Probability in the Elementary School:

An Annotated Bibliography

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Probability is a versatile topic in elementary school mathematics. Many teachers see its study as an integral part of a program which has as a goal problem-solving and independent attack.

On the other hand, it can be regarded, at the elementary level, as an enrichment topic that provides desirable preliminary experiences for children prior to their move to junior high school.

Unfortunately, there are many texts currently available which presume that pupils already know what probability is all about, yet the authors claim they are presenting introductory instruction.

Much material has been sifted in order to produce the following list of references. Whether you view probability as an integral part of your elementary mathematics program or simply as an enrichment topic, you should find the following references valuable resource material.

▶Berry, Clifford. "Probability and Graphing", *Mathex*, Level 4. Teacher's Bulletin 12. Toronto: Encyclopaedia Britannica, 1968.

Emphasis on child activity provides a sound basis for discovering the fundamental ideas of probability. Children are encouraged to record their findings using graphs and to write their explanations. The author avoids "giving formal definitions and developing formal and often complicated notation".

▶Buxton, R. "Probability and its Measurement", *Mathematics Teaching*, 49 (Winter 1969), 4-12.

This readable account discusses clearly the meaning of probability without recourse to complicated formulae. Practical applications with emphasis on the concept of equally likely frequencies are suggested.

The second part of this article compares (a) objective and subjective theories, and (b) empirical and logical theories; therefore, it does not seem to be relevant to the elementary school teacher or pupil.

▶Cathcart, W. George. "What are the Chances?" *Mathex*, Level 6. Pupil Bulletin 10. Toronto: Encyclopaedia Britannica, 1968.

More advanced activities are used to establish the numerical relationships within a probability situation. The pupils are offered informal experiences leading to the graphing of the normal distribution curve. Those pupils who are mathematically sophisticated will be interested in learning to distinguish empirical from theoretical probability.

▶Engel, Arthur. "Mathematical Research and Instruction in Probability Theory", *The Mathematics Teacher*, 59 (December 1966), 771-782.

Geared to the teaching of junior high school students, this relatively short article describes experiments that children can do to develop intuitive notions of probability, prior to a study of the theory itself. Although mathematical discourse and explanation are provided in abundance, the non-math major teacher can ignore this aspect and still gain much from reading this article at his own level of conceptualization.

▶Engel, Arthur. "Teaching Probability in Intermediate Grades", *International Journal of Mathematical Education in Science and Technology*, 2 (July/September 1971), 243-294.

This long article is packed with teacher information as well as with an extremely large collection of activity ideas. The level extends from the very simple assignment to problems that would challenge many junior high school students. There is much theoretical explanation for the expert, which can be ignored by the non-mathematician without spoiling the usefulness of this major contribution to the topic of probability.

▶Johnson, Donovan, Viggo Hansen et al. *Activities in Mathematics - first course, Probability*. Glenview, Illinois: Scott, Foresman, 1971.

Some novel situations as well as the usual dice - and coin - throwing activities provide experiences of probability. Students are given much practice in completing one particular type of table, but are not encouraged to construct or devise their own ways of recording data. Bar graphs, ordered pairs and coordinates are valuable by-products. Fractions are reviewed extensively. Attractive illustrations and good spacing are features of the format of this series.

▶Lovell, Kenneth. "Proportionality and Probability" in Myron F. Rosskopf, Leslie P. Steffe and Stanley Taback (eds.) *Piagetian Cognitive-Development Research and Mathematical Education*. Washington: National Council of Teachers of Mathematics, 1971.

Piaget's view that the development of probability understanding to the point of quantification demands the onset of formal-operational thought is documented and compared with other recent research in this area. Preliminary aspects which can be profitably introduced in elementary school are suggested.

▶May, Lola J. "What are the Odds?" *Grade Teacher*, 88 (March 1971), 62-63.

The author assumes (a) that children have to be told that fractional notation is a form of expressing probability; and (b) that children and teachers already have an intuitive understanding of probability. However, the suggestion of recording throws of dice on a lattice is useful.

▶Nelson, L. Doyal, and W. W. Sawyer (general editors). *Mathex* (Junior Level, Grades 4-6. No. 6:2, pp.38-52). Toronto: Encyclopaedia Britannica, 1970.

This series of practical assignments develops the child's understanding of probability, including methods of recording data. However, some of the vocabulary is

likely to tax some elementary children. The games suggested provide enjoyable reinforcing activities.

▶The Nuffield Mathematics Project. *Probability and Statistics*. London: W & R Chambers and John Murray, 1969.

This book of only 55 pages follows the Nuffield Project pattern of gradually developing the child's understanding of and facility with the mathematical concept under discussion. The table of contents summarizes this approach as it applies to Probability:

Early Uses of Pictorial Representation
Games Leading to Ideas of Probability
Sampling
Recording
Simple Averages
Measuring Probability.

▶Ojemann, Ralph H., James E. Maxey,and Bill C. Snider. "The Effect of a Program of Guided Learning Experiences in Developing Probability Concepts at the Third-Grade Level", *Journal of Experimental Education*, 33 (Summer 1965), 321-330.

The learning program devised by the researchers contains many practical suggestions for the classroom teacher. The application of probability to everyday living is discussed without undue jargon and symbolization.

▶Razzell, Arthur, and K.G.O. Watts. *Probability* (Mathematical Topics 4). London: Rupert Hart-Davis, 1968.

This cheerful-looking book of 32 pages gives interesting historical background and shows how probability is related to everyday life. Although some activities are suggested, the contents could be used as informative reading. Terms such as random sampling are explained within appropriate situations and in simple language.

▶Skukyn, Murray J. "Probability", *Mathex*, Level 5, Pupil Bulletin 3. Toronto: Encyclopaedia Britannica, 1968.

A wide variety of open-ended activities using simple materials provide open-ended situations which children enjoy investigating.

▶Yee, Albert H. "Mathematics Probability and Decision-Making", *The Arithmetic Teacher*, 13 (May 1966), 385-387.

The author establishes a case for the inclusion of the study of probability in elementary mathematics on the grounds of the need to train children in decision-making skills. He rejects technical jargon in favor of relating probability to the everyday experiences of the young child.