using art for assessment

Weaving arts into science assessment is usually met with enthusiasm among middle school students. Along with traditional assessments such as tests and quizzes, I often try to offer a few other options in order to build excitement and interest. For example, in one assessment that developed into an inquiry-based project, eighth graders, as a class, created a lab safety video to communicate their understanding of lab safety practices. A formative assessment of safe lab practices guided me as to what safety points needed to be reviewed. Students collaborated and discussed which were the most important lab safety practices. They wrote a skit for the key safe lab practices, videotaped the skit, and edited the video. The completed video was played for younger students in grades 4 and 5, complete with a pre- and post-video quiz. The eighth-grade students compared the younger students' correct quiz answers before and after viewing the video, and we analyzed the results as a class by trying to answer this question: Can younger students effectively learn safe lab practices from watching a video? Finally, students reported their findings in a lab report. This alternative to yet another lab safety test engaged students, assessed their previous learning, and let them be creative.

Options to consider for this project include the following: For a larger class, divide students into smaller groups, each group developing one skit from

selected lab safety practices. One class can evaluate videotaped skits made by another class for accuracy as part of an assessment. If videotaping is not an option, skits may be performed live in younger-grade classrooms or for a special assembly.

Another art-inspired assessment used in eighth grade was directed toward developing a lab report to communicate an investigation and findings. While students were required to use a standard lab report format to include components common to science inquiry investigations (problem, hypothesis, variable, constants, materials, procedure, data, analysis, and conclusion), they could choose the reporting vehicle, such as a traditional written report, a PowerPoint presentation, a brochure, or a poster, to express their understanding. Students who enjoy drawing were encouraged to enhance procedure steps in the investigation using sketches to illustrate the steps. A few students chose a traditional lab report format, using templates, but other students appreciated employing a nontraditional means to communicate their findings and understanding.

Other summative assessment choices that can be adapted to all science disciplines to explain understanding of science concepts include creating rap songs, story books, board games, or cartoon strips to express key concepts and detail points of topics currently being studied in science. In all art-based assessments, Illinois state learning standards and associated rubrics were used to assess science concept understanding, science knowledge of content, and communication skills necessary in science.

Enhancing content

Sometimes art activities are more appropriately used as a supplement to content. For example, when introducing a study of wind patterns within our unit on atmosphere and weather, I read aloud to students a tale from a Native American legend that explains wind in nature (see Resources). Next students were asked, "How can you 'see' wind?" After initially discussing signs of wind seen in nature, such as flags whipping, bending branches, swirling leaves, large waves and whitecaps, or bending tall grass in a field, students were shown images of Van Gogh's paintings "Starry Night" and "Wheatfield with Cypresses." Other images where wind effect is visualized can easily be found online to share with students (see Resources). After learning about how to qualitatively gauge wind using the Beaufort scale, students were asked to create their own pictures using paints or crayons to visually depict wind blowing (Figure 1). The student wind images were started in class and completed at home as homework and later displayed in the hallway. An extension of this exercise would be to have students evaluate their wind pictures, or classmates', using the Beaufort scale. Another option is to have students generate a descriptive observation paragraph to describe the wind force in the picture.

Collaborating

If art teachers are available and willing to collaborate, sharing your curriculum can reinforce lessons and may lead to deeper student understanding of science concepts, with tangible results that include not only better marks on science assessments, but developing science literacy as students learn to connect art to science and science to the arts. For example, while learning about atoms making up matter in physical science, students were introduced to the artist Georges Seurat (see Resources). They examined Seurat's pointillism style and technique, both in science and art class. In science, students were introduced to atoms making up matter by first examining colored cartoons from newspapers. They identified the images in the newspaper cartoon, then examined the images with hand viewers. Students were able to see distinct dots of color in the newspaper image that often created a different color when the dots were viewed as a whole image. The individual color dots were compared to atoms. When many dots are combined, a larger, more complex image is visible. Similarly, when atoms are combined with other atoms, matter is created. I also relate atoms making up matter to tile mosaic work, photo mosaics, as well as Seurat's pointillism (a poster of "Sunday Afternoon on the Island of La Grande Jatte" is mounted in my classroom).

In art class, the teacher introduced pointillism as a technique used by the impressionist artists and gave students background history using a PowerPoint presentation. They learned how a small spot of individual color placed on a canvas reflects light differently when a different color is placed very nearby, creating different hues. Similar to their experience in science, students viewed a small, magnified portion of pointillism from a painting and were able to identify individual colors, but were unable to identify the

subject of the painting. When the magnified portion was revealed within the entire painting, students could see the subject and images in the painting, but not the individual colors. At this point, the art teacher reinforced the idea that small amounts of color, when combined, create a whole picture, as atoms combine to make up matter. Our resident artist arranged a field trip to the Art Institute of Chicago, where students were able to examine Seurat's work in person, however, these images can also be viewed and examined online.

Students also used the pointillism technique in their own artwork. In small groups, students decided what image they would create and employed pointillism for color and image development. Their collaborative work resulted in several large student pointillism paintings that are framed and displayed in our school halls and administration offices (Figure 2). As part of their summative assessment in science during the study of atoms and matter, students were asked to write a short essay and compare atoms and matter to impressionist pointillism art.

In a dance class, the dance teacher applied Newton's laws of motion to dance while middle school students were learning physics in science. In science, students studied Newton's laws, learned about potential and kinetic energy, and reviewed machines. In addition, they examined potential and kinetic energy along with force and motion as applied to arm or leg movement in sports. In dance class, students also explored concepts of force and motion, along with inertia, action and reaction, speed, friction, center of balance, and gravity to create movement sequences. Students' choreographed movements were put to music, and dance interpretations of simple machines, including levers and pulleys, were highlighted during the spring dance show.

Technology also enhances the art–science connection by enabling art to be created, documented, and communicated to others. Digital photography, video, sound editing, and the internet bring a wealth of art options and tools to our fingertips.

Conclusion

Research consistently links improved academic achievement to the inclusion of art in the curriculum (Ruppert 2006). Allowing students to create in school brings energy into the classroom and fosters real-life art connections. In addition, some believe that including arts in education becomes the vehicle for education/school reform (Burnaford, Aprill, and Weiss 2001). Art in science works well as an introduction to concepts, such as the story and pictures of wind; as an option for a summative assessment, such as lab report options; or as an enhancement in science, such as pointillism pieces created in art class.

If art can be incorporated in science and across the curriculum in core subjects, middle school students may remain more engaged in school as they begin to grasp the concept that science is absolutely connected to art, but also many aspects of life they enjoy: sports, new technology, music, and entertainment. ■

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Blowing in the wind posters and prints—*www.zazzle.com/blowing+in+the+wind+posters*

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