Research on Student Learning

Research presents somewhat contradictory results on elementary children's understanding of probability. Piagetian research says lower elementary children have no conception of probability. [1] Other studies indicate that even lower elementary-school children have probabilistic intuitions upon which probability instruction can build. Falk et al. (1980) presented elementary-school students with two sets, each containing blue and yellow elements. Each time, on color was pointed out as the payoff color. The students had to choose the set from which they would draw at random a "payoff element" to be rewarded. From the age of six, children began to select the more probable set systematically. The ability to choose correctly precedes the ability to explain these choices. [2]

Upper elementary students can give correct examples for certain, possible, and impossible events, but cannot calculate the probability of independent and dependent events even after instruction on the procedure. [3] That is partly because students at this age tend to create "part to part" rather than "part to whole" comparisons (e.g., 9 men and 11 women rather than 15% of men and 10% of women). By the end of 8th grade, students can use ratios to calculate probabilities in independent events, after adequate instruction. [4]

Upper elementary students begin to understand that there is an increase in regularity of a sample distribution with an increase in the sample size, but they can apply this idea only to relatively small numbers. It is postulated that to deal with large numbers, children must first cope with notions of ratio and proportion and that their failure to understand these notions creates "a law of small large numbers". [5]

Extensive research points to several misconceptions about probabilistic reasoning that are similar at all age levels and are found even among experienced researchers. [6] One common misconception is the idea of representativeness, according to which an event is believed to be probable to the extent that it is "typical." For example, many people believe that after a run of heads in coin tossing, tails should be more likely to come up. Another common error is estimating the likelihood of events based on how easily instances of it can be brought to mind. [7]

References

[1] Piaget, J., Inhelder, B. (1975). The origin of the idea of chance in children. *The origin of the idea of chance in children.*.

Shayer, M., Adey, P. (1981). Towards a science of science teaching. *Towards a science of science teaching.*.

[2] Falk, R., Falk, R., Levin, I. (1980). A potential for learning probability in young children. *Journal for Research in Mathematics Education*, 11, 181-204.

[3] Fischbein, E., Gazit, A. (1984). Does the teaching of probability improve probabilistic intuitions?. *Educational Studies in Mathematics*, 15, 1-24.

[4] Fischbein, E., Gazit, A. (1984). Does the teaching of probability improve probabilistic intuitions?. *Educational Studies in Mathematics*, 15, 1-24.

[5] Bliss, J. (1978). Ideas of chance and probability in children and adolescents. *Physics Education*, 13, 408-413.

[6] Kahneman, D., Slovic, P., Tversky, A. (1982). Judgment under certainty: Heuristics and biases. *Judgment under certainty: Heuristics and biases.*.

Shaughnessy, J. M. (1992). Research in probability and statistics: reflections and directions. In Grouws, D. (Ed.), *Handbook of research on mathematics teaching and learning* (pp. 465-494).

[7] American Association for the Advancement of Science, Project 2061

(2001). *Atlas for Science Literacy*, 126.