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INTRODUCTION TO *MATHS DISCOVERIES ABOUT CHANCE & DATA, BOOK 3*

The explorations and investigations in this book are designed to help students develop the maths skills and understandings articulated in the CSFII Learning Outcomes.

Manipulatives are wonderful tools and models for students to use. They enable students to explore concepts in ways that are impossible on paper. When students are able to hold something in their hands, to look at it and move it around in various ways, and to take it apart, their learning is greatly enhanced. They are able to investigate and explore concepts in concrete ways; this allows them to integrate concepts into their basic maths understandings from a sound base of personal experience. The intrinsic value of manipulatives in maths education is the underlying premise of this book.

In *Maths Discoveries About Chance & Data, Book 3,* students will be using transparent chips, linking cubes, calculators, dice, and spinners. They will be using transparent chips to compare experimental and theoretical probabilities. They will use linking cubes to conduct experiments to determine equally and unequally likely outcomes; to make physical representations of data in bar, stacked bar, and circle graphs; and to determine combinations. Calculators will be used to convert data into percentages for comparison in circle graphs. Dice are used to simulate games and to develop the concept of sample space and prediction of experimental probability. Spinners are used in Monte Carlo simulations to broaden the student's understanding of the shape of data, especially involving Pascal's Triangle.

USING *MATHS DISCOVERIES ABOUT CHANCE & DATA, BOOK 3*

Contents

The book contains 40 short problem-solving activities, called *explorations*, divided into eight sections. There are five similar explorations in each section. Each section of explorations is preceded by teaching notes which identify the skills and understandings developed in the explorations and describe an activity for introducing the explorations. The teacher notes may also suggest questions that can be used to encourage students to think and communicate about what they have learnt, provide ideas for extending the activities, and suggest ways to assess student learning.

The book also contains three longer, more open-ended activities called *investigations*. The investigations give students the opportunity to extend and deepen their learning and to apply what they have learnt to solving a problem.

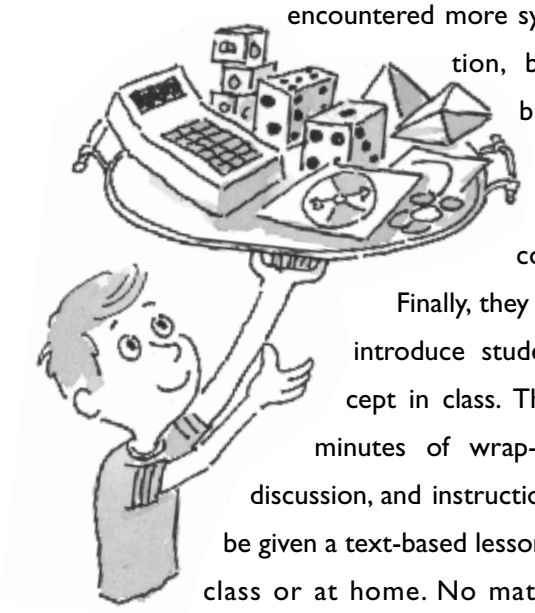
Suggestions for Classroom Use

The explorations are sequenced according to level of difficulty within each section and from section to section throughout the book.

These activities can be used by students working individually, in pairs, or in small cooperative learning groups. Working together encourages students to talk about their thinking and their discoveries. Students will benefit from articulating their thinking and hearing how others may have solved the same problem in a different way. Encourage the students to share their ideas with other pairs of students, with other small groups, or with the whole class.

Open-ended questions that invite students to express their thoughts are critical to the classroom discussion. As students share the insights they have gained through developing their solutions, they teach one another important concepts about mathematics.

The activities in this book work well in three different classroom formats. Firstly, they can be used to introduce data and probability concepts manipulatively prior to presenting concepts more formally, symbolically, or algorithmically. Secondly, they can be used to provide foundations for students who may have already encountered more symbolic instruction, but who need better understanding of the concepts on a concrete level. Finally, they can be used to introduce students to a concept in class. Then after a few minutes of wrap-up, processing, discussion, and instruction, students can be given a text-based lesson to work on in class or at home. No matter which format suits your needs, you will find that students will benefit from this book in a variety of ways.



If the students have not used particular manipulatives before, give them time to become familiar with them. Then let students begin the explorations.

Materials Needed

It is recommended that these materials be available:

- One calculator for each student or pair of students (Calculators with fraction capability are a nice plus but are not necessary.)
- A set of polyhedra dice (one pair each of 4-sided, 6-sided, and 8-sided dice) for each pair of students
- A set of 1000 Lacer links or other linking cubes of various colours for a class
- A set of 250 transparent coloured chips for a class
- A transparent spinner for each pair of students
- A straightedge for each student (optional) for drawing straight lines in graphs

NOTES ABOUT EXPLORATIONS **1–5**

MATHS SKILLS AND UNDERSTANDINGS

- Predict probability of a given outcome
- Record data in a T-chart format
- Conduct a probability experiment
- Compare experimental and theoretical probabilities
- Determine whether a game is fair or unfair

GETTING READY

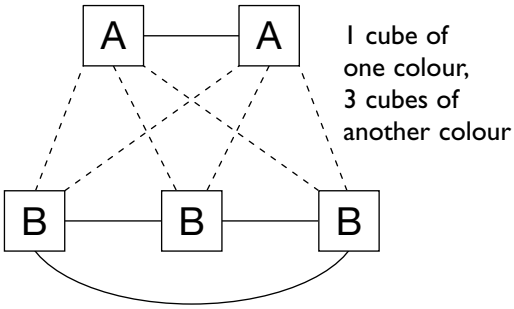
Each pair of students needs two colours of linking cubes and a paper bag or other opaque container. Read the day's exploration for the precise number. Each student will need a copy of the exploration.

INTRODUCING THE EXPLORATIONS

Put a few red and blue cubes in a paper bag. Model the first problem for students by drawing a pair of cubes from the paper bag, and recording on the board whether the cubes match or don't match; then replace the cubes in the bag. Shake the bag and draw again. You may wish to encourage the students to cross every fifth tally mark for easier counting.

TALKING AND WRITING ABOUT THE EXPLORATIONS

Suggest to students that they make lists or diagrams to see the possible outcomes of each experiment. Encourage groups to compare their ways of showing these. As the number of cubes varies with each exploration, students may change their methods of representation. Ask students how their results compare with the theoretical prediction made by the sketches and lists that they draw. The sample diagram below displays Exploration 3, which is an experiment with an equal number of matches and non-matches. The solid line represents a match.



EXTENSION IDEAS

Combine results for the whole class and compare with the theoretical prediction, and then compute the percentage error. Another extension for this exploration involves drawing three cubes from the bag instead of two.

ASSESSMENT TIPS

You can assess students' understanding of equally likely outcomes by having them sketch the appropriate diagram, and then count the matches. If the number of matches equals half the total number of lines drawn, then the outcomes are equally likely.

EXPLORATION 1

Name .....

Use linking cubes and a paper bag.
Work with a partner.

Put two cubes of one colour and two cubes of another colour in the bag.

A. You are going to do an experiment. You will draw two cubes out of the bag, record whether or not they match in colour, and put them back in the bag. You will keep drawing in the same way for a total of 10 times. What do you think is more likely to happen — more matches, more non-matches, or an equal number of both? Explain.

_____

_____

B. Now try the experiment. Use tally marks to record.

Match	Non-match
Total match → ◯	◯ ← Total non-match

Was your prediction correct? _____ What surprised you about the results? _____

_____

How did your results compare with others' results?

_____

Think and Write

In the long run, which outcome is most likely to occur; matches or non-matches? Why?

EXPLORATION 3

Name .....

Use linking cubes and a paper bag.
Work with a partner.

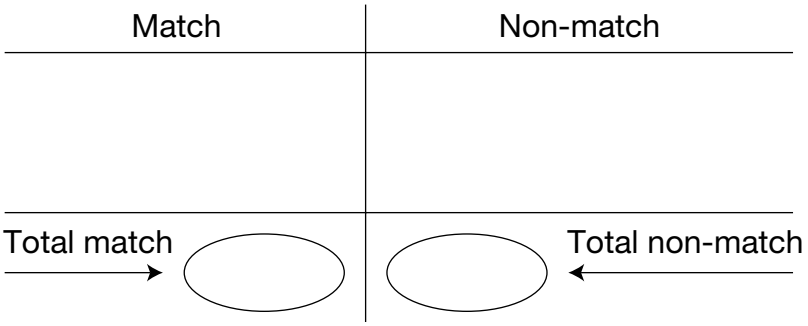
Put one cube of one colour and three cubes of another colour in the bag.

A. You are going to do an experiment. You will draw two cubes out of the bag, record whether or not they match in colour, and put them back in the bag. You will keep drawing in the same way for a total of 10 times. What do you think the outcome will be — more matches, more non-matches, or an equal number of both? Explain.

_____

_____

B. Now try the experiment. Use tally marks to record.



Was your prediction correct? _____ What surprised you about the results? _____

_____

How did your results compare with others' results?

_____

Think and Write

Suppose you had two red cubes and six blue cubes in the bag, and you drew two cubes from the bag. Do you think you would have more matches, more non-matches, or an equal number of both? Explain.