Multicultural *Science and Math* Connections

Middle School Projects and Activities

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Introduction

The connections of science and mathematics to history, art, and music provide the theme of this book. The first part of the book highlights the cultures of groups from Africa to the Arctic who are underrepresented in traditional curricula. The second part features historically outstanding individuals from these cultures.

Activities and readings on these reproducible pages provide opportunities for students to explore the contributions of 17 underrepresented cultures. Many of these achievements deserve to be better known, such as the ancient observatory of Kenya, Africa, the automatically controlled lamp of the Arctic Inuit, and the invention of coordinates in ancient Egypt. Students gain pride in their heritage and learn respect for other cultures as they put into practice some of the brilliant discoveries made in Africa, Asia, and pre-Columbian America.

Role Models

Role models featured in activity-based units span the period of history from ancient times to the present day. Some of their exciting life experiences are included to inspire students with the conviction that they, too, can succeed. Students should be encouraged to do further research on scientists and mathematicians who can serve as role models.

Cooperative Learning and Critical Thinking

Many underrepresented groups have a tradition of cooperation and critical thinking. This book builds on these traditions. Opportunities for cooperative learning and critical thinking are provided in every unit in the book.

Instructional Process

A variety of instructional strategies are used, including extensive opportunities for cooperative learning and application-driven learning. The instructional philosophy of this book is based on recommendations of the curriculum reform movements and the experiences of the authors in the Chicago public schools and nationally. Key

elements in this process are the teaching of science and mathematics from a culturally relevant perspective, and integration of science and mathematics with other disciplines. Two brief excerpts from statements by leading professional organizations highlight the educational philosophy of this book.

The American Association for the Advancement of Science (AAAS) in its report *Science for All Americans* asks that students learn that "women and minorities have made significant contributions in spite of the barriers put in their way by society; that the roots of science, mathematics, and technology go back to the early Egyptian, Greek, Arabic, and Chinese cultures. . . ."

The National Council of Teachers of Mathematics (NCTM) states in the Mathematical Connections section of its curriculum standards document: "Students should have many opportunities to observe the interaction of mathematics with other school subjects and with everyday society." (*Curriculum and Evaluation Standards for School Mathematics, p. 84.*)

Safety First

All activities in this book avoid hazardous materials or temperatures. It is important for students to learn safe laboratory practices in preparation for classes, such as chemistry, where hazardous materials may be involved. For any activity, safe practices could be established by the group and approved by the teacher. In group activities, every step should be considered in terms of health, safety, and the environment.

Author's Note

We wish to acknowledge, with thanks, the support and encouragement that we have received from many colleagues. We deeply appreciate advice from Professor Siu Man Keung, University of Hong Kong, on Chinese numerals, advice from Professor Leonel Morales, University of San Carlos, Guatemala, on Maya numerals, and the tepee pattern and background information supplied by Monica Buckman, a registered Native American storyteller of the Gros Ventres, Montana. Any mistakes, however, are our own.

How to Use This Book

Cultural units include:

1. **A student activity, suitable for the classroom**, introduces the culture through a relevant, hands-on science or mathematics experience. All materials needed are listed and are inexpensive and readily available.

2. **Background information** is presented through a reading about the experiences of young people from that time and culture.

3. **Questions for Critical Thinking** are based on the background information presented and are intended to stimulate creative thinking. Answers will often vary, as there may be no one correct answer.

4. **Science Projects, Mathematics Projects, and Class Projects** are derived from the relevant culture. To get students started, a list of materials and step-by-step instructions are provided. To help students organize their work, you may suggest that they check off each step as they complete it. The suggested projects are only a beginning, and students are encouraged to do additional research and experimentation.

Answers to "Questions for Critical Thinking" appear in the back of the book. Of course, students' answers will often vary as these are open-ended activities.

Although the units are designed to work well as a whole, individual pages can be used alone, except for "Questions for Critical Thinking." The page of questions should be used with the related background information.

Part I

From Africa to the Arctic

Sailboats, An African Invention

The first evidence of sailboats comes from Nubia, 6,000 years ago.

Materials: small model sailboat with rectangular or trapezoidal sail; plastic straws; a tub of water

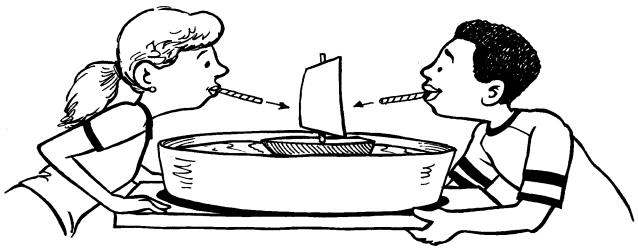
Hypothesis: A change in motion is proportional to the strength of the applied force and is in the direction of this force.

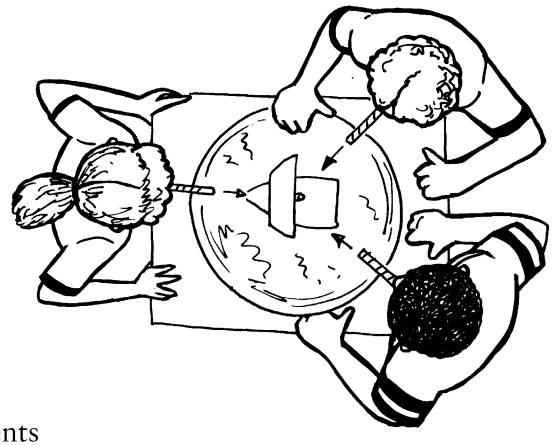
Check off each step as you complete it. Make a diagram to illustrate the resulting motion for each step.

☐ 1. Aim the straw at the center of the sail and blow, first gently, then harder. Observe the relative speed and direction of the boat.

☐ 2. Two students repeat step 1 but blow on opposite sides of the sail. Does the boat move and, if so, in what direction? Is it possible to adjust the two wind forces (your breaths) so that the boat does not move?

☐ 3. Position two students behind the sail with straws on a line to make about a 45° angle with the sail. The student on the left blows, and observes the direction of boat motion. Then student on the right blows and observes the resulting motion.





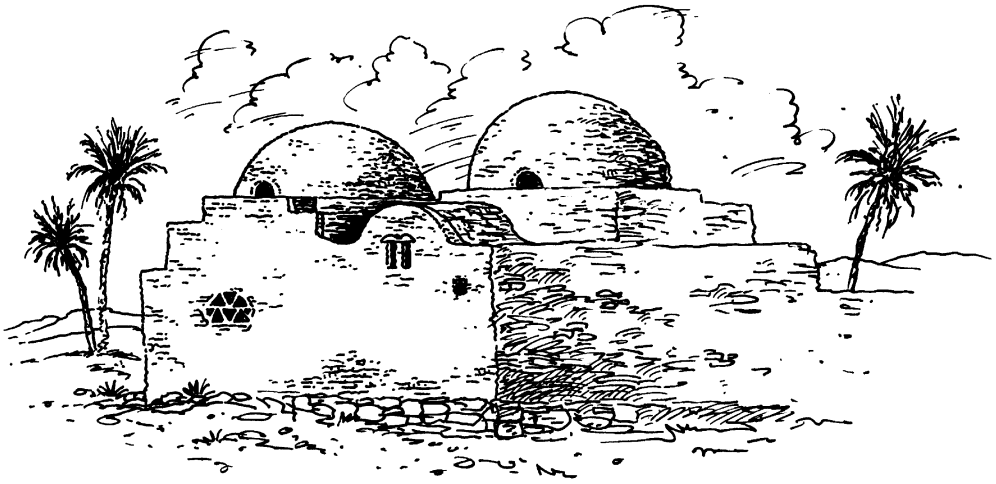
☐ 4. Both students blow through straws at a 45° angle to the sail, trying to apply the same breath force.

☐ 5. Repeat step 4, but add a third student in front of the sail. Can all three students blow at the same time without moving the boat?

Nubia, 3500 B.C.

Mernet and Djer were Nubian teenagers who lived near the Nile River town of Kom Ombo, 5,500 years ago. Their parents were weavers who made cloth to sell at the market. Mernet and Djer helped at the market, recording sales by making tally marks. But Djer and Mernet did not grow up to be weavers like their parents. Djer became a famous sea captain and adventurer. And Mernet became the biggest merchant at the Kom Ombo market.

At Kom Ombo, many products changed hands—Nubian gold and textiles, Egyptian jewelry, East African incense, pottery from Palestine, and more. The Nile was like a busy highway, with sailboat traffic moving north and south. For short trips, papyrus boats were used. These were just bundles of water reeds tied together. The sail was



another African invention. Perhaps some clever sailors happened to hold up branches in the wind and noticed that the boat began to move faster. Making a sail soon followed. Oars were still kept in the boats, however, in case there was no wind.

One day a large sailboat came from Merimde in the north, an event that changed Djer's life. He was big for 13, and the boat owner wanted to hire him as a sailor. Djer begged for permission to go on this great adventure. No one knew that it would be three years before he would return, rich and famous.

During a trading trip to a desert oasis, the whole crew was taken prisoner. Djer helped overpower the guards and freed another prisoner, who turned out to be a prince. The father of the prince was so grateful that he gave Djer his own boat. In two years, Djer became a ship's captain, moving goods up and down the Nile River. Finally he was able to arrange a trip that took him to Kom Ombo, where he could see his family again.

Questions for Critical Thinking

1. What role do you think trade played in the development of boat design?

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2. Trade took place before boats were invented. What other means of transport could have been used?

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3. Even today, freight transport by water is cheaper than transport by land. Why do you think this is so?

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4. What different sources of power do boats use?

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5. When people from different countries met to trade, what else might they have exchanged besides trade objects?

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6. How might trade have helped the spread of science?

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