Secondary Math Activities in a Time of Change

Terry A. Souhrada
Johnny W. Lott

Session Objectives

Participants will:

- compare recommendations and philosophies from NCTM's *Catalyzing Change* and *SIMMS Integrated Mathematics (SIMMS IM)*.
- experience activities from the *SIMMS IM* materials.
- continue the "*Critical Conversations*."

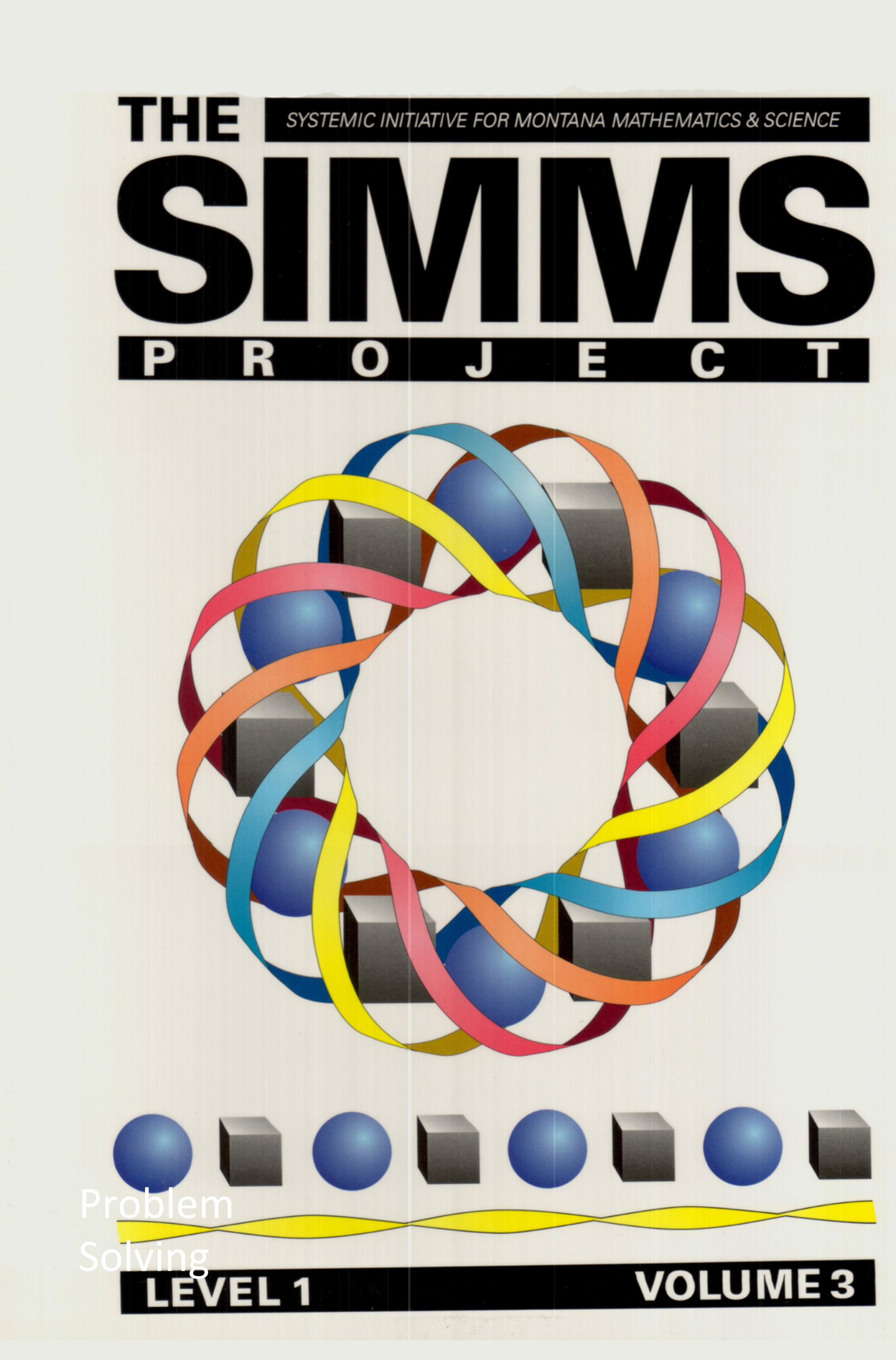
Catalyzing Change suggests major changes in what we teach and how we teach it!

Key Recommendations

- Essential concepts learned by *all* students.
- End student tracking *and* teacher tracking.
- Research-informed and equitable teaching practices.
- Continuous 4-year mathematics pathways for *all* students.
- Common 2-3 year pathway on essential concepts for *all* students.

Essential Concepts

- Concepts in Number
- Concepts in Algebra and Functions
- Concepts in Statistics and Probability
- Concepts in Geometry and Measurement



In 1989, 1991, and 1995 and again in 2000, NCTM standards suggested major changes in what we teach and how we teach it!

In 1992, NSF challenged five secondary mathematics projects to address these suggestions.

The Systemic Initiative for Montana Mathematics and Science (SIMMS Project) was one of those.

From the SIMMS Project came the

SIMMS Integrated Mathematics: A Modeling Approach Using Technology

Key Components

- Develop a complete mathematics 9-12 curriculum *for all students*.
- Make mathematics accessible to students of *all* physical, mental, and learning abilities or disabilities.
- Teaching practices informed by NCTM standards.
- Continuous 4-year mathematics pathways for *all* students.
- Common first 2 years of mathematics for *all* students.
- Mathematics integrated with other areas and within itself.
- Technology used as exploratory tool to understand mathematics.

Essential Beliefs

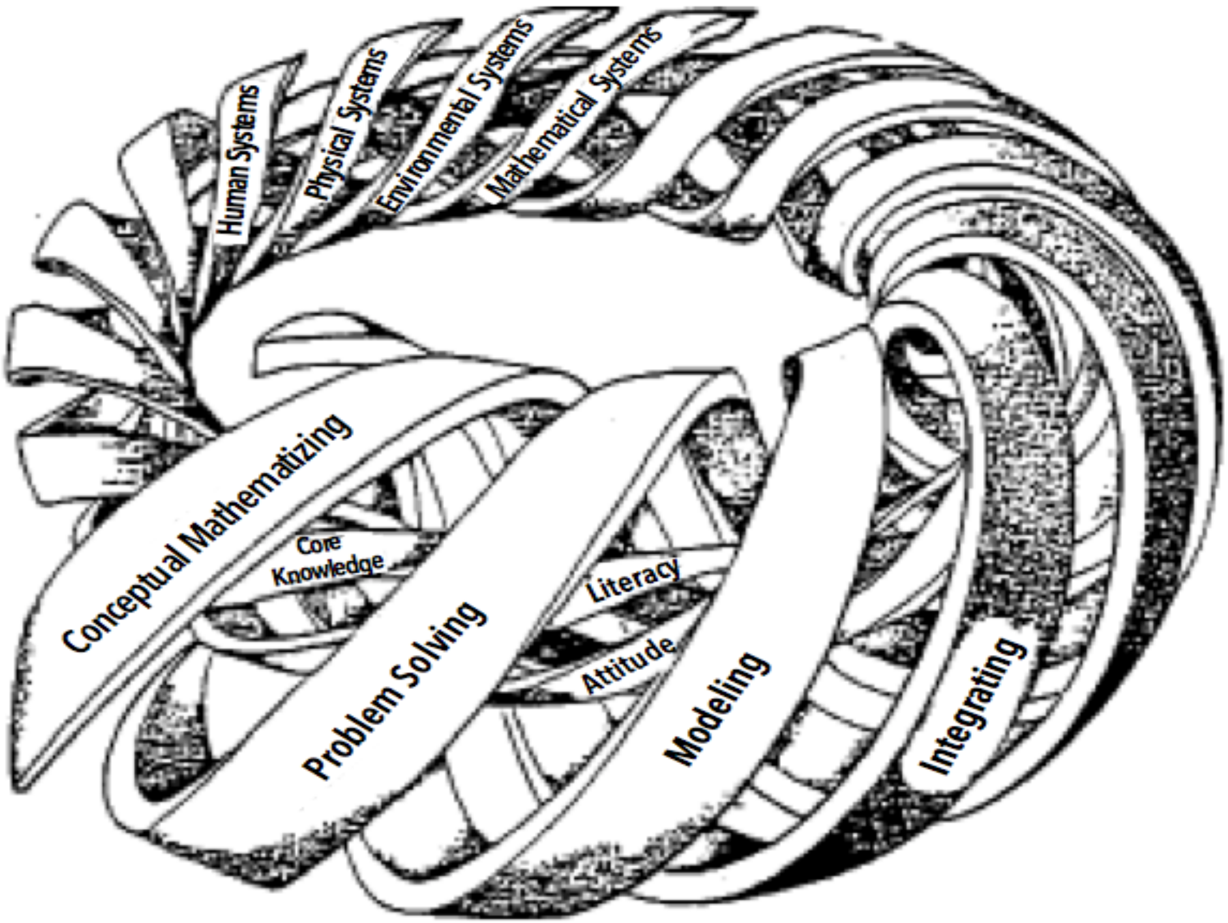


Illustration based on M.C. Esher's work - SPIRALS - 1953

With Permission of the M.C. Esher Foundation - Baarm - Holland

Experiencing *SIMMS IM*

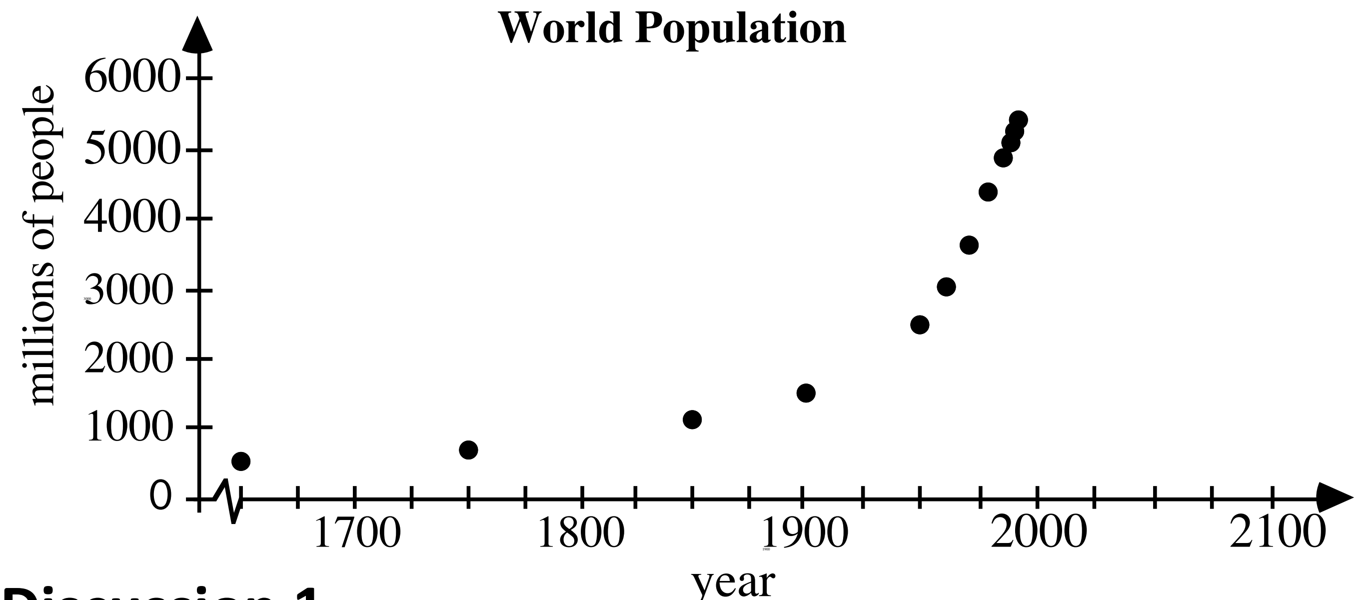
- ***Skeeters Are Overrunning the World***
- ***Traditional Design***
- ***What Are My Child's Chances?***

Class/Group Expectations

- No *individual* will be called upon to share their thinking unless they volunteer to do so.
- If you are willing to share your thinking, you must allow others to ask questions to understand your thinking.
- Each member of the group takes responsibility for his or her own learning.
- Each member of the group is willing to help any other member of the group who ***asks for help***.
- Groups may only ask the teacher for help if all members of the group have the same question.
- There is always a challenge.

Skeeters Are Overrunning the World

Introduction



Discussion 1

a. Describe any pattern you see in the world's population since 1650.

b. Based on the pattern you find, predict what you think the world population will be in the year 2075.

Skeeters Are Overrunning the World

Exploration

To help make predictions in real-world situations, researchers often use experiments known as **simulations**. The results of the simulations are gathered and analyzed.

In this exploration, you investigate the modeling process using a population of Skeeters. Skeeters reproduce asexually (by themselves). Reproduction is triggered when the marked side of a Skeeter is exposed to light. Each Skeeter produces one (1) offspring when reproducing.

Skeeters Are Overrunning the World

Exploration (cont.)

a. Obtain a large, flat container with a lid, a sack of Skeeters, and a sheet of graph paper.

b. Before beginning the simulation, read Steps **1–7** below and predict how you think the number of Skeeters will change.

1. Place two Skeeters in your container. This is the *initial population*.

2. After closing the lid, shake the container.

3. Open the lid causing the marked-side-up Skeeters to reproduce.

4. Add one Skeeter to the container for each marked-side-up Skeeter.

5. Count and record the total number of Skeeters now in the container. This is the end of one “shake” or time period.

6. Also record the number of “shakes” or time periods.

7. Repeat Parts **2** − **6** for 15 time periods.

Skeeters Are Overrunning the World

Exploration (cont.)

c. Create a graph to display the data you recorded. Represent the "shake" number on the horizontal axis. Describe any patterns you see.

d.
1. Use the pattern you described to predict the number of Skeeters after 20 shakes.
2. How large of a box would you need to hold this population? Explain how you came to this conclusion.
3. Predict how many shakes it would take for the Skeeter population to reach 1000. Describe how you reached your prediction.

Skeeters Are Overrunning the World

Discussion 2

a. Discuss any similarities or differences you observe between your scatterplot and those of your classmates.

b. How did the number of Skeeters in your population change during the exploration?

c. 1. Consider your scatterplot as describing the change in the population of Skeeters over time. Use this idea to explain the shape of the graph.

   2. How do the graphs obtained in the exploration compare to the linear graphs explored in previous modules?

d. 1. What other types of living creatures might show the same pattern of population growth as the Skeeters?

   2. What limitations might this simulation have in modeling a real-world population?

Skeeters Are Overrunning the World

Activity 1

Within any population, there are differences in appearance and behavior due to genetics and environment. In this activity, you investigate some Skeeter populations with different growth characteristics.

Exploration

In this exploration, each color of Skeeter has its own growth characteristics and initial population. Table **1** shows a list of these characteristics for each color.

Table 1: Skeeter growth characteristics

Color	Growth Characteristics	Initial Population
green	For every green Skeeter with or without a mark showing, add 2 green Skeeters.	1 green
yellow	For every yellow Skeeter with or without a mark showing, add 1 yellow Skeeter.	1 yellow
orange	For every orange Skeeter with a mark showing, add 1 orange Skeeter.	1 orange
red	For every red Skeeter with a mark showing, add 1 red Skeeter.	2 red
purple	For every purple Skeeter with a mark showing, add 1 purple Skeeter.	5 purple

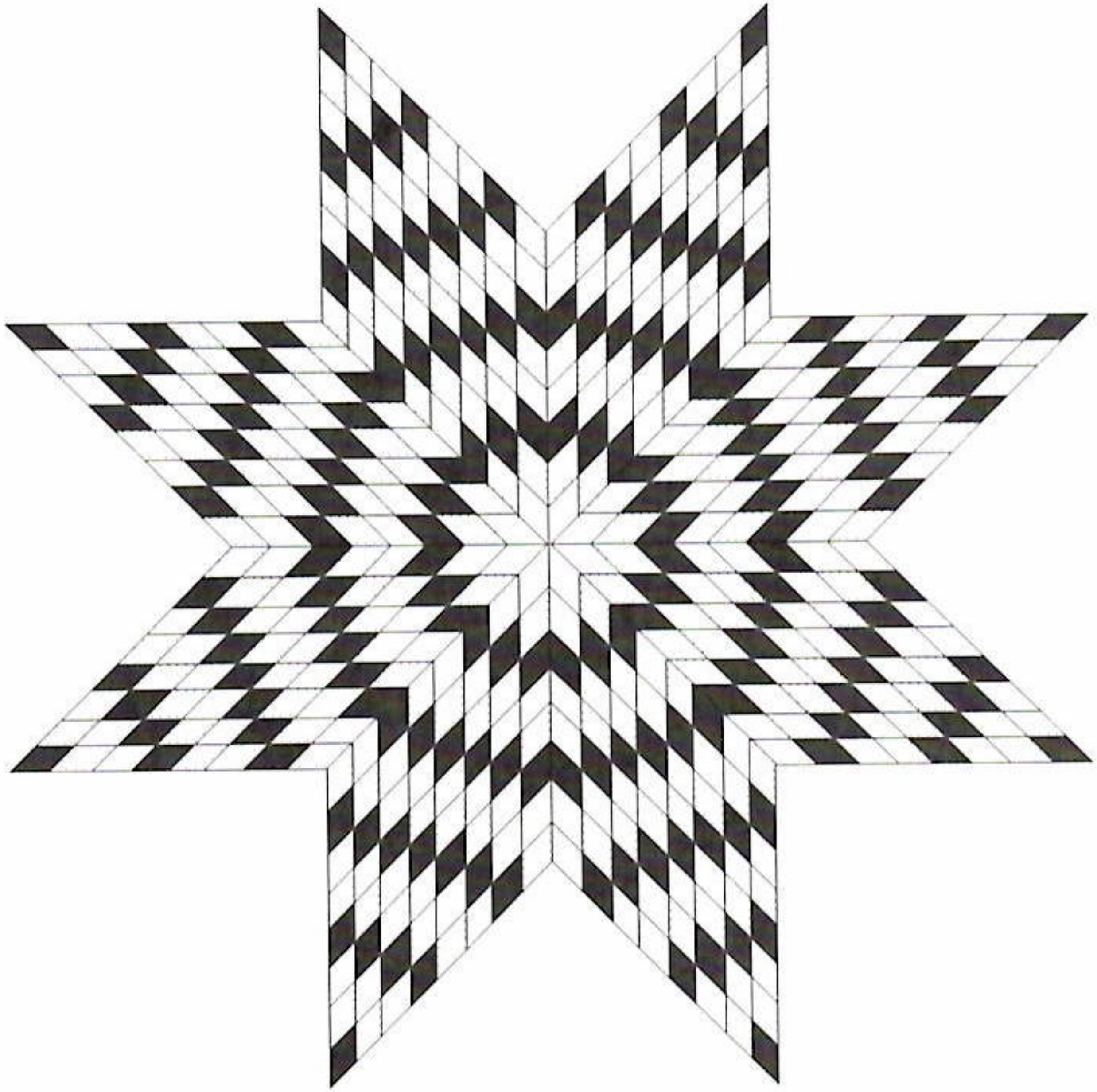
Traditional Design

American Indian families mark important events by giving gifts.

Today Assiniboine and Sioux tribes in Montana preserve this tradition through a star quilt ceremony where an honored person is wrapped in the quilt.

Star quilt ceremonies are typically held at community gatherings, and reflect the values, attitudes, pride, and identity of the presenting family.

Star Quilt Pattern

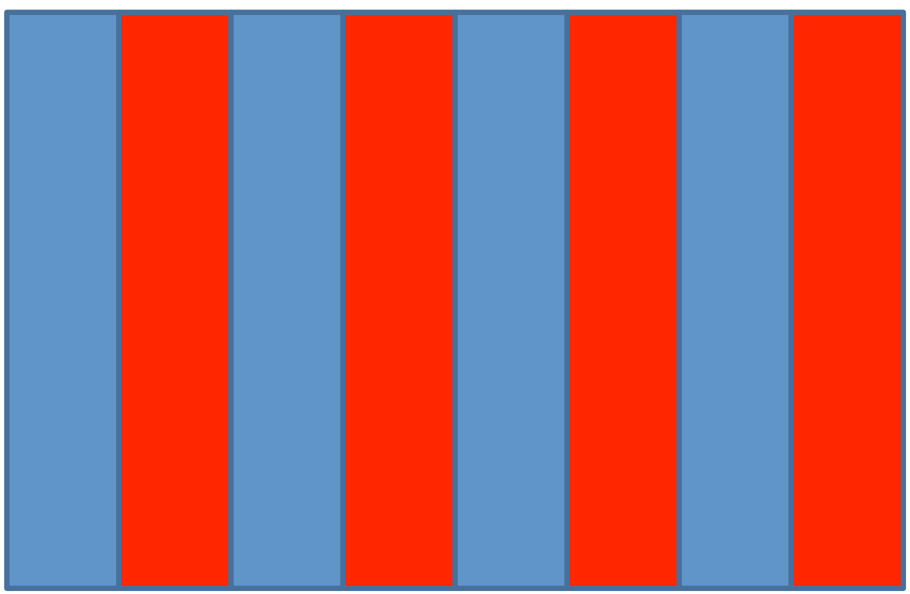


Star Quilt Pattern

- What shapes do you see?
- What are the primary properties of the major geometric shape you see?

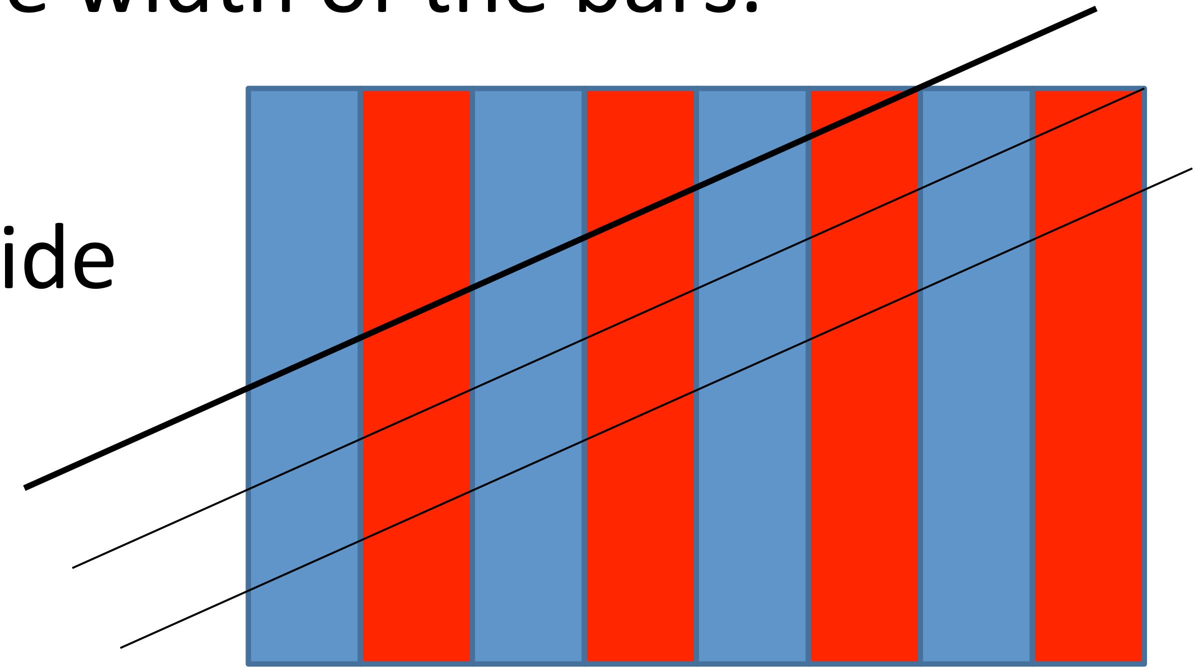
How was the star quilt made?

- Idea: Use a rhombus.
- Make a strip of one color.
- Make a second strip congruent to the first and of an alternating color.



Making a Star Quilt

- Put parallel lines across the strips with the same distance between the parallel lines as the width of the bars.
- Cut and slide the bars.



What Are My Child's Chances?

Exploration

Table **1** describes the characteristics associated with five physical traits. Read the descriptions and determine whether or not you have each trait.

Table 1: Five traits determined by single sets of genes

Trait	Description
Mid-digit hair	The middle section of each finger has hair on it.
Widow's peak	When the hair on the head is pulled back, a distinct point in the hairline can be seen in the center of the forehead.
Free earlobes	The bottom parts of the earlobes are not attached to the side of the head.
Rolled tongue	The tongue can be rolled to form a "U" shape.
Folded hands	When the hands are folded so that fingers interlace, the left thumb falls naturally on top.

Wheel of Traits

What Are My Child's Chances?

To explore your own inherited characteristics, use a wheel of traits.

a. Place your finger at the trait in the center of the wheel, "mid-digit hair." If you have this trait, move your finger to the "yes" portion. If you do not have it, move your finger to the "no" portion.

b. From the portion of the ring where you placed your finger, move outward to the next ring and determine whether or not you have the trait "widow's peak." Again, move your finger to the appropriate portion of the ring.

What Are My Child's Chances?

c. Continue this process for the next three traits, working your way outward through each ring of the wheel.

d. The last portion of the ring where you placed your finger determines your personal number. Record this number.

Questions and Answers

Creation of the *SIMMS IM* curriculum[1] was funded through an National Science Foundation (NSF) grant awarded to the Montana Council of Mathematics (MCTM). MCTM has decided to make these free open source materials. They are available at:

mathmontana.org

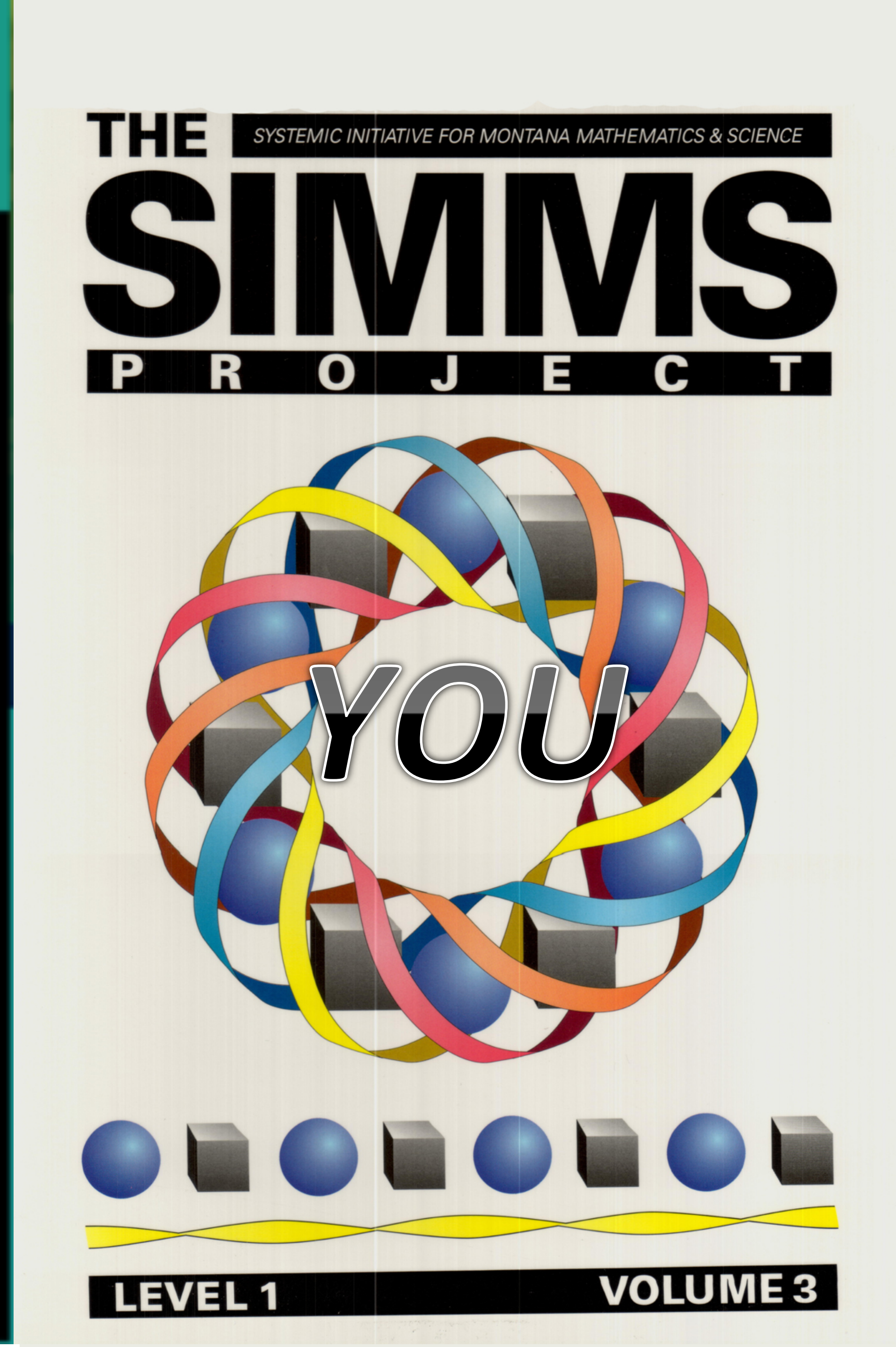
Contact Information:

Terry Souhrada at terry.souhrada@skc.edu

Johnny Lott at jlott@mso.umt.edu

[1]The *SIMMS IM* curriculum material is based upon work supported by the National Science Foundation under Cooperative Agreement No. OSR 9150055. Any opinions, findings, conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of the National Science Foundation.


Catalyzing Change
in High School Mathematics
Initiating Critical Conversations
THANK
NCTM
NATIONAL COUNCIL OF
TEACHERS OF MATHEMATICS


THE
SYSTEMIC INITIATIVE FOR MONTANA MATHEMATICS & SCIENCE
SIMMS
PROJECT
YOU
LEVEL 1
VOLUME 3