

The Beautiful Triangle

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The Beautiful Triangle workshop introduces to educators a multi-disciplinary study that integrates geometry, spatial sense, aesthetics, language, the history of ideas, and visual arts. The guiding concept of the study is that geometric figures represent and communicate concepts, feelings, and experiences. The workshop, which is rooted in a constructivist pedagogical model, combines both explanatory and experiential learning. By engaging in the same learning activities as the students would, educators gain insight into the analytical and creative processes involved in the study. The learning activities include: making choices based on aesthetic preferences; analyzing these choices through reference to geometric properties; naming triangles based on Greek and Latin roots; experimenting with triangles as analytical tools based on the model of Thales; appreciating and analyzing the work of Wassily Kandinsky as a model of conceptual geometric art; and designing a piece of conceptual geometric art with accompanying Artist Statement. The Beautiful Triangles workshop is based on a unit of study that has been piloted with students at The Toronto Heschel School. The workshop will be of interest to educators who are looking for ways to integrate mathematics and arts in ways that enhance critical and creative thinking.

Introduction

The Beautiful Triangle is a workshop based on a multi-disciplinary study of triangles that integrates geometry, spatial sense, aesthetics, language, the history of ideas, and visual arts. The guiding concept of the study is that geometric figures represent and communicate concepts, feelings, and experiences. The Beautiful Triangle was conceived and developed by educators at the Lola Stein Institute for Leadership in Education and has been piloted for the past four years at the Toronto Heschel School with classes of grade seven students. Through this unit, students appreciate how the properties of triangles can be used to express their own thoughts and ideas. This motivates students to produce innovative conceptual art, and to write insightful Artist Statements that evince a deep understanding of the geometry curriculum. The workshop - which combines presentation with hands-on activities- enables participants to experience the key elements of the unit, and provides them with tools for replicating it with students.

Aesthetics

The Beautiful Triangle workshop begins with an exercise in which participants are asked to look at a collection of triangles arranged on a white page. Participants are asked to consider which triangle is the “most beautiful” or “most appealing”, and to rank the triangles in order from most to least beautiful. Participants scribe and then discuss their thoughts and feelings about each triangle. This first stage of aesthetic impression is followed by an analytic stage, in which participants use tools such as a ruler and a protractor to discover the properties of the triangle which they have selected. For instance, a person who

preferred a particular triangle because it appeared to be “balanced” will discover, using a protractor and ruler, that the triangle has three equal angles and three equal sides.

Constructivist Approach to Naming

The next stage involves naming the triangles. A list is provided of root words, suffixes, and prefixes with Greek and Latin etymologies such as *poly-*, *-gon*, *-skelos*. Using these roots, suffixes, and prefixes, participants construct a name for each triangle. The purpose of this exercise is two-fold, when done with students. Firstly, the activity provides a pretext for a lesson in the history of ideas: it is an opportunity for teachers to expose students to the development of geometry in ancient Greco-Roman civilization. Secondly, the activity constitutes a form of constructivist pedagogy: by allowing students to construct their own terms for the shapes, students recognize how the construction of language has both logical and contingent elements. For example, one might reasonably name the “balanced” triangle with equal angles an *equigon* (*equi-* meaning *equal*, and *-gon* meaning *angle*), or an equilateral (*-lateral* meaning *sides*). Of course, once students have assigned a personal name to their triangle, they are then introduced to the standard accepted nomenclature. This activity is replicated with workshop participants, as a hands-on example of constructivist pedagogy.

History of Geometry in Abstract Thinking

The workshop continues with examples of lessons that demonstrate for students how the ancient Greeks used geometry as an analytical tool. In particular, Thales' use of similar triangles to measure the heights of pyramids is discussed, and a practical way for students to replicate his experiment is provided. The purpose of these lessons is to further enhance students' understanding of how geometric figures can be used to represent and communicate abstract concepts.

Models of Abstract Art

The next stage of the workshop, which reflects the progress of the unit of study, is for participants to examine the abstract art of Wassily Kandinsky. Slides of Kandinsky's work which feature the use of geometric figures are shown. Participants respond to the art using the same set of guiding questions that are provided to students. These include questions such as, what emotions does this art evoke? What is the story or message conveyed by this work? What title would you give this work of art? After participants view a few of Kandinsky's works, they have an opportunity to share and discuss responses. The workshop leader provides some examples of additional lessons which can be done with students to enhance their understanding and appreciation of Kandinsky's background, artwork, and aesthetic philosophy.

Student Conceptual Art

The final stage of the Beautiful Triangle unit is for students to create their own abstract geometric art that expresses a concept, emotion, or narrative. Over the years, students have selected topics as diverse as “Trust & Friendship”, “Jewish History”, “Gymnastics”, “Rock and Roll”, “The Cosmos”, “Chaos”, “Creation”, “Acceptance”, and “A Picnic in the Park”. Because of the precision required in forming the geometric images, the first stage of the work is done using a pencil, protractor and ruler. The work is then finished using pencil crayons, or water colour. In longer versions of the workshop (2-2.5 hours) participants have an opportunity to begin creating samples of geometric conceptual art. In shorter versions

(1.5 hours) the workshop leader describes the process through which students develop their artwork, and provides examples of student work that can be used as models.

Artist Statement

Each work of art is accompanied by an Artist Statement, which describes the concept of the work. This statement outlines how the choice of composition, the selection of particular shapes, and the properties of these shapes support and communicate the concept. The Artist Statement includes technical information about the shapes used, including their standard nomenclature, various angles and properties such as congruency, similarity, and ratio.

Teaching Tools

Each workshop participant receives a full colour booklet that provides an outline of the unit of study, examples of the key activities, and samples of student art and Artist Statements.

Samples of Student Work



Figure 1: *The Cosmos*

Figure 2:
*Everything
Revolves Around
Art*

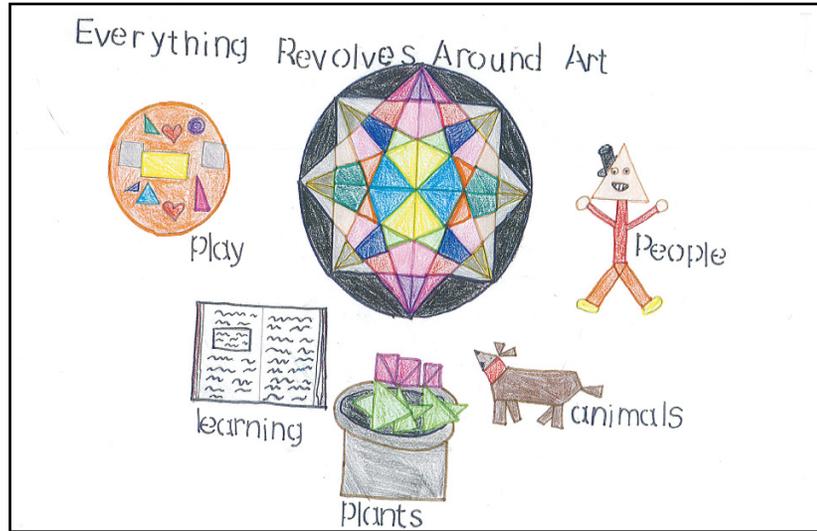


Figure 3:
Happiness



Figure 4:
Diversity

