THIS GOES WITH THIS:
DATA COLLECTION, FRACTIONS,
A STRIP GRAPH, A PIE CHART, AND PERCENTAGES

Adapted from MCTP, Professional Development Package from the Curriculum Development Centre, Canberra Australia.

OVERVIEW:

Pupils put their survey preferences onto a strip of paper - a simple strip graph. But then this strip is bent into a circle, a voila - a pie graph! Then the strip is surrounded by 100 beads and instantly - there are the percentages for all to see!

Rarely is there such a powerful illustration for teachers of an activity that makes important mathematical concepts and their integration so clear and understandable and in such an effective way.

Features of this Activity:
- The power of a concrete aid to illustrate concepts - in this case to link fractions, strip graphs, pie charts and percentages.
- The organizational structure which converts a good idea into a successful classroom activity.
- Group work.
- Use of pupils' firsthand data in a survey.
- Optional use of calculators.
- Follow-up work.
- Sample survey sheet included.

Materials Needed:
- Strips of lightweight cardboard or adding machine tape folded in halves or thirds to make it stiffer. Strips should be about 2 cm × 100 cm. Provide one per group.
- '100-bead' rings, one per group. Craft beads on thick elastic thread work well.
- Sheets of butcher's paper, one per group, with a circle of radius 16 cm drawn. The center should be marked.

This activity is in three sections.

I. Demonstrating equivalence. The class is surveyed to find ice-cream preferences. A strip graph is made and bent to make a pie graph. 100 beads are put around it and there are the percentages.

II. Group work. Pupils generate their own data, make graphs and analyses, and present their findings to the whole class.

III. Follow-up extensions. These activities are designed to reinforce the general concepts, imagery and concept of conversion from fractions to percentages.

I.   Demonstrating Equivalence

1.   Collecting the data

Use information from a simple class survey such as favorite ice cream flavor. The survey should generate no more than six categories. Let students know that they will be looking at different ways of representing information and comparing how these different methods are mathematically the same as each other. Begin by showing results in the form of fractions.

Sample results: Chocolate   8/27
                   Strawberry   7/27
                   Vanilla 5/27
                   Caramel   3/27
                   Other   4/27

Teaching note: The teacher should join the survey if needed to ensure that the class total is not an "easy" number such as 20, 25, or 30.

2.   Fractions to Strip Graph

Comment that another way to show factions is on a graph. Prepare a strip of heavy paper such tagboard or adding machine tape folded into halves or thirds. (It is critical to use stiff paper to ensure the shape forms a circle.) The heavy paper needs to be 80 cm to 100 cm long to match the bead ring. (See Section II, Step 3.) If necessary, tape together two strips of paper to get a least 80 cm length.
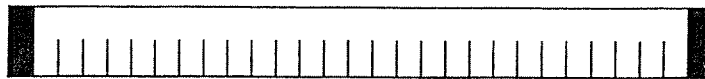
Leave a couple of centimeters overlap at the ends for the next step.

Use "Tack-a-Note" or tape to hold the strip to the chalkboard. Invite students to come to the board and shade in the appropriate number of sections to represent the fractions in each category. For example:

Overlap   Chocolate   Strawberry   Vanilla   Caramel   Other
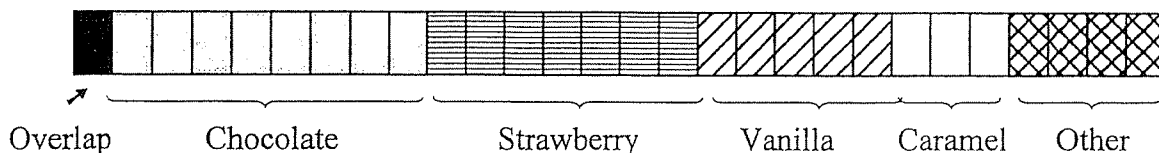
You may need to organize the students according to their response to the survey, so each can shade his or her own small section of the graph.

3.   Strip graph to pie chart.

Do this step slowly and demonstrably. The action from straight line to circle provides a visual image of the relationship.
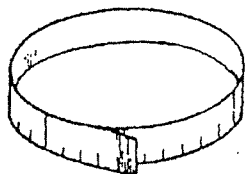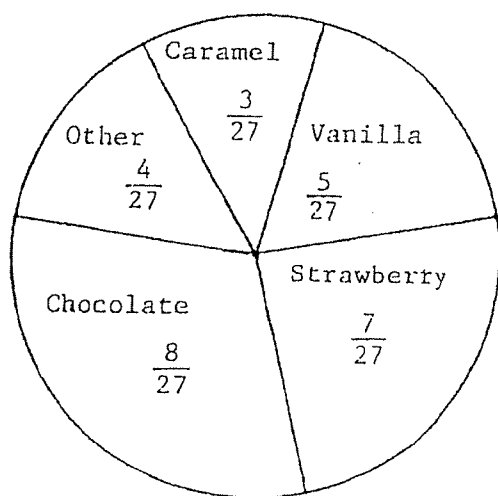
Join with Tack-a-Note or tape using overlap. Lave the markings on the outside.

Place the cardboard ring onto butcher's paper along the predrawn circle.

Draw line segments from the center to the lines that divide the sections of the strip graph.
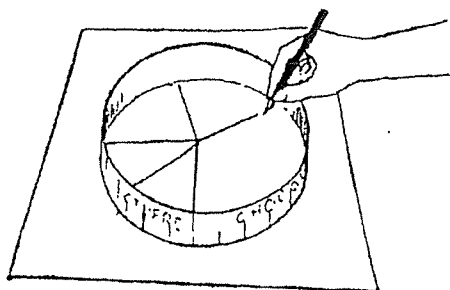
Remove the cardboard ring and complete the pie graph by labeling it with the fractions from part 1.

Comment that all the class votes have ben transferred to the pie chart.

Caramel $\frac{3}{27}$

Other $\frac{4}{27}$

Vanilla $\frac{5}{27}$

Chocolate $\frac{8}{27}$

Strawberry $\frac{7}{27}$

4.   Pie chart to percentage:

Comment that people often find advantages in giving information as a fraction of 100, that is a d percentage.

Place the 100-bead loop around the pie chart. It is best if the loop is just a bit larger than the pie chart circle.

Convert the sections on the pie chart to percentages by inviting students to count the beads. Record these findings beside the graph and on a separate chart.

The method of counting beads is surprisingly accurate. Still interesting debate sometimes occurs about accuracy of counting or if someone notices the total is perhaps 98 rather than 100 due to rounding errors. The major emphasis by far is the visual image generated of the equivalence of fractions on the strip graph and pie chart to percentages.

5.   Calculator accuracy (optional)

For individuals interested in the challenge of precision, the calculator can resolve the dilemma of accuracy. In particular, with a fraction calculator such as the TI Math Explorer students can enter fraction such a 8/27, use the F $\rightleftarrows$ D key to find a decimal and note that 100 times the decimal yields the percent.

II.   GROUP WORK

1.   Generating and collecting data for the group activity.

Having demonstrated the various forms of presentation, this section details how pupils, working in groups, can have first hand experience of the conversions.

Every pupil individually fills out a questionnaire on about nine surveys by circling his/her choice. (See sample survey sheet at the end of this packet.) This allows for up to nine groups to undertake their own investigation.

All pupils then walk past collection boxes and 'snip off' their survey tickets into the relevant box. (e.g. ice-cream or margarine containers). This kind of survey takes less than 5 minutes.

2.   Pose the Question.

I want each group to prepare a report to be presented to the whole class. Your presentation must include the initial fractions, the grip graph, pie chart and percentages.

The report should also include interpretation of the results and recommendations, for example, " we should write a letter to the TV station to tell them that hardly anyone here watches ____."

3. Group Work.

It is important that each group physically handle the concrete aids, so each group needs a piece of butcher's paper marked with a circle, a 100-bead ring, a strip of heavy paper and sticky tape.

Teacher Hint: If there are 27 in the class, rule a large piece of lightweight tagboard into 27 rows (plus extra for overlap) and then cut off one strip for each group.

4. Reporting.

There are enough tasks in the reporting to require every member of the group to participate. One method is to ask each group member to report on one of the forms of representation. Listening to the oral reports give the teacher valuable insights into a pupil understandings. The completed graphs and charts could be displayed on a board and used for reference in the future or made into a class activity book. It might also be sent home to families as a form of reporting.

III. Follow-up

A. For reinforcement.

To get away from always using the same denominator in fractions (i.e. the class size) report the activity with a range of denominators. (These could be survey results from another class or from a neighborhood survey.)

B. Highlight the use of percentages to compare fractions.

Here are the survey results of two classes. Convert these fractions to percentages. What do these figures tell you?

C. For imagery ask students to estimate the number of beads that would correspond to a given fraction. Present any sets of fractions such as 8 out of 21, 9 out of 11, 14 out of 21, 4 out of 28, 4 out of 7.

I want you to visualize a pie graph of 8 out of 21. Got it? Now estimate the number of beads on the eight section and write it down. The answer is 38%. Record how many you were 'out.'

1. Try five practice problems.
2. Give out the answer, add up errors and discuss estimation strategies.
3. Give a retrial and look for improvement.

SAMPLE SURVEY SHEET

TV Shows I Watch Most Often	Favorite Juices	Favorite Number From 1 to 10	Favorite Kind of Fast Food	I Would Most Like to Visit	Favorite Chocolate Bar	Favorite Color	I Came to School by:	The Number of Brothers and Sisters I Have
Sports	Apple	1 6	Pizza	Europe	Snickers	Red	Walking	0
Rock Video	Orange	2 7	Burgers/Beef	Africa	Milky Way	Blue	Car	1
Movies	Grape	3 8	Chinese	Antarctica	Baby Ruth	Green	Bike	2
'Sit Coms'	Pineapple	4 9	Chicken	Asia	Butterfinger	Yellow	Bus	3
Cartoons	Tomato	5 10	Mexican	Australia	Hershey's	Other	Other	more than 3
Game Shows				South America	Heath Bar			

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