

# Teaching Fractions:

## *An Annotated Bibliography*

- Bettina M. Blackall and W. George Cathcart

Fractions is a topic of concern to many teachers and a cause of considerable difficulty for many students. The following list of periodical articles should be helpful to the experienced teacher looking for meaningful instructional alternatives as well as for the beginner seeking guidance. The articles annotated below were selected from hundreds of articles on fractions as being the most mathematically and pedagogically sound.

The articles are divided into three categories. The first set deals primarily with basic mathematical principles. Recent trends in mathematics education have emphasized the teacher's need for a deeper knowledge of basic principles, in order to foster in children a similar understanding and appreciation of mathematical concepts.

The articles in the second group focus primarily upon alternative teaching strategies. The meaningfulness of children's learnings depends largely on the strategies and situations prepared by the teacher.

The final set of articles outlines some puzzles and games which can provide children with enjoyable practice needed for consolidation of ideas.

### TEACHER INFORMATION

- Bray, Claud J. "To Invert or Not to Invert", *The Arithmetic Teacher*, 10 (May 1963), 274-276.

A clear explanation of division of fractions by the reciprocal method. Numerals only are used to illustrate the procedure.

- Dilley, Clyde, and Walter E. Rucker. "Division with Common and Decimal Fractional Numbers", *The Arithmetic Teacher*, 17 (May 1970), 438-441.

After explaining the importance of 1 in division of fractions, the authors develop an alternate method that depends on number pattern and an understanding of measurement division.

- Filipek, Jerome T. "Common Denominators Made Easy", *Vector*, 11 (July 1970), 16-17.

An interesting method of finding Lowest Common Denominator through the use of number patterns. The approach could be used to extend a pupil's knowledge of equivalent fractions.

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- ▶ Hannon, Herbert. "Why Invert the Divisor?" *The Arithmetic Teacher*, IV (December 1957), 262-265.

The author approaches the problem of the title by concentrating on the inverse relationship between division and multiplication. Thus he provides, for at least some teachers, another line of reasoning, to broaden the basis of pupils' understandings of the former "mumbo-jumbo" recital.

- ▶ Heddens, James W., and Michael Hynes. "Division of Fractional Numbers", *The Arithmetic Teacher*, 16 (February 1969), 99-103.

A summary of practical approaches to the learning of division of fractions, including regions, number lines, and sets of discrete objects.

- ▶ Junge, Charlotte W. "Now Try This - Division of Fractions", *The Arithmetic Teacher*, 15 (February 1968), 177-178.

A number of surprisingly "modern" methods of division of fractions, gleaned from textbooks of the last century.

- ▶ Koenker, Robert H. "Dividing by a Fraction", *The Arithmetic Teacher*, 12 (March 1965), 225-226.

Explanation of the lowest common denominator method, and two versions that lead to the generalization "To divide by a fraction, invert the divisor and multiply".

- ▶ Larson, H. L. "The Structure of a Fraction", *The Arithmetic Teacher*, 13 (April 1966) 296-297.

A short article by an Albertan, who adds a further dimension to understanding by linking the unit fraction of the Egyptians to the child's knowledge of whole numbers.

- ▶ Latino, Joseph J. "Take the Folly out of Fractions", *The Arithmetic Teacher*, 2 (November 1955), 113-118.

The author questions children's comprehension level of terms such as lowest common denominator and lowest terms, and gives some practical suggestions for sounder teaching practices that utilize concrete materials.

- ▶ Morton, Robert L. "Fractional Numbers with a Sum of 1", *The Arithmetic Teacher*, 13 (December 1966), 647-655.

Children who have enjoyed exploring patterns in numbers will delight in exploring unit fractions, which we have inherited from the ancient Egyptians. Bonuses include lowest common multiples, factors, perfect and abundant numbers, and lots of practice in the four basic operations as applied to fractions.

- ▶ Olberg, Robert. "Visual Aid for Multiplication and Division of Fractions", *The Arithmetic Teacher*, 14 (January 1967), 44-46.

A gridded rectangular region gives a concrete model for multiplication and division of fractions.

- ▶ Vance, Irvin E. "A Natural Way of Teaching Division of Rational Numbers", *The Arithmetic Teacher*, 16 (February 1969), 91-93.

A clear explanation of division of fractions using the method

$$\frac{14}{9} \div \frac{2}{3} = \frac{14 \div 2}{9 \div 3} = \frac{7}{3}$$

## SPECIFIC TEACHING STRATEGIES

- ▶Clarkson, David M. "A Number Pencil", *The Arithmetic Teacher*, 14 (November 1967), 557-559.

Inspired by Robert Davis of the Madison Project, this discovery lesson develops the notion of fractions as numbered pairs plotted on coordinate graphs.

- ▶Cunningham, George S., and David Raskin. "The Pegboard as a Fraction Maker", *The Arithmetic Teacher*, 15 (March 1968), 224-227.

The lengths between pegs are used to develop an understanding of simple fractions. The number line is shown as a "natural" way of recording these relationships.

- ▶Florence, Desmond. "Fractions in the Junior School", *Primary Mathematics*, 7 (April 1969), 41-49.

Having justified the use of structured materials in the development of mathematical ideas, the writer gives the specifications of a "Fraction Set", consisting of circle segments and a pack of cards bearing various fractional numerals in color. The games described give enjoyable practice in equivalence of fractions and the four operations involving fractions.

However, it would seem that (a) the children would need more experience of fractional relationships before being introduced to symbols, and (b) the exclusive use of one structured material is narrowing to a child's understanding.

- ▶Hillerby, D. J. "Multiplication and Division of Fractions", *Teaching Arithmetic*, 4 (Summer 1966), 52-53.

Children build up experience of the meaning of multiplication of fractions by exploring rectangular grids of varying proportions.

- ▶Jacobson, Ruth S. "Fun with Fractions for Special Education", *The Arithmetic Teacher*, 18 (October 1971), 417-419.

The learning of addition and subtraction of fractional numbers, both "like" and "unlike", is facilitated by the use of an acetate projectual and corresponding fractional parts in color. The children themselves can discover equivalent relationships and solutions to examples. Although designed for use on an overhead projector, the projectuals would be beneficial as a manipulative aid for the individual pupil.

- ▶Lansdown, Brenda C. "From Cake to Cancellation", *The Arithmetic Teacher*, IV (April 1957), 136-137.

Each pupil makes his own set of segments of circles - "fraction pies". After much exploratory play, the children are encouraged to play games that incorporate the idea of exchange, thus giving experience in equivalence of fractions and cancelling.

- ▶McMeen, George, "Division by a Fraction - a New Method", *The Arithmetic Teacher*, 9 (March 1962), 122-126.

A different approach to division of fractions by the use of number wheels, easily constructed by the child. The author presents a combination of experiment and telling, though the creative teacher will devise means of reducing the latter.

- ▶Ranucci, Ernest R. "Fractions without Friction", *Primary Mathematics*, 9 (June 1971), 27-30.

Geometric shapes are used to give experience in value relations, as a preparatory step to the manipulative stages of the development of fractions.

Unfortunately, the exercises are somewhat inconsistent in the use of area measure in determining the value of the various shapes; therefore, otherwise very useful assignments could confuse the pupils.

N.B. Teachers need to guard against the unfortunate tendency to depend on the use of one structured material as the solution to all problems, and to forget that children need a wide variety of experiences in order to generalize basic mathematical concepts.

#### PUZZLES TO REINFORCE

- ▶ Hammond, Robert C. "A Device for Practice with Common Denominators and Addition of Unlike Fractions", *The Arithmetic Teacher*, VIII (November 1961), 373.

A magic square game designed to give practice in addition of fractions to the sum of 1. Pupils are encouraged to make up their own sets of rules.

- ▶ Cook, Nancy. "Fraction Bingo", *The Arithmetic Teacher*, 17 (March 1970), 237-239.

An enjoyable activity to reinforce knowledge of equivalent fractions, after the concept has been developed. Children are encouraged to explore relationships and to devise feasible strategies.

- ▶ Rode, Joann, "Make a Whole - a Game using Simple Fractions", *The Arithmetic Teacher*, 18 (February 1971), 116-117.

A set of simply-made circle segments are used to play a fractions game that practises equivalent fractions as well as the combinations of fractions that equal one. The writer leaves the way clear for the classroom teacher and/or the pupils to devise other sets of rules.

