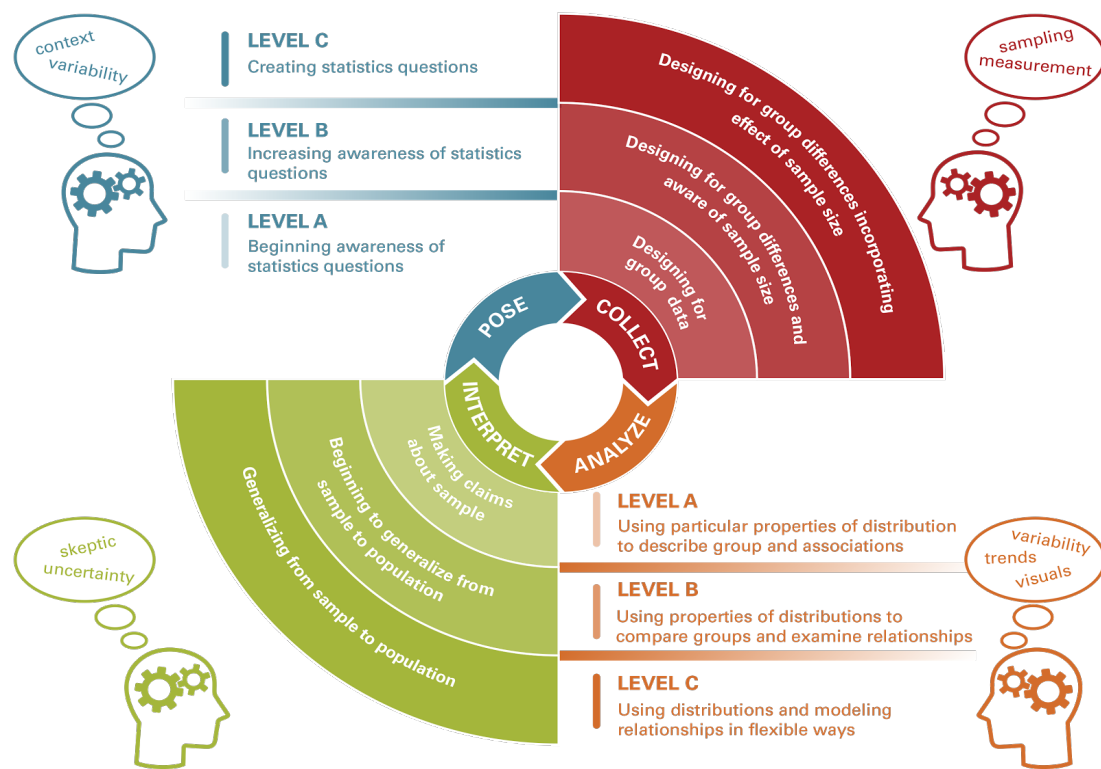


Mod 1: Part 2

How Students' Statistical Sophistication Can Develop Across Levels



Overview Diagram of SASI Framework

The next several pages provide more details about how students' statistical sophistication can develop across three levels within each phase of a statistical investigation.

-----> **Increasing Levels of Statistical Sophistication**----->

| Phase of Statistical Investigation | Level A | Level B | Level C |
|---|--|---|--|
| Pose Questions | <p>Students are beginning awareness of statistics questions.</p> <p>Questions about contexts of interest to students are given or posed by teachers.</p> <p>Questions seek to account for variability (measurement, natural, and induced) within a group.</p> | <p>Students are increasing awareness of statistics questions.</p> <p>Questions of interest can be posed by teachers or students.</p> <p>Questions also begin to seek generalization that account for sampling variability (within a group and between groups).</p> | <p>Students are creating statistics questions.</p> <p>Questions of interest are posed by students.</p> <p>Questions also seek generalization that account for chance variability.</p> |
| Collect Data | <p>Students are designing for group data and simple experiments.</p> <p>Data from a specific population is collected, without regard to group size (e.g., whole class).</p> <p>Data is collected from a simple experiment.</p> <p>Sample size is noted.</p> | <p>Students are designing for group differences and aware of sample size.</p> <p>Sample surveys are conducted in which students begin to use random selection.</p> <p>Data is collected from comparative experiments that begin to account for random assignment.</p> <p>Sample size is considered when designing data collection.</p> | <p>Students are designing for group differences and incorporating effect of sample size.</p> <p>Sample surveys are conducted using sampling designs that account for random selection.</p> <p>Data is collected from experimental designs with random assignment to groups.</p> <p>Sample size is explicitly considered when designing data collection.</p> |

-----> **Increasing Levels of Statistical Sophistication** ----->

| Phase of Statistical Investigation | Level A | Level B | Level C |
|---|---|---|---|
| Analyze Data | <p>Students are using particular properties of distributions to describe group and associations.</p> <p>Analysis includes comparing individual to individual, individual to group, beginning awareness of comparing group to group, and describing relationships between variables informally.</p> <p>Variability and group tendencies are initially described informally, then quantified using mean, mode, median, and range.</p> <p>Appropriate representations are used to display variability within a group including: students' invented data displays, bar graph, dotplot, stem and leaf plot, scatterplot, table (using counts). Representations are beginning to be coordinated.</p> | <p>Students are using properties of distributions to compare groups and examine relationships.</p> <p>Analysis includes using proportional reasoning to quantify variability within a group, comparing groups, and beginning to quantify and model relationships between variables (e.g., Quadrant Count Ratio; estimated linear models). Additional variables are considered to explore trends.</p> <p>Variability and group tendencies are described attending to shape, center, and spread, and quantified using additional measures including Interquartile Range (IQR), Mean Absolute Deviation (MAD).</p> <p>Additional representations used include: histogram, pie graph, boxplot, proportional bar graph, time series plot, and contingency tables for categorical variables. Multiple representations are coordinated and may be augmented with additional information.</p> <p>Sampling error is acknowledged.</p> | <p>Students are using distributions and modeling relationships in flexible ways.</p> <p>Analysis includes quantifying variability within a group, comparing groups using multiple displays and numerical measures, quantifying association (e.g., Pearson correlation), and fitting models for associations (e.g., goodness of fit). Additional variables are used to explain trends and relationships.</p> <p>Analysis attends to the distinction among a model (or population) distribution, a distribution of a sample, and a distribution of a sample statistic.</p> <p>Variability is also quantified using standard deviation (SD).</p> <p>Representations are used flexibly, augmented to integrate information, and include non-traditional displays made possible by software tools.</p> <p>Sampling error is described and quantified.</p> |

-----> **Increasing Levels of Statistical Sophistication** ----->

| Phase of Statistical Investigation | Level A | Level B | Level C |
|---|--|---|--|
| Interpret Results | <p>Students are making descriptive claims from data collected.</p> <p>Descriptive claims are only appropriate for the group from which data was collected.</p> <p>Characteristics of the group are considered as a possible limitation.</p> <p>Interpretations include differences between two individuals with different conditions.</p> <p>Association among variables is described holistically.</p> | <p>Students are beginning to make inferences to a population.</p> <p>Claims/Inferences indicate that a sample may or may not be representative of the larger population.</p> <p>Interpretations include the difference between two groups with different conditions.</p> <p>Basic measure of strength of association and models for association among variables are provided and interpreted.</p> <p>Interpretations begin to distinguish between association and cause and effect.</p> <p>Interpretations demonstrate awareness of the distinction between observational studies and experiments.</p> | <p>Students are using data to make inferences to a population.</p> <p>Inferences include generalizations from sample to population that account for expected variation.</p> <p>Interpretations indicate role of sample size and the effect of random assignment on the results of experiments.</p> <p>Measures of strength of association and models of association are provided and interpreted.</p> <p>Interpretations distinguish between association and cause and effect.</p> <p>Interpretations distinguish between observational study and experiment.</p> |

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