Integrating Geometry with Art

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Introduction

Thomas West, an author, has stated that there is a longstanding myth that mathematical symbols are "for serious professionals – whereas pictures and diagrams for the lay public and children" (2004). As a result of this belief, mathematics is often presented solely as a numeric and symbolic subject, which leads to many lost opportunities for children to develop visual understandings and to access mathematics in a creative way.

## How do art and math complement each other?

Research shows that extended participation in fine art activities correlates with increased mathematical reasoning skills, as well as intrinsic motivation, visual imagination, and the ability to form creative ideas (Brezovnik, 2015). Grade 4/5 students who experienced fine art integration performed better on math tests (Brezovnik, 2015), and experienced a dramatic increase in knowledge for mathematics, science, and visual arts (Hanson 2002). To ensure students are motivated and willing to see the value in math, it is important to connect it to other subjects such as art. This allows students to see math as a whole subject, as opposed to isolated topics (Sendova & Grkovska, 2005).

As students go into careers related to science, engineering, or math, they can use their visual arts abilities to enhance their creative and problem solving skills (Wynn & Harris, 2012). Students who integrate themselves in the fine arts have a higher level of academic achievement, and a lower level of social, emotional, or behavioural issues (Respress & Lutfi, 2006). Therefore, art and math complement each other, and can enhance student learning in both areas (Bickley-Green, 1995).

Why geometry and art?

Research has shown that young students and adults perceive geometric shapes in different ways (Siew, Chong, & Abdullah, 2013). For instance, elementary students learn about the concept of geometric shapes through visualization based on experiences from real-life (Siew et al., 2013). Visually-assisted tools such as drawing and using manipulatives also allow students to improve their ability to classify shapes (Siew et al., 2013). Furthermore, students who have had previous training in visual arts have shown greater performance in geometric reasoning tasks including visualization and mental manipulation of objects (Walker et al., 2011).

Cool Colours
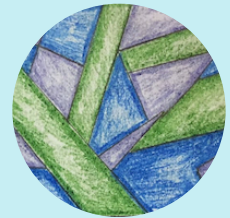
Green, Blue, Purple

Complementary Colours

Red- Green
Blue- Orange
Yellow- Purple

Warm Colours

Red, Orange, Yellow

Activity

- Begin with an open discussion about the four artists' work and gauge how the colours make the students feel.

- Students will receive a blank cue card and be given parameters of different types of angles and lines that must be included in your art piece.

- You will review the definitions of the terms parallel lines, perpendicular lines, right angle, acute angle, obtuse angle, straight angle, and intersecting lines with your students. Students will also be able to refer to the terms as they will be displayed.

- After students complete the math aspect of the activity, they will then choose coloured markers or pencil crayons to bring to their art piece. The colours they use should be based on their feelings.

- You and your students will have an open discussion about the colours they used and what those colours mean to them in relation to their artwork.

- At the end, all students will compare their artwork, and make note of how even with the exact same parameters, everyone was able to make something unique.

Curriculum Connections

Grade 5 Geometry and Spatial Sense: Specific Expectations: Page 82:
– Identify and classify acute, right, obtuse, and straight angles;
– Measure and construct angles up to 90°, using a protractor;
– Identify triangles (i.e., acute, right, obtuse, scalene, isosceles, equilateral), and classify them according to angle and side properties;
– Construct triangles, using a variety of tools (e.g., protractor, compass, dynamic geometry software), given acute or right angles and side measurements

Grade 5: Visual Arts: D1: Creating and Presenting:
D1.1 Create two- and three-dimensional art works that express feelings and ideas inspired by their own and others' points of view
D1.3 Use elements of design in art works to communicate ideas, messages, and understandings

References

Bickley-Green, C. A. (1995). Math and Art Curriculum Integration: A Post-Modern Foundation. (1), 6. doi:10.2307/1320488

Boaler, J., Chen, L., Williams, C., & Cordero, M. (2016). Seeing as understanding: The importance of visual mathematics for our brain and learning. *Journal of Applied & Computacional Mathematics*, 5(5), 1000325.

Brezovnik, Anja. (2015). The Benefits of Fine Art Integration into Mathematics in Primary School. *Center for Educational Policy Studies Journal*. 5. 11-32.

Respress, T., & Lutfi, G. (2006). Whole brain learning: The fine arts with students at risk. Reclaiming children and youth, 15(1), 24.

Sendova, E., & Grkovska, S. (2005). Visual modeling as a motivation for studying mathematics and art. *Educational Media International,42*(2), 173-180. doi:10.1080/09523980500060332

Siew, N. M., Chong, C. L., & Abdullah, M. R. (2013). Facilitating students' geometric thinking through Van Hiele's phase-based learning using tangram. *Journal of Social Sciences*, 9(3), 101.

Walker, Caren & Winner, Ellen & Hetland, Lois & Simmons, Seymour & Goldsmith, Lynn. (2011). Visual Thinking: Art Students Have an Advantage in Geometric Reasoning. Creative Education. 2. 22-26. doi: 10.4236/ce.201121004.

Wynn, T., & Harris, J. (2012). Toward a STEM+ arts curriculum: Creating the teacher team. Art Education, 65(5), 42-47.

TERMS

PARALLEL LINES

Two lines in a plane that do not intersect or touch each other at any point

PERPENDICULAR LINES

Lines that meet or cross at right angles (90 degrees)

RIGHT ANGLE

An angle of 90 degrees

OBTUSE ANGLE

An angle that measures more than 90 degrees but less than 180 degrees

ACUTE ANGLE

An angle that measures less than 90 degrees but more than 0

STRAIGHT ANGLE

An angle of 180 degrees

INTERSECTING LINES

The point where two lines meet or cross