Math and Art:
The Schema Connection

Presented by
Deborah Ekwo, Ed. D.
Daniel Ortiz Middle School, HISD

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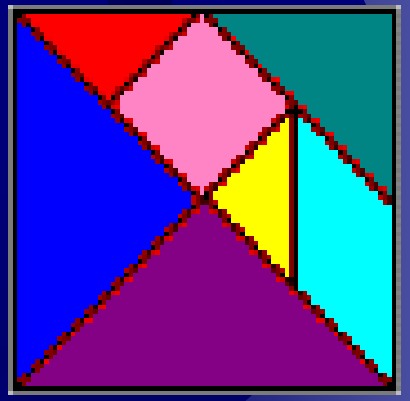
What is Art?

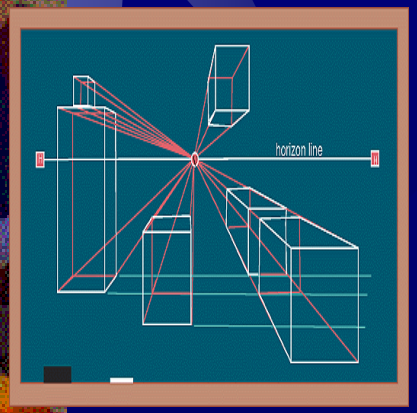
- H. Thompson(1979) describes art as intertwined with our total life and as a vehicle for learning and a necessary element of education.
- H. Broudy (1977) explained that art symbolizes images of thought and feeling.

Cont.

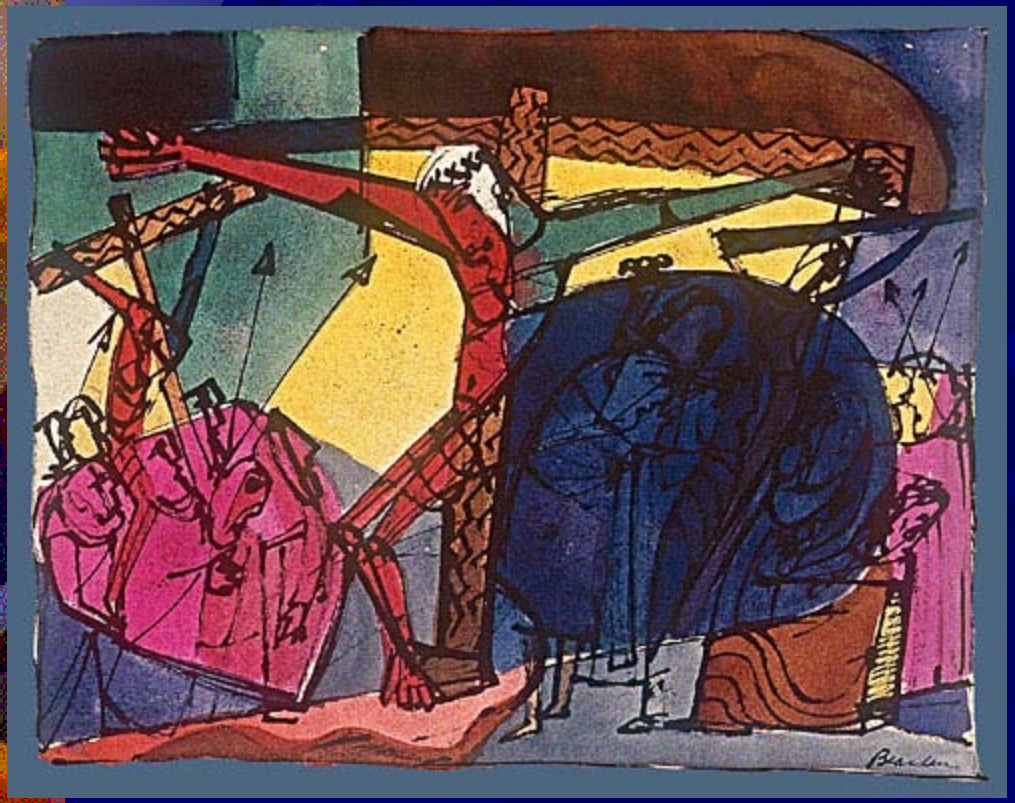
- Art has played an important role in human experiences as a motivator.
- I see art as the inner expression of a man’s soul.

Math in Art or Art in Math

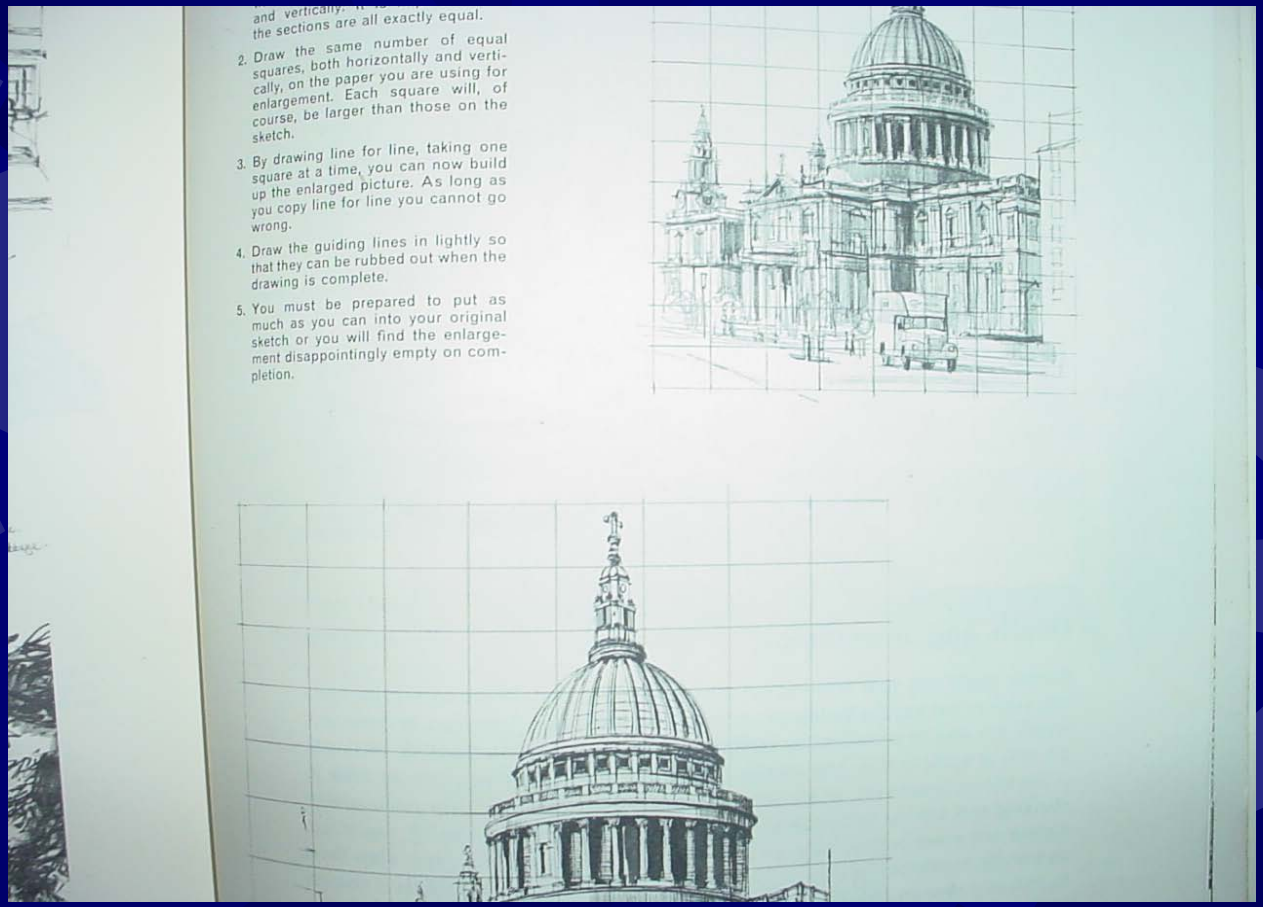




Seeing the Math



Using Math



and vertically. It ... the sections are all exactly equal.

2. Draw the same number of equal squares, both horizontally and vertically, on the paper you are using for enlargement. Each square will, of course, be larger than those on the sketch.
3. By drawing line for line, taking one square at a time, you can now build up the enlarged picture. As long as you copy line for line you cannot go wrong.
4. Draw the guiding lines in lightly so that they can be rubbed out when the drawing is complete.
5. You must be prepared to put as much as you can into your original sketch or you will find the enlargement disappointingly empty on completion.

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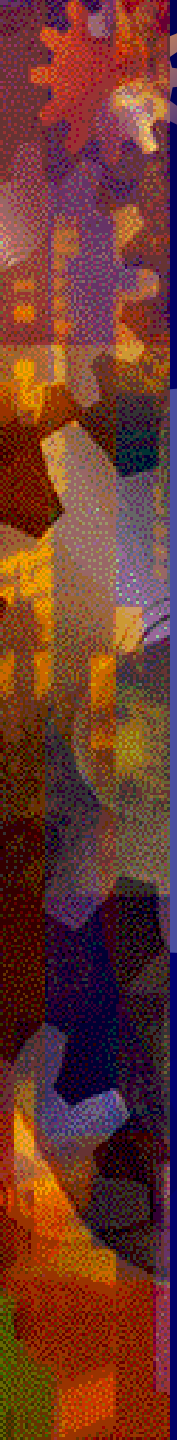
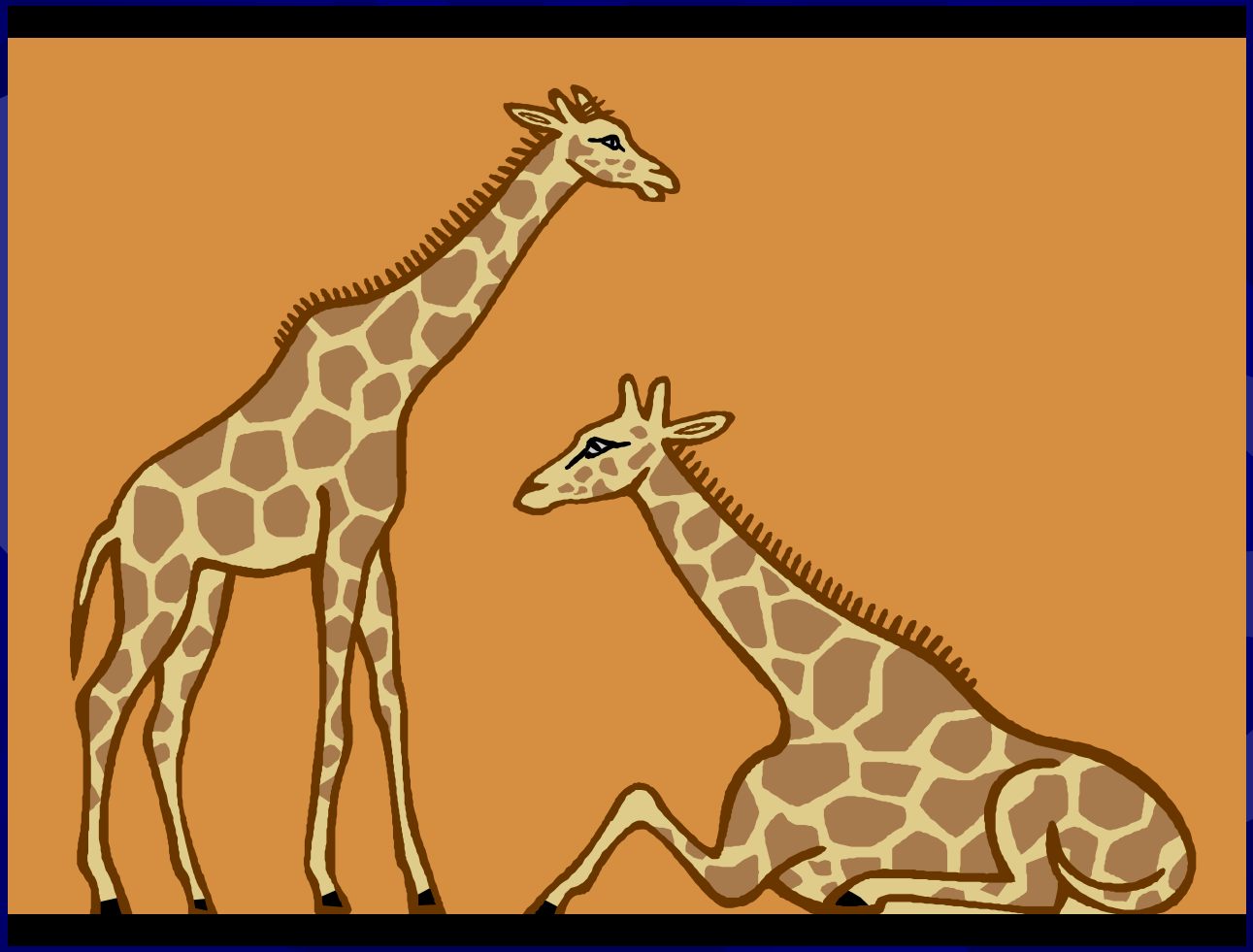
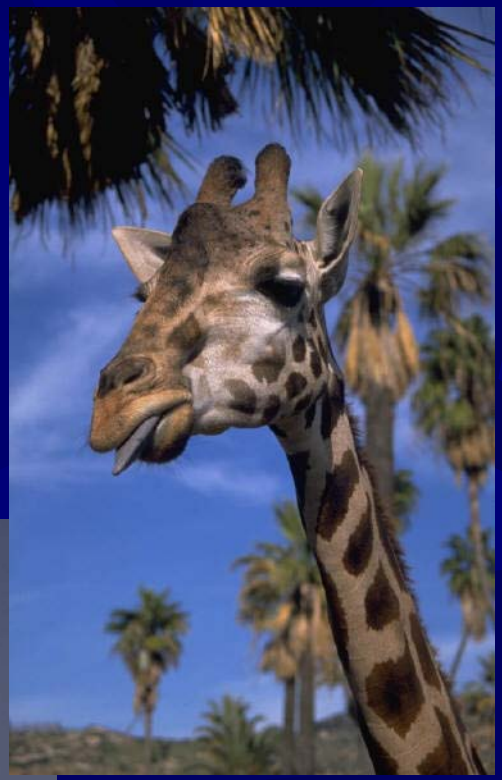
Before Hands-on Activity



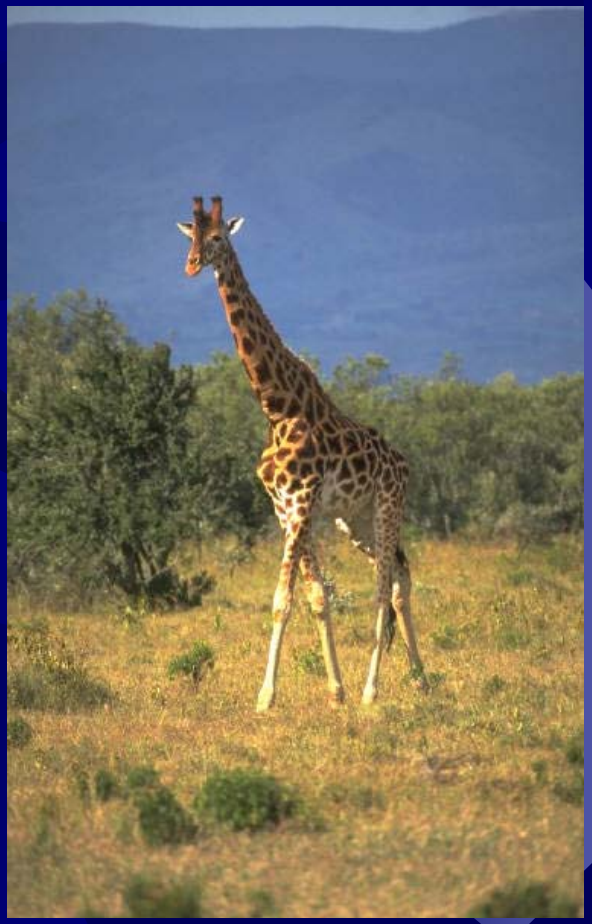
Giraffes



Giraffes cont.



More Giraffes

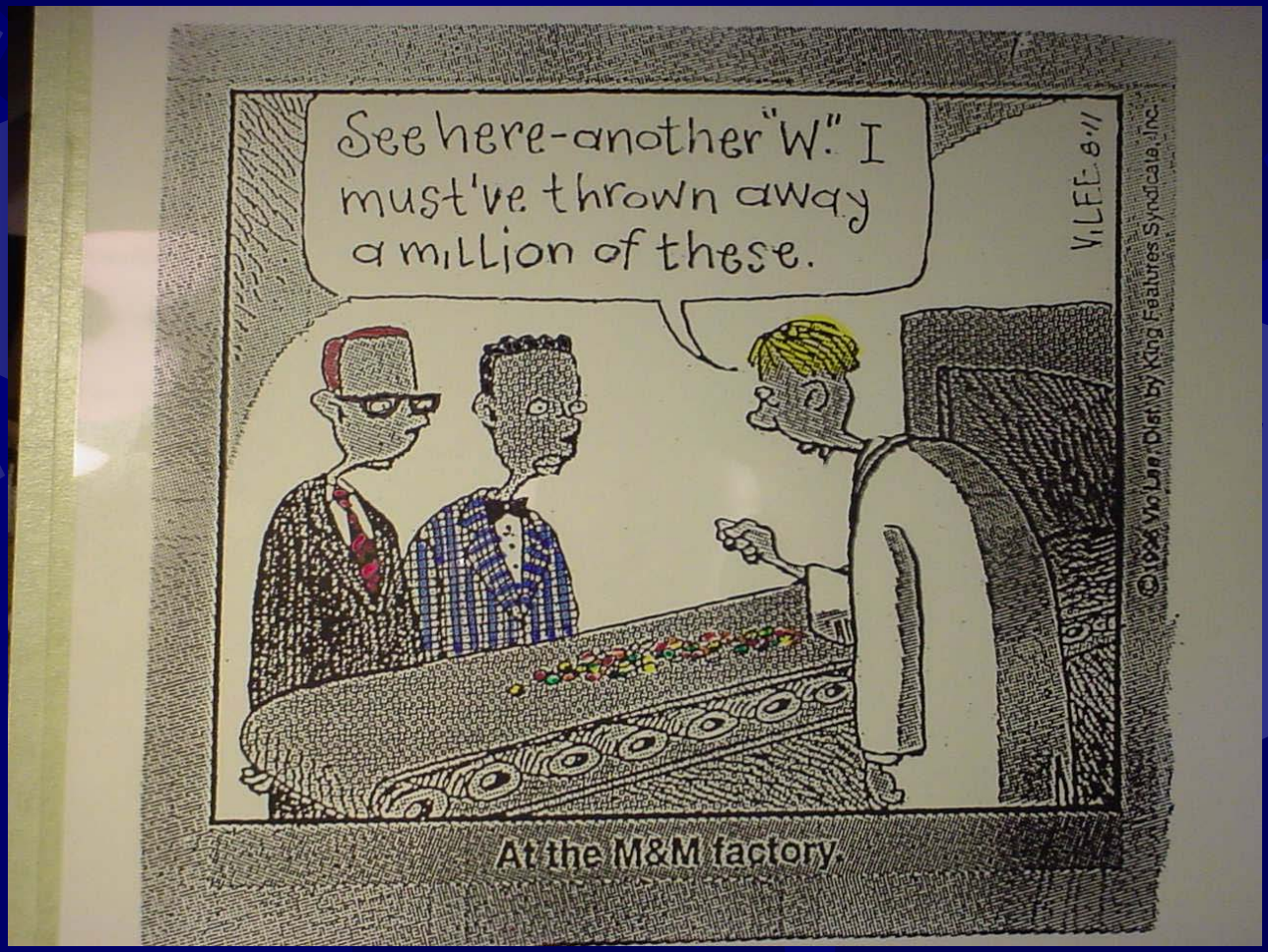


After Hands-on Activity

The Schema

Perspective

Perspective cont.



What Is Mathematics?

Mathematics is discovering patterns and relations and expressing them symbolically.

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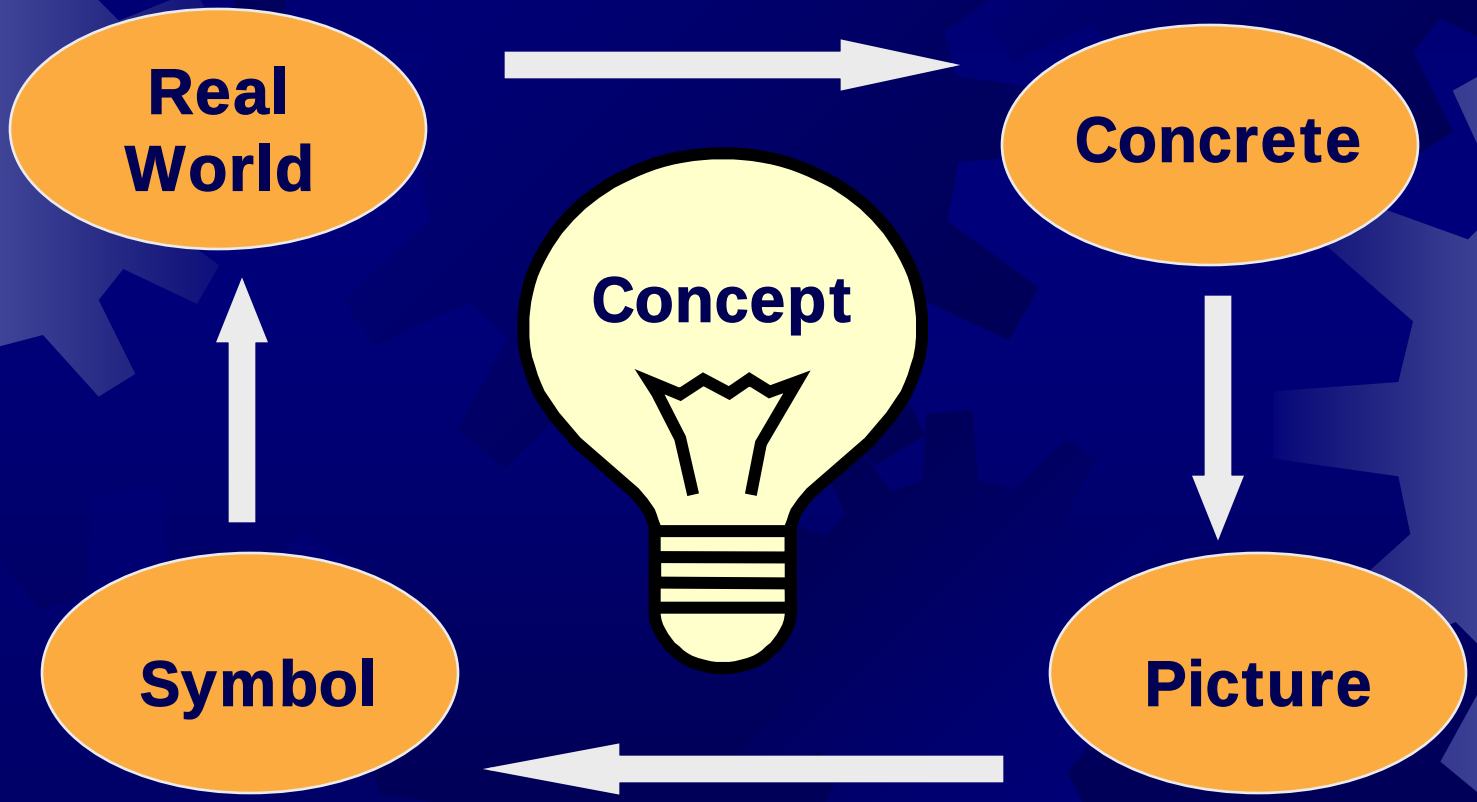
Mathematics Is A Process

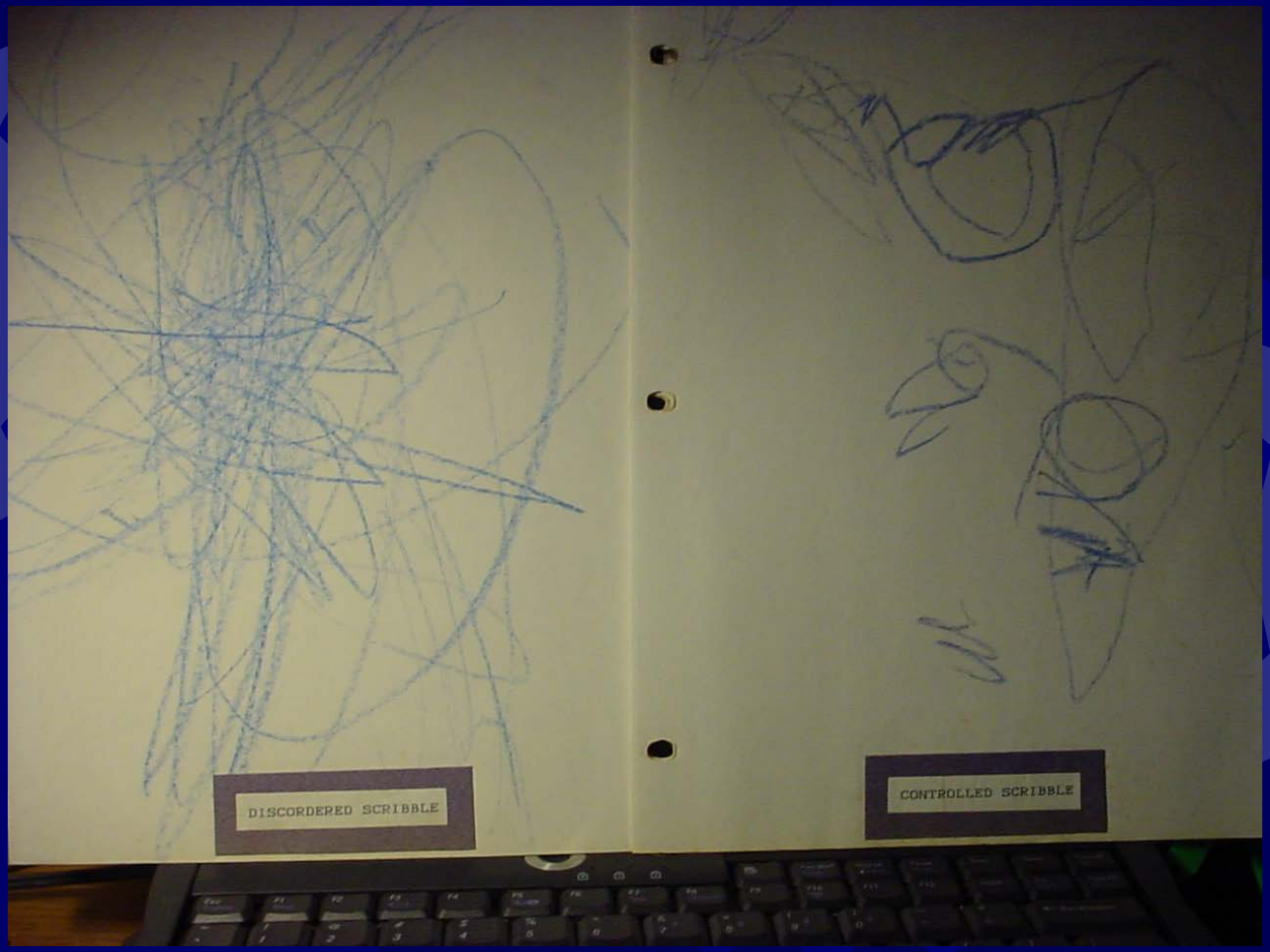


What Is A Concept?

- Richard Skemp (1987): A concept is a way of processing data which enables the user to bring past experience usefully to bear on the present situation. Concepts can be interrelated and form conceptual structures called schemas.

- Viktor Lowenfeld (1987): Third developmental stage (7-9 yrs) states that children arrive at a definite concept of man and his environment. Although any drawing could be called a schema, or symbol, of a real object, he refers to schema as the concept at which a child has arrived and which he repeats again and again whenever no intentional experience influences him to change this concept.

Scribbling Stage (2-4 yrs)



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Preschematic Stage (4-7 yrs)

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Schematic Stage (7-9 yrs)

Schematic Stage (7-9 yrs)

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Gang Age Stage (9-11 yrs)

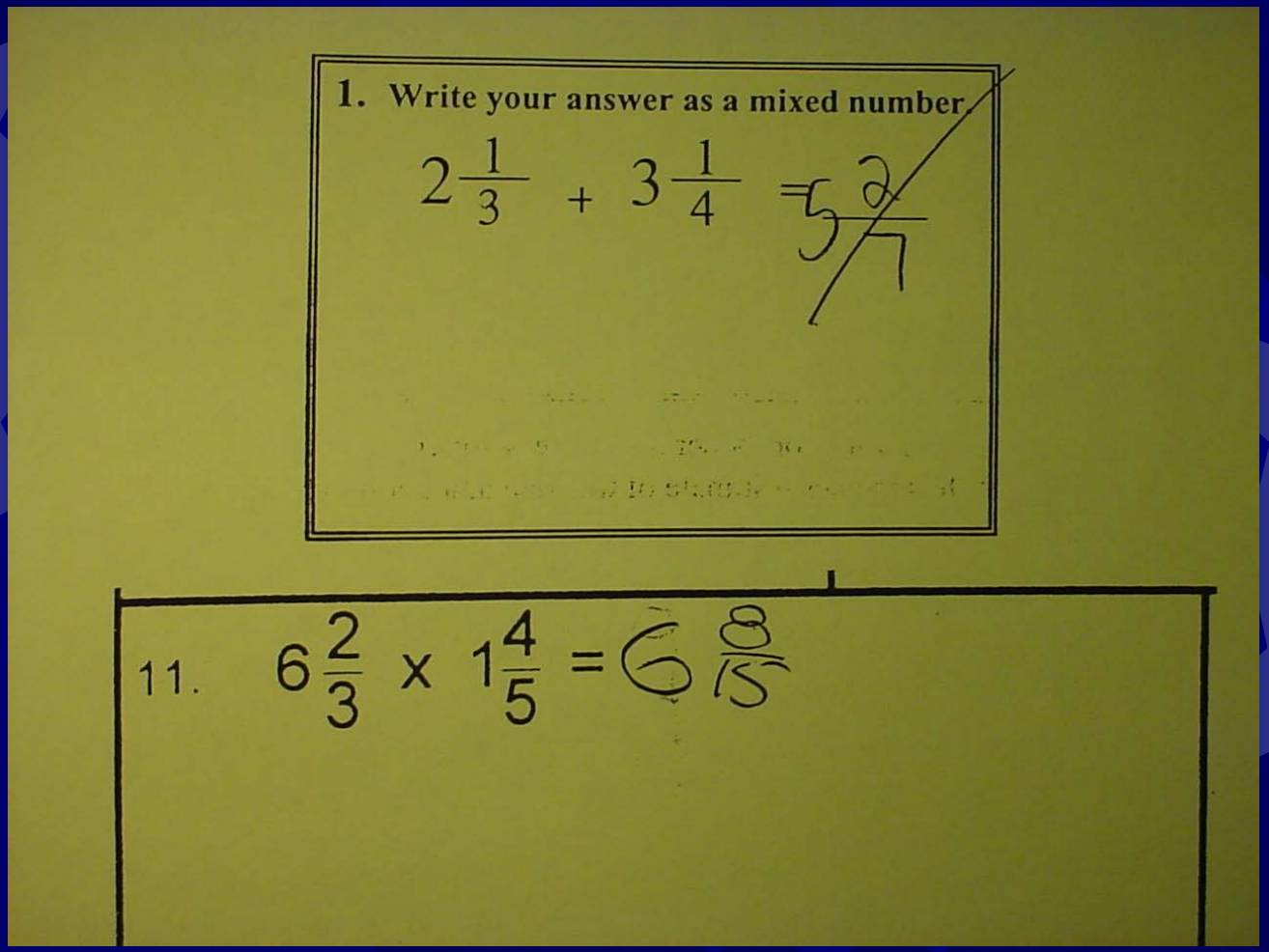
Math Concepts

Betty Herbert: Concepts are big ideas that transcend time and cultures.

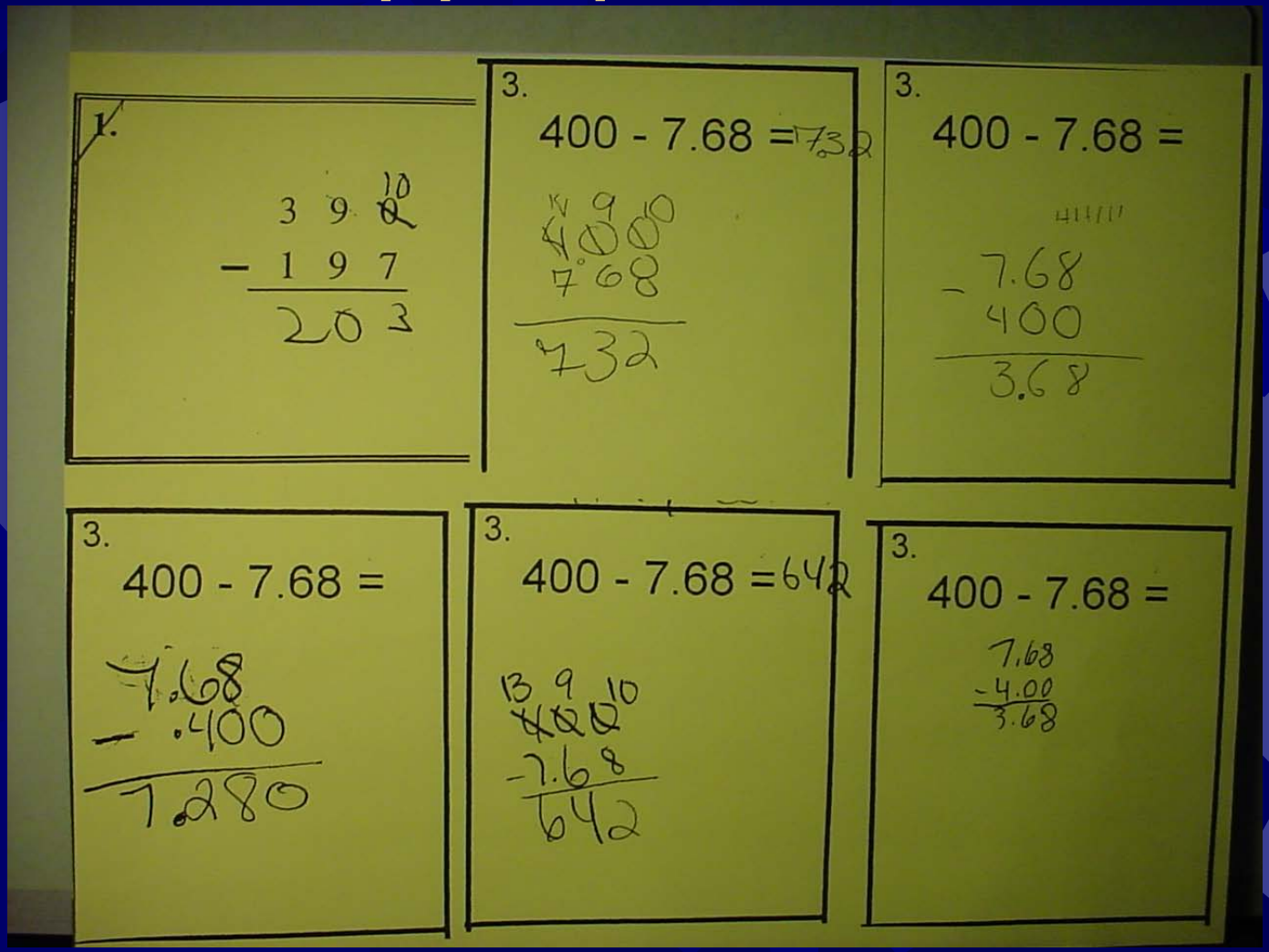
For Example

- Natural Number System—the set of counting numbers together with the operations of addition and multiplication
- Fractional Numbers

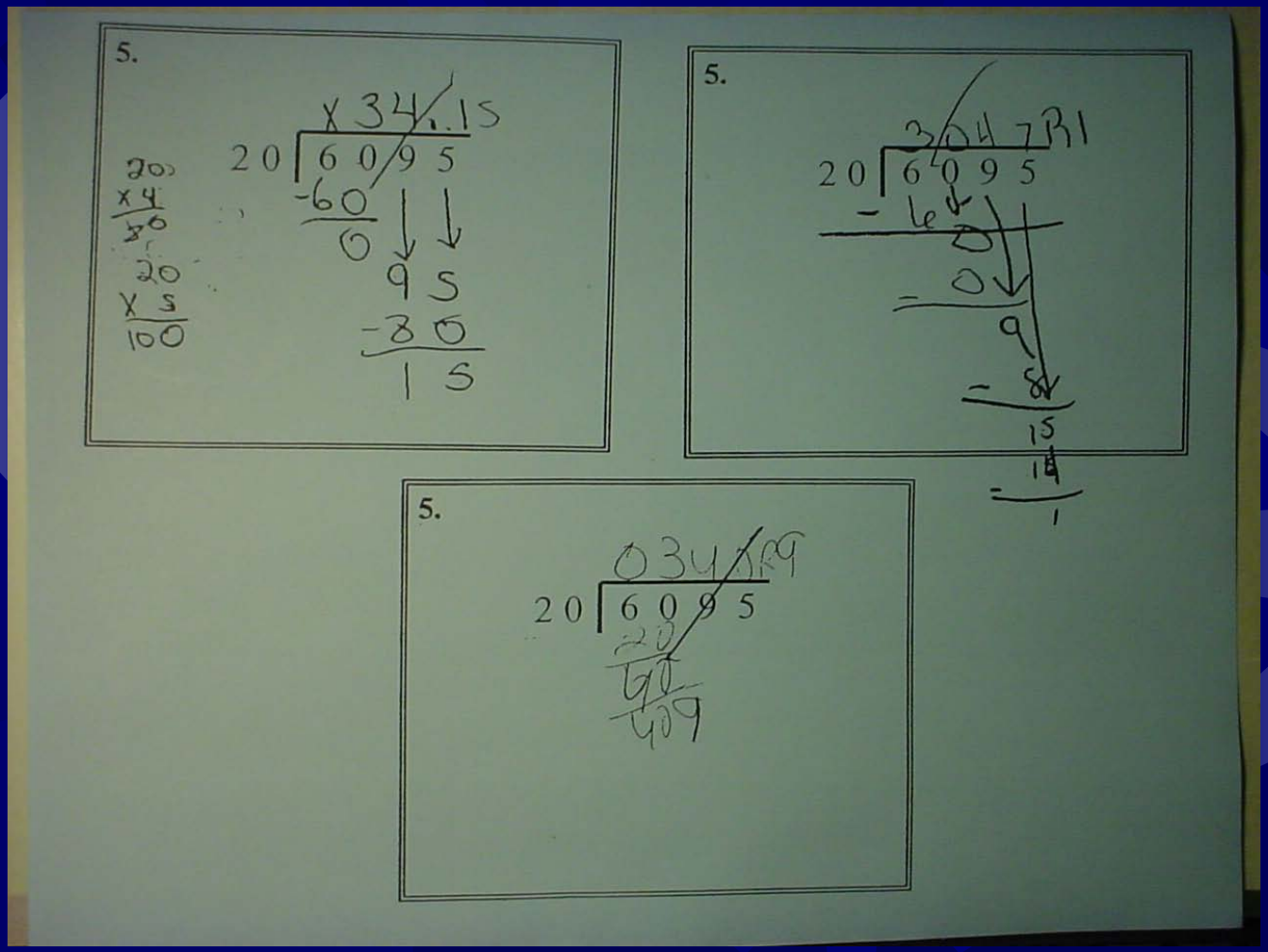
Inappropriate Schemas



More Inappropriate Schemas



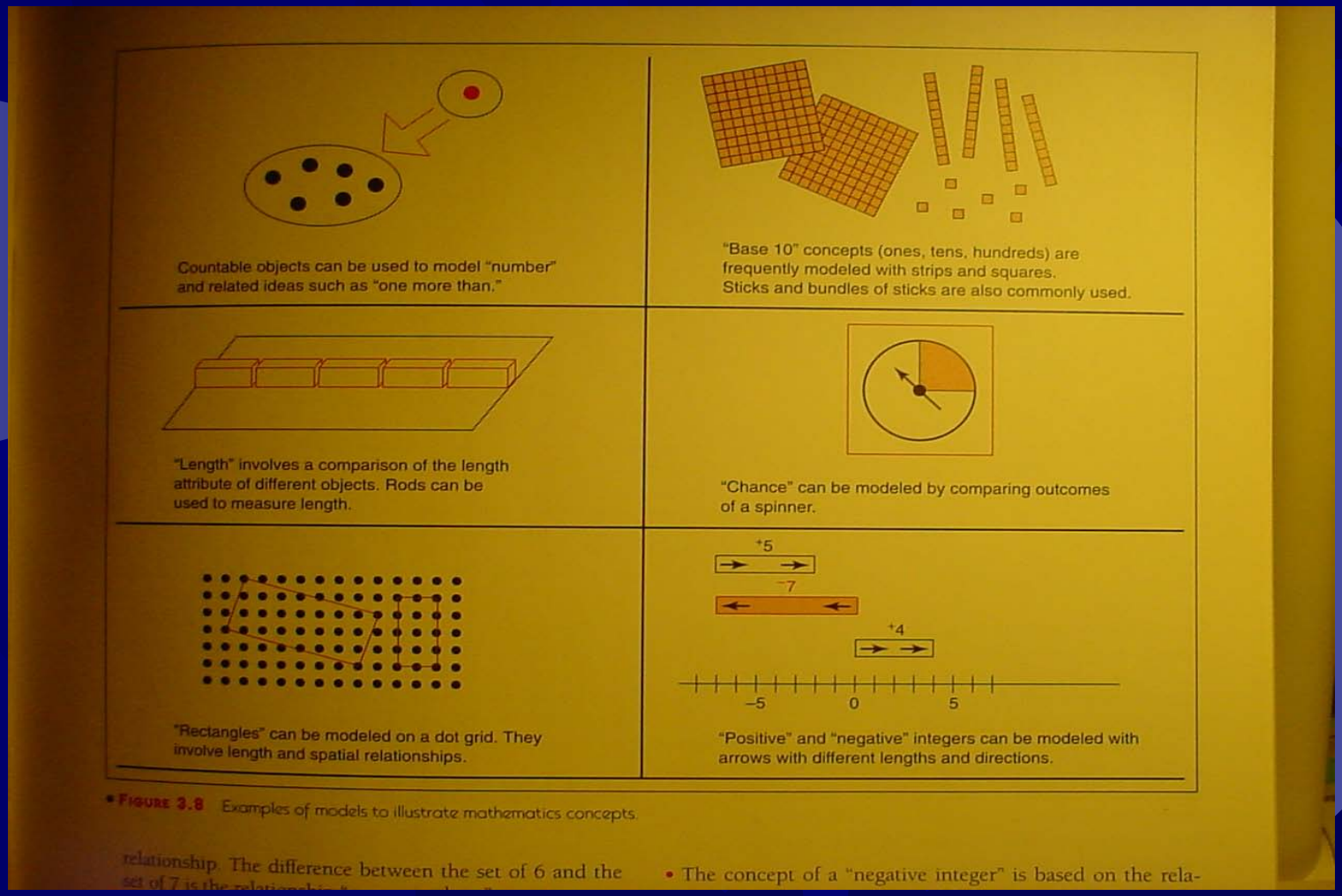
Where do I put the zero?



Building Appropriate Schemas

- The curriculum
- The teaching/learning process
- The assessment

Models for Math Concepts



Countable objects can be used to model "number" and related ideas such as "one more than."

"Base 10" concepts (ones, tens, hundreds) are frequently modeled with strips and squares. Sticks and bundles of sticks are also commonly used.

"Length" involves a comparison of the length attribute of different objects. Rods can be used to measure length.

"Chance" can be modeled by comparing outcomes of a spinner.

"Rectangles" can be modeled on a dot grid. They involve length and spatial relationships.

"Positive" and "negative" integers can be modeled with arrows with different lengths and directions.

• FIGURE 3.8 Examples of models to illustrate mathematics concepts.

relationship. The difference between the set of 6 and the

• The concept of a "negative integer" is based on the rela-

Tradition

- Abstract only

Factor the trinomial.

$2x^2 + 3x + 1$

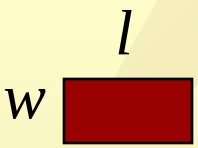
Answer:

$(2x + 1)(x + 1)$

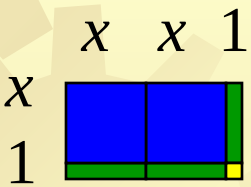
Modeling

- Concrete to Abstract

$2x^2 + 3x + 1$



$A = lw$



$l = x + x + 1$

$w = x + 1$

$\longrightarrow$ $(2x + 1)(x + 1)$

Two Colored Counters

Fraction Circles

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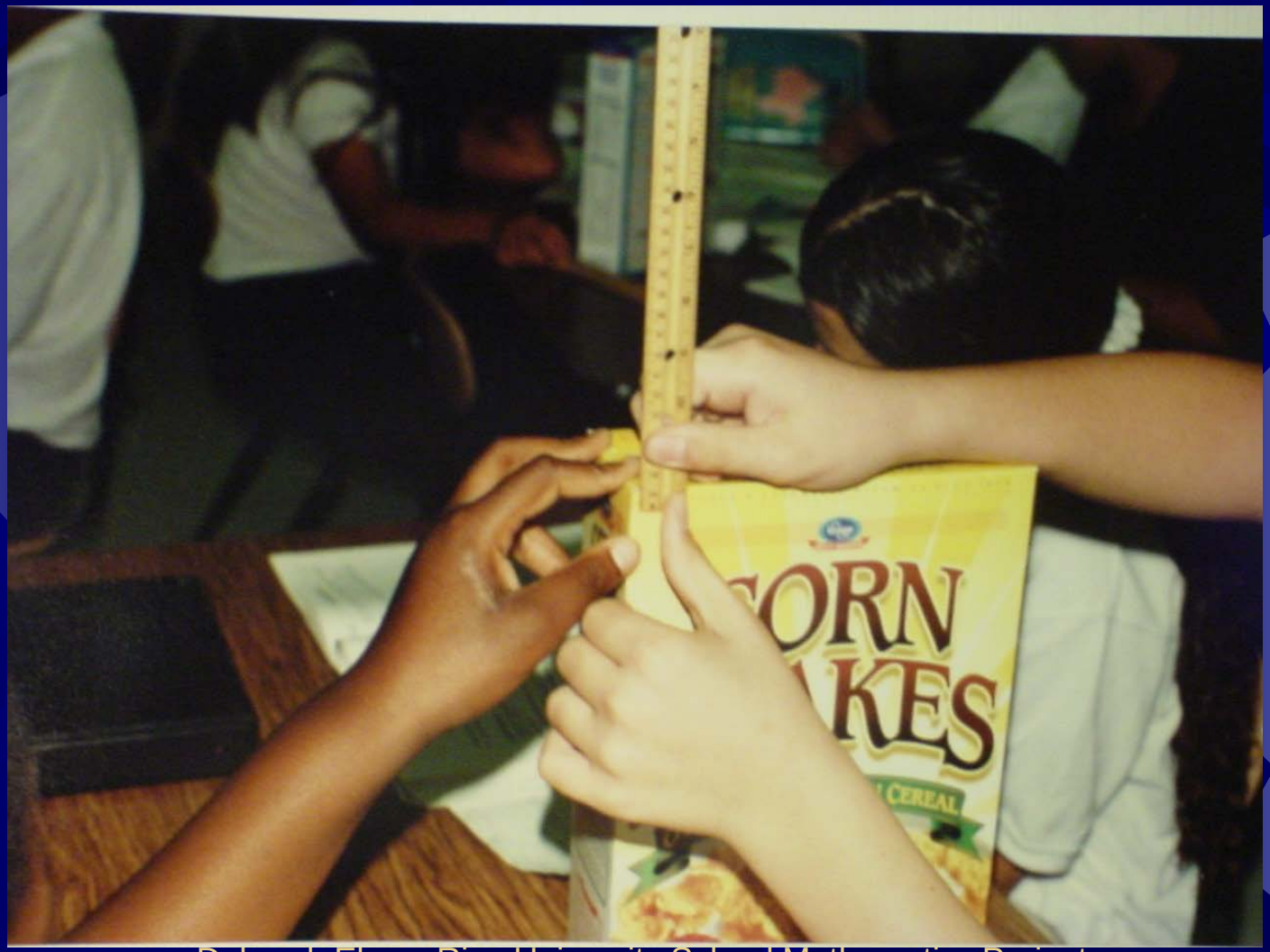
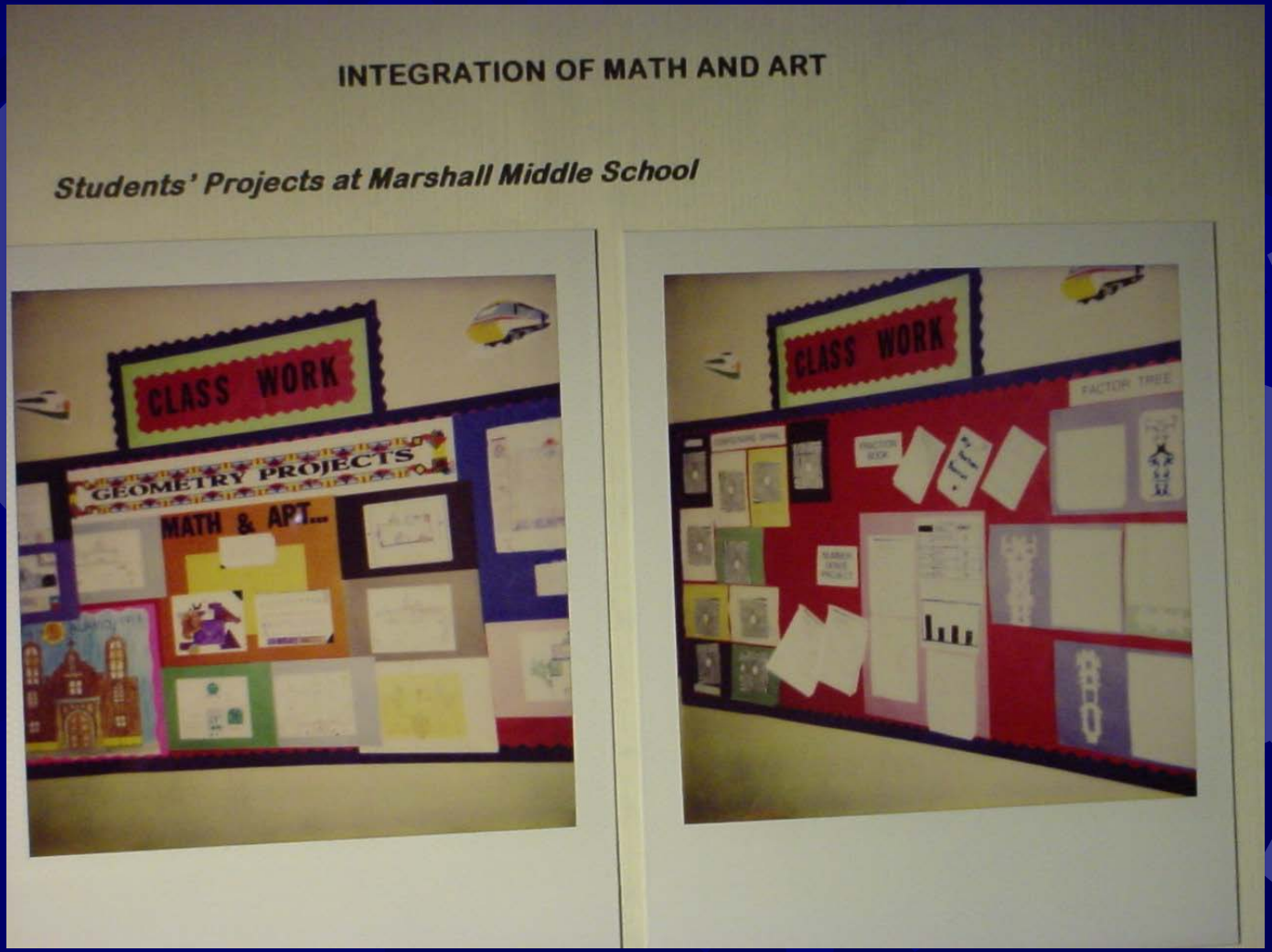
Measuring



Students' Projects



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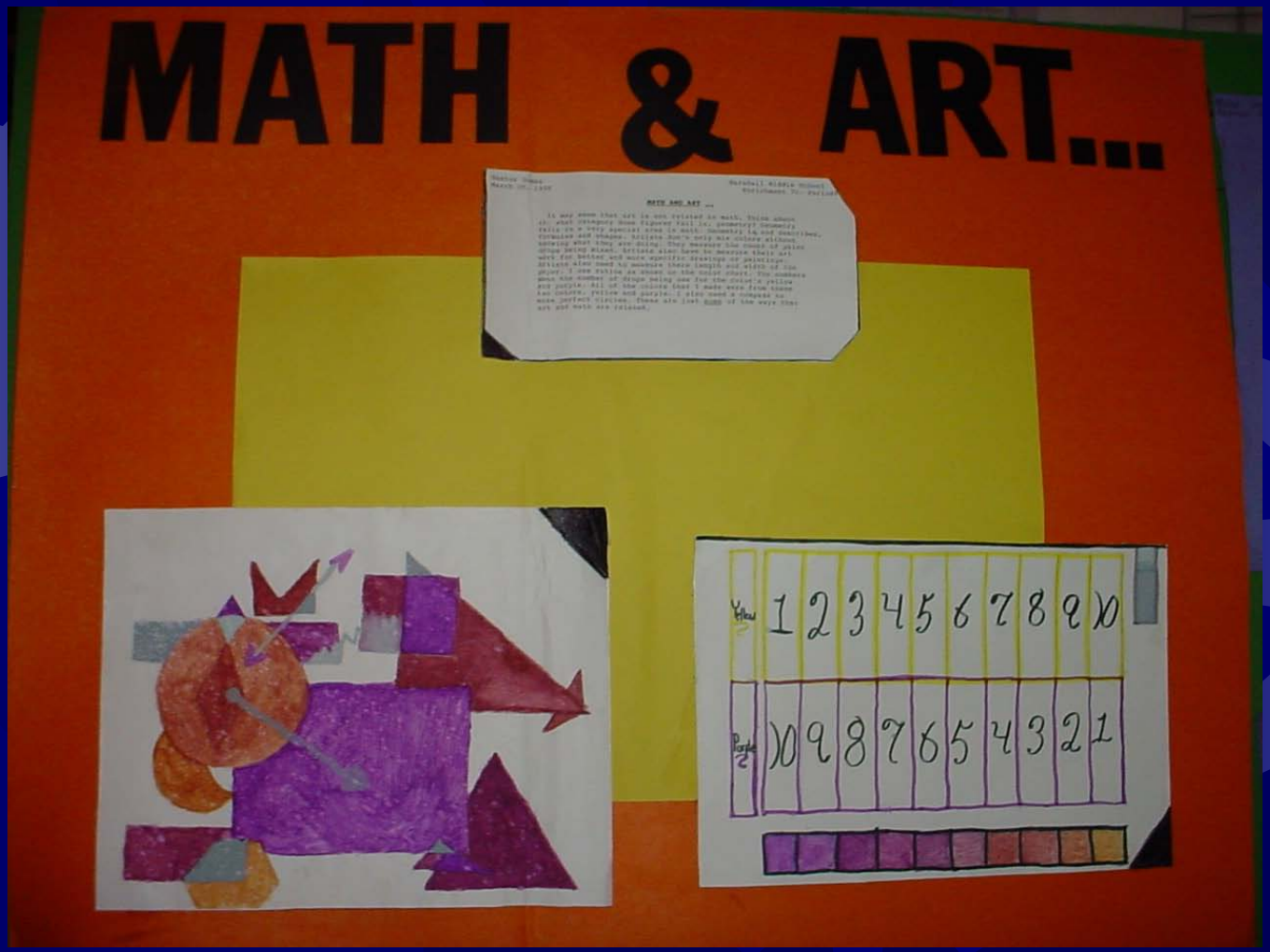
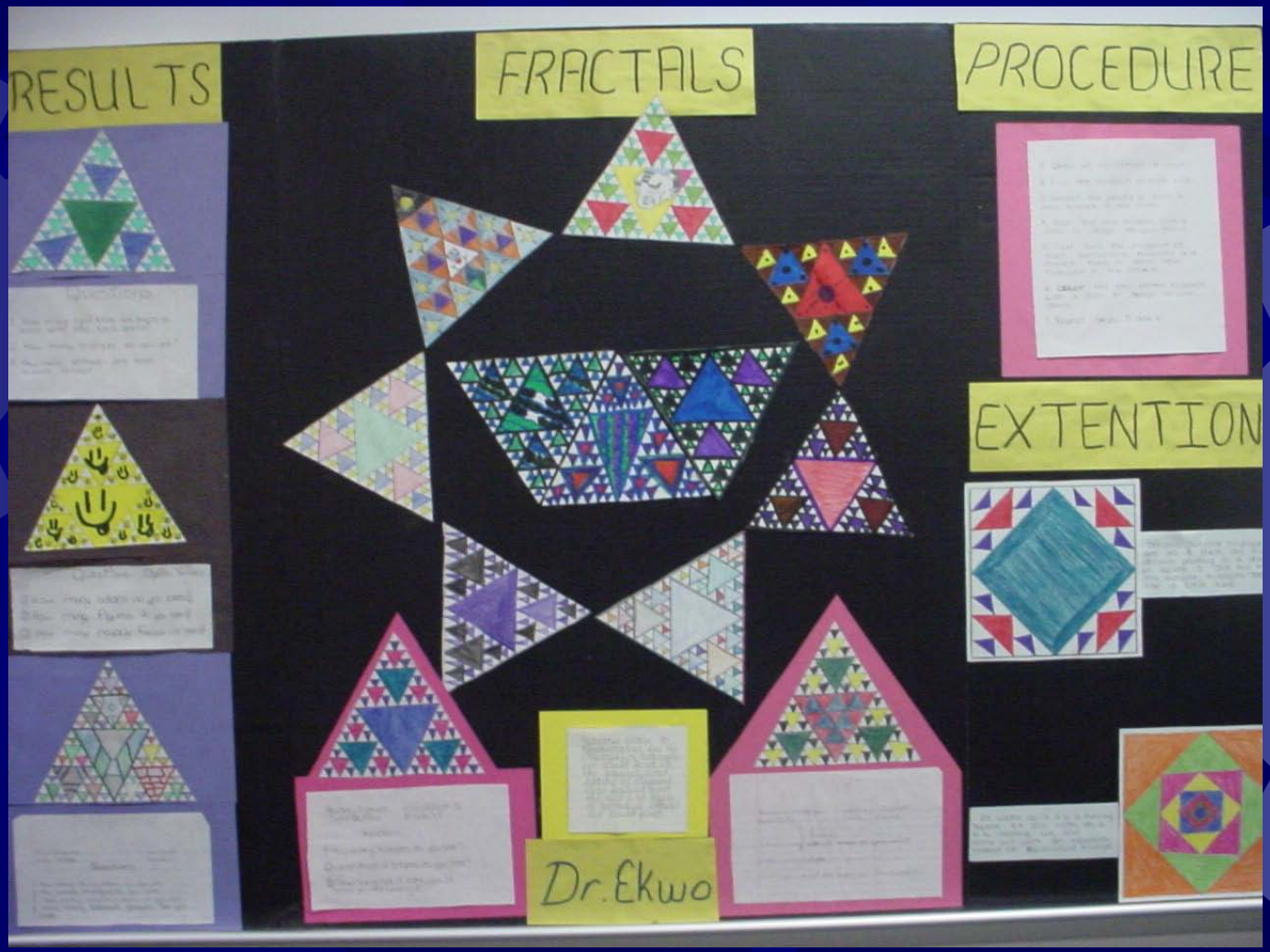


More Students' Projects



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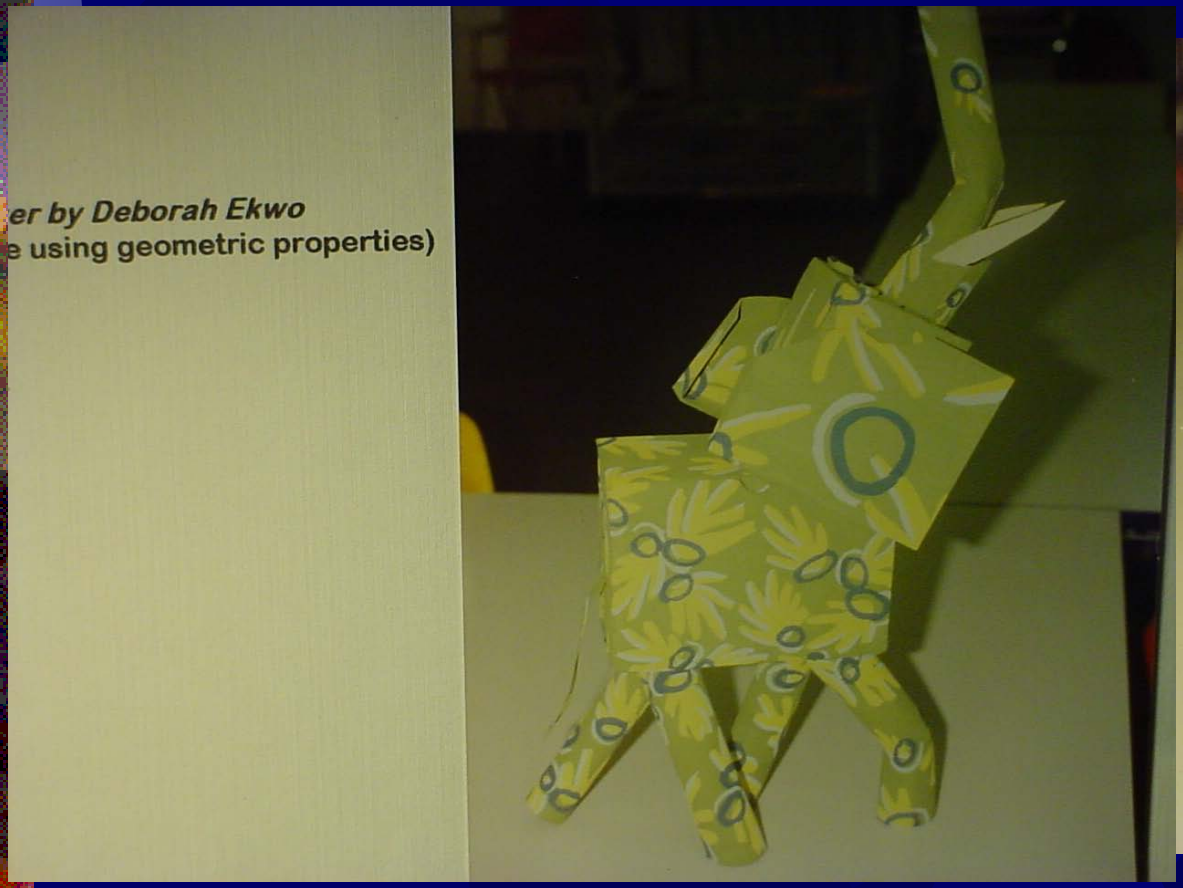
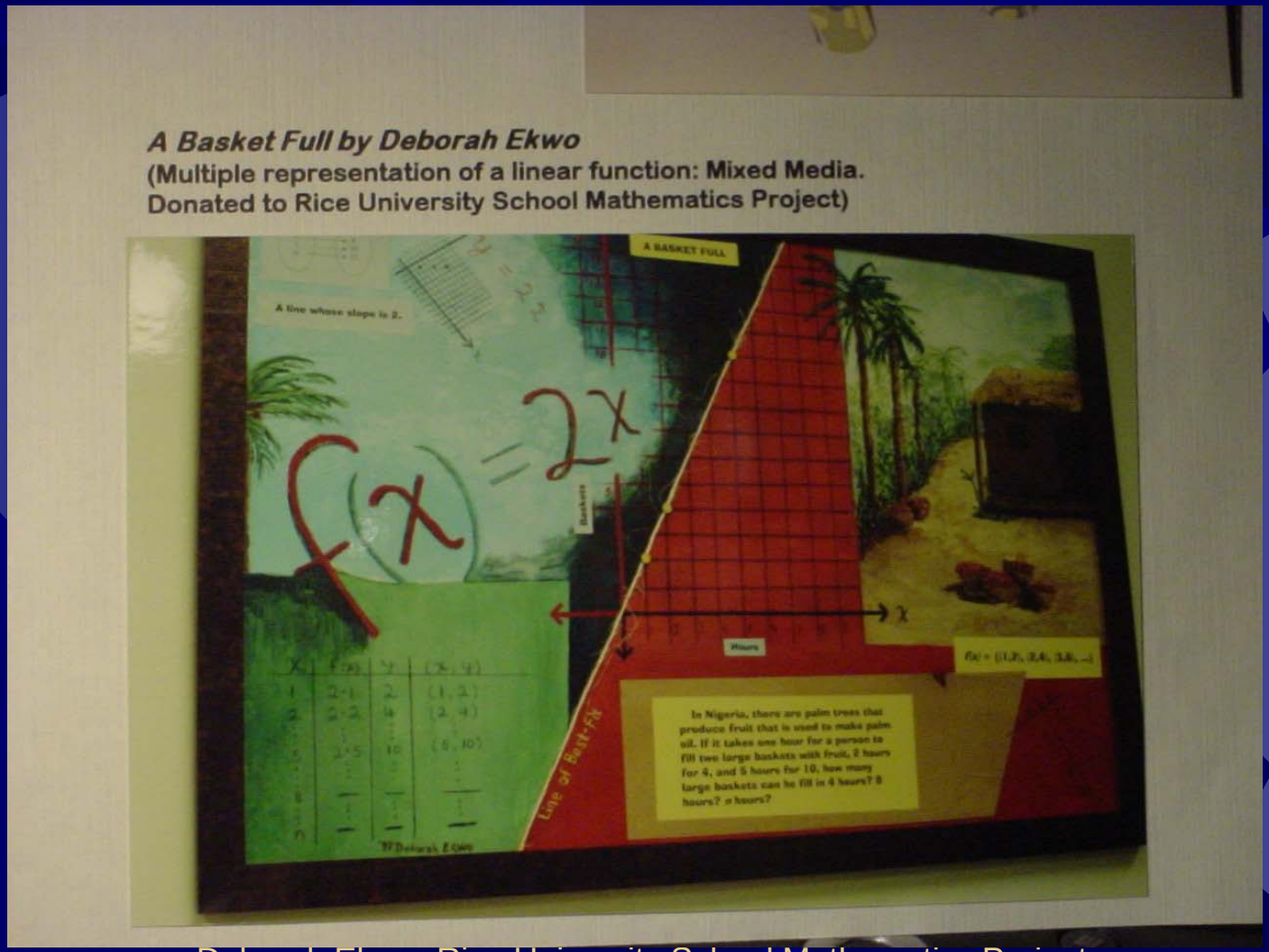
Box Sculpture



Math and Art



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Resources: Math-Art Lessons

- MATHART: Connecting Geometry and Art (http://u2.lvcm.com/esullivan/webquest.html)
- Fractals: Math or Art? (http://www.dcet.k12.de.us/teach/quest/shari.htm)

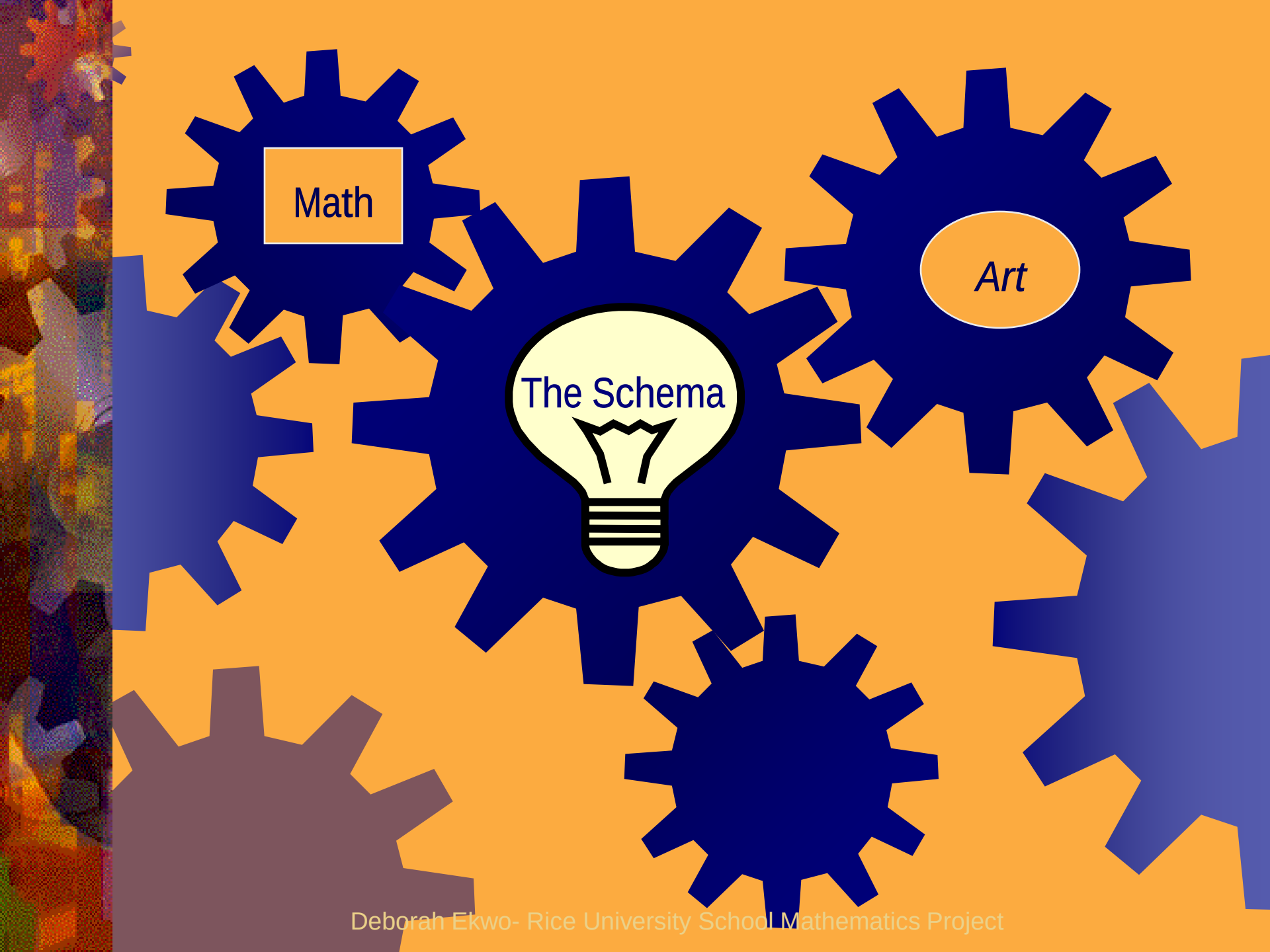
An Orange

Mushrooms

Schema to Learning

- A long journey begins with one step.

- It is this journey, not its destination, where learning takes place. *(Summermath 98)*


Math
Art
The Schema