

Mathematics Education to Develop Students Agency
Part III: Pattern and Data
Various Meaning of Probability

Finding and utilizing **Invariant** is the nature of mathematics. Graph and Table are used for showing invariant mathematically

Through the visualization of data, we can discuss symptom on the real data in our life

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4. Pattern and Data
 4.1. Forecasting: How to find the pattern
 4.2. Data Handling and Visualization of Data
 4.3. Various Meaning of Probability

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 September 3rd - 2022

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Various words for probability

Chance
 Number of Chances
 Possibility
 Odds
 Expectation
 Probably
 Occurrence
 Certainty
 Likelihood
 Frequency
 Equally likely
 Probability
 Plausible

Intuitive Probability

Descriptive-Statistical Probability
 Ratio and Percent

Mathematical Probability
 Equally likely
 Number of Chances

Statistical Probability
 law of large number
 Distribution
 Sample-Population
 null hypothesis

Axiomatic Probability

Bayesian Probability
 Unknown Probability $P(x)$

Probability
 Part-Whole Ratio? VS Part-Part Ratio (odds)?

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Various Interpretation of Probability

Making sense of earthquake forecasts is difficult, in part because standard interpretations of probability are inadequate. A model-based interpretation is better, but lacks empirical justification. Furthermore, probability models are only part of the forecasting machinery. For example, the USGS San Francisco Bay Area forecast for 2000–2030 involves geological mapping, geodetic mapping, viscoelastic loading calculations, paleoseismic observations, extrapolating rules of thumb across geography and magnitude, simulation, and many appeals to expert opinion. Philosophical difficulties aside, the numerical probability values seem rather arbitrary. (by Stark and Freedman, 2016)

A summary of some interpretations of probability [2]

	Classical	Frequentist	Subjective	Propensity
Main hypothesis	Principle of indifference	Frequency of occurrence	Degree of belief	Degree of causal connection
Conceptual basis	Hypothetical symmetry	Past data and reference class	Knowledge and intuition	Present state of system
Conceptual approach	Conjectural	Empirical	Subjective	Metaphysical
Single case possible	Yes	No	Yes	Yes
Precise	Yes	No	No	Yes
Problems	Ambiguity in principle of indifference	Circular definition	Reference class problem	Disputed concept

Subjective Probability → Bayesian Probability

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Australian Curriculum: Enhanced Probability
 Number and Algebra
 Measurement and Geometry
 Statistics and Probability

Applying Data Handling for Sustainable Living

1. Read data related to sustainable development such as emergency preparedness and readiness, food and energy security, waste, marine, tourism and human connectivity in society, and living meaning in the changing society such as TVET (Technical and Vocational Education and Training) and adopting positive view for changing the society.

2. Understand the idea of probability as ratio and percentage in reading the data for situations related to sustainable development such as weather report and risk analysis.

3. Experience implementing a project of reasonable size in data handling for the purposes of achieving sustainable development and appreciate the power of data handling.

SEA-BES: CRRLS has 5 Strands for each

Key Stage 1
 > Numbers & Operations
 > Quantity & Measurement
 > Shape, Space & Units
 > Pattern & Data
 > Representation

Key Stage 2
 > Extension of Numbers & Operations
 > Measurement & Relations
 > Classification
 > Representation

Key Stage 3
 > Numbers & Algebra
 > Statistics & Probability
 > Statistics & Probability

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Australian Curriculum: Enhanced Probability

Chance Year 1
Identify outcomes of familiar events involving chance and describe them using everyday language such as 'will happen', 'won't happen' or 'might happen' (ACMSP024 - Scootle [↗](#))

Chance Year 2
Identify practical activities and everyday events that involve chance. Describe outcomes as 'likely' or 'unlikely' and identify some events as 'certain' or 'impossible' (ACMSP047 - Scootle [↗](#))

Chance Year 3
Conduct chance experiments, identify and describe possible outcomes and recognise variation in results (ACMSP067 - [↗](#))

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Australian Curriculum: Enhanced Probability

Chance Year 4
Describe possible everyday events and order their chances of occurring (ACMSP092 - Scootle [↗](#))
Identify everyday events where one cannot happen if the other happens (ACMSP093 - Scootle [↗](#))
Identify events where the chance of one will not be affected by the occurrence of the other (ACMSP094 - Scootle [↗](#))

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Australian Curriculum: Enhanced Probability

Chance Year 5
List outcomes of chance experiments involving equally likely outcomes and represent probabilities of those outcomes using fractions (ACMSP116 - Scootle [↗](#))
Recognise that probabilities range from 0 to 1 (ACMSP117 - Scootle [↗](#))

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Australian Curriculum: Enhanced Probability

Chance Year 6
Describe probabilities using fractions, decimals and percentages (ACMSP144 - Scootle [↗](#))
Conduct chance experiments with both small and large numbers of trials using appropriate digital technologies (ACMSP145 - Scootle [↗](#))
Compare observed frequencies across experiments with expected frequencies (ACMSP146 - Scootle [↗](#))

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