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Secondary Students Scheme Of Composite Functions

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Abstract Constructivist theory suggested that an individual construct schemes as a tool to thinking processes and schemes were used and remodified during interactions with the environment. The main objective of the study reported in this paper was to investigate students' schemes of composite functions. Twelve secondary students participated in a videotaped clinical interview where a series of tasks related to composite functions were presented to them. Constructivism is the theoretical perspectives undertaken by this study. Datas obtained from the interviews which basically focused on students verbal and non verbal responses to the tasks were transcribed and later analyzed. Two cases of students' inferred schemes selected from twelve are discussed.
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Teaching about Islamic Art/Learning Geometry
Teaching Geometry/Learning about Islamic Art

A Workshop

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I. Abstract

Many folks are unaware that the terms algebra and algorithm came into English and other European languages from Arabic. In fact, Arab and Muslim mathematicians contributed greatly to the early development of mathematics as we understand it today. Many basic principles of mathematics are expressed in the arts and architecture of the Islamic world. In this presentation/workshop we will explore major Islamic monuments such as the Alhambra in Spain and the Taj Mahal in India, and examine symmetry and geometric patterns that are used in Islamic art and architecture elsewhere to learn about numbers, shapes, and the nature of space, and their relationship to constructions of beauty.

Note: This workshop fits into the following themes at this conference:
- effectively utilizing new paradigms in teaching and learning
- applications of mathematics and modelling in the real world
- ways of dealing with cultural differences
- teacher education

II. Mathematical Principles and Concepts Present in Islamic Art

Arithmetic operations (addition, subtraction, multiplication, division)
Number, shape and the nature of space
Polygons; shapes; relationships of shapes
Parallelograms; rhombuses; kites (almonds); darts
Triangles and six-pointed stars; twelve-pointed stars
Squares and eight-pointed stars
Decagonal forms and dodecagonal forms
Squares and square roots
Halving and doubling
Geometry; circles and centers; pi = constant ratio of circumference to diameter
Pi and proportional relationships

Infinity and boundedness
Pythagorean theorem; Pythagorean triples; visual proofs
Plato's ideal triangles; √2 systems; √3 systems
Roto-centers 2-3-6; 2-4-4; 3-3-3; 1-∞-∞
Diophantine equation: 1/X + 1/Y + 1/Z = 1
Grids and tessellations
Symmetry and asymmetry
    Border patterns (7); field patterns (17)
    Group theory; sets
    Color symmetry; uses of color: binary; algorithmic; random
    Dissymmetry; antisymmetry; symmetry-breaking
Patterns
    Units and repeats; additive/successor function; modularity
    Algorithms; iterations and variables (color; form; scale; orientation)
    Organizing principles: symmetry; self-similarity and scaling; space-filling curves; spirals; phi/golden section; algorithms; fractal dimension; dilation/projection
    Prisms; antiprisms
    √2 patterns; √3 patterns
Mensuration and measurement
Knot theory; interlacing

III. Student Activities Designed to Address These Concepts

1. Playing with *pi*: pennies, CDs, paper plates, rubber tires
2. Introducing symmetry: mirrors, pinwheels, swastika, baseball, postcards
3. Observing symmetries: take a walk (architecture/nature)
4. Introducing tessellations: construction paper, scissors, tape, pencils; walk
5. Drawing patterns: graph paper, pencils, colored pencils
6. Paper-folding: arithmetic functions
7. Paper-folding: right isosceles triangle
8. Paper-folding: paper plates
9. Building polyhedra; constructing Platonic solids using paper plates
10. Building polyhedra: using kits
11. Paper-folding and cutting: six-pointed stars
12. Paper-folding and cutting: eight-pointed stars
13. Visual analysis and interpretation: Persian miniature painting
14. Visual analysis and interpretation: Renaissance painting
15. Visual analysis and interpretation: two-dimensional space; three-dimensional space
16. Point-line-plane-solid exercise
17. Relating three-dimensional space to two-dimensional space
18. Visual analysis and interpretation: grids and axes in the Taj Mahal and Alhambra
19. Visual analysis and interpretation: patterns and pattern formation
20. Visual analysis and interpretation: patterns and different technologies
21. Observing symmetries: border patterns and field patterns; manipulating designs
22. Making patterns: coloring using one, two, three, and four colors – paper, markers
23. Making patterns: arranging triangles – construction paper or Origami paper
24. Visual analysis and interpretation: symmetry-breaking

25. Making patterns: *Geometer's Sketchpad*

IV. Websites Useful for the Study of Islamic Art (including Museums)

Symmetry and Pattern: The Art of Oriental Carpets http://mathforum.org/geometry/rugs

Doris Duke's Shangri La www.shangrilahawaii.org

Los Angeles County Museum of Art/Islamic http://www.lacma.org/islamic_art/islamic.htm
Courtly Art and Culture in Western Asia: http://www.lacma.org/khan/index_flash.htm

Freer Gallery of Art/Arthur M. Sackler Gallery/Islamic Art
http://www.asia.si.edu/collections/islamicHome.htm

The Metropolitan Museum of Art www.metmuseum.org
Flowers Underfoot: Indian Carpets of the Mughal Era
http://www.metmuseum.org/explore/Flowers/HTM/INDEX.HTM
Timeline of Art History: The Nature of Islamic Art
http://www.metmuseum.org/toah/hd/orna/hd_orna.htm

The Detroit Institute of Arts/Islamic Art
http://www.dia.org/collections/ancient/islamicart/islamicart.html

National Gallery of Art www.nga.gov
Palace and Mosque: Islamic Art from the Victoria & Albert Museum
http://www.nga.gov/exhibitions/islamicinfo.shtm

The Textile Museum www.textilemuseum.org
Flowers of Silk and Gold: Four Centuries of Ottoman Embroidery
http://www.textilemuseum.org/fsg/

V. Useful References for the Study of Geometry and Islamic Art

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Castéra, Jean-Marc et al. *Arabesques, Decorative Art in Morocco* (ACR, Courbevoie 1999).
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Gerdes, Paulus. *Geometry from Africa* (Math Association of America 1999).
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