Unit 8: Statistics & Probability

Content Area: **Mathematics**
Course(s): **Mathematics**
Time Period: **Week 31**
Length: **4 weeks**
Status: **Published**

Unit Overview

In this unit, students will learn about probability and how to properly get and display data. This unit will begin with an explanation of what probability is, and that the probability of a given outcome can be written as a fraction, decimal, or percentage. Students will learn about theoretical probability and how they can apply it and their previous knowledge of proportions in order to make predictions of a certain situation. Then, they will learn about experimental probability and how it differs from theoretical probability. To truly grasp the difference, students will actually conduct experiments to see if the experimental probability matches the theoretical probability. Students at this time will also learn about different simulations that can be done to model different situations. Finally, they will learn about compound probabilities involving independent and dependent events. As with singular probability, students will conduct experiments to see if the experimental probability for the compound situation matches the theoretical probability.

The second half of this unit will focus solely on statistics. First, students will learn about different types of samples and sampling techniques. They will learn the differences between biased and unbiased samples, in addition to learning how to conduct a random sample that would accurately represent the population. Next, students will review the different types of data displays, specifically dot plots and box and whisker plots. They will create and analyze these types of data displays and later be asked to explain why certain data displays could be considered misleading. Lastly, students will be able to compare and contrast populations when given a box and whisker plot and will be able to discuss which population shows more consistency.

Standards

MA.7.SP.A.1	Understand that statistics can be used to gain information about a population by examining a sample of the population; generalizations about a population from a sample are valid only if the sample is representative of that population. Understand that random sampling tends to produce representative samples and support valid inferences.
MA.7.SP.A.2	Use data from a random sample to draw inferences about a population with an unknown characteristic of interest. Generate multiple samples (or simulated samples) of the same size to gauge the variation in estimates or predictions.
MA.7.SP.B.3	Informally assess the degree of visual overlap of two numerical data distributions with similar variabilities, measuring the difference between the centers by expressing it as a multiple of a measure of variability.
MA.7.SP.B.4	Use measures of center and measures of variability for numerical data from random samples to draw informal comparative inferences about two populations.
MA.7.SP.C.5	Understand that the probability of a chance event is a number between 0 and 1 that expresses the likelihood of the event occurring. Larger numbers indicate greater likelihood. A probability near 0 indicates an unlikely event, a probability around 1/2 indicates an event that is neither unlikely nor likely, and a probability near 1 indicates a

	likely event.
MA.7.SP.C.6	Approximate the probability of a chance event by collecting data on the chance process that produces it and observing its long-run relative frequency, and predict the approximate relative frequency given the probability.
MA.7.SP.C.7	Develop a probability model and use it to find probabilities of events. Compare probabilities from a model to observed frequencies; if the agreement is not good, explain possible sources of the discrepancy.
MA.7.SP.C.7a	Develop a uniform probability model by assigning equal probability to all outcomes, and use the model to determine probabilities of events.
MA.7.SP.C.7b	Develop a probability model (which may not be uniform) by observing frequencies in data generated from a chance process.
MA.7.SP.C.8a	Understand that, just as with simple events, the probability of a compound event is the fraction of outcomes in the sample space for which the compound event occurs.
MA.7.SP.C.8b	Represent sample spaces for compound events using methods such as organized lists, tables and tree diagrams. For an event described in everyday language (e.g., "rolling double sixes"), identify the outcomes in the sample space which compose the event.
MA.7.SP.C.8c	Design and use a simulation to generate frequencies for compound events.

Essential Questions

- How do you know which type of graph to use when displaying data?
- Why is choosing an appropriate sample important when surveying a group of people?
- How can the probability of an outcome help influence in making decisions?

Application of Knowledge: Students will know that…

- A biased sample of a population occurs when instances were not equally likely to be selected.
- A box and whisker plot shows measures of variation for a set of data (shows how consistent a set of data is).
- A combination is when the order in which things are selected is not important.
- A graph can be considered misleading based on the size of the picture being represented in a pictograph.
- A graph can be considered misleading if the intervals are not consistent throughout the entire display.
- A permutation is when the order in which things are arranged in is important.
- A simulation is a way to model random events.
- An unbiased sample occurs when everything has an equally likely chance of being selected.
- Certain probabilities have a 100% chance of occurring.
- Dependent events occur when the probability of one event does effect the probability of the second event.
- Equally likely probabilities have a 50% chance of occurring.
- Experimental probability is the probability that you actually get after conducting an experiment.
- Impossible probabilities have a 0% chance of occurring.

- Independent events occur when the probability of one event does not effect the probability of the second event.
- Probabilities can be written as a fraction, decimal, or percent.
- Probability is the likelihood that an event will occur.
- The expected value of a situation is a prediction based on a given probability.
- The solution to a compound probability problem can be achieved by multiplying the probability of each event together.
- Theoretical probability is the probability that should occur before conducting a test.
- When comparing populations using box and whisker plots you can compare the center by examining the median.
- When comparing populations you can compare the variation of each by examining the inter-quartile range for each.

Application of Skills: Students will be able to...

- Apply proper surveying techniques to seek an answer to a statistical question.
- Calculate the expected value of an event occurring.
- Calculate the experimental probability of an event occurring.
- Calculate the probability of a compound situation (independent/dependent event).
- Calculate the singular probability of a given event.
- calculate the theoretical probability of a given event occurring.
- Choose an appropriate data display to depict given information properly.
- Compare and contrast information about two populations presented in a box and whisker plot.
- Create a box and whisker plot to represent a given set of data.
- Create a simulation to model the probability of an event occurring.
- Determine whether or not a given data display is misleading.
- Identify on a number line (from 0 to 1) the likelihood that an event will occur.
- Represent the probability of an event as a fraction, decimal, and percent.

Assessments

- Do-Now's: These daily assessments will be used to check for prior knowledge and to determine mastery of particular topics. If needed, remediation will be completed on an as needed basis.
- Exit Tickets: These will be used to measure student understanding of the lesson and assist in determining whether remediation is needed for the topic.
- Communicator Practice: This will be used as a quick whole-class assessment tool to check for complete comprehension.
- Quarterbacks Project: In this project, students will compare the touchdowns of two different quarterbacks and from there analyze the graphs and state who was a more consistent quarterback.
- Survey Project: Students will be asked to come up with a survey question and apply appropriate surveying techniques to get responses to their survey. Students will then display their results using a variety of different data displays and then must explain which display is the best to display their information.
- Unit Quiz

- Unit Test
- End of year benchmark assessment: Information from this unit will be included on the end-of-year assessment.

Suggested Activities

- Grade 7 Digits Topics 14 - 17 Launches
- Review games using communicators.
- Student centered SMART Board lessons: Students will use interactive activities (i.e. rolling number cubes and flipping coins) to simulate experiments so students can see the differences between experimental probability and theoretical probability.
- Quarterbacks Project (see description in assessments).
- Survey Project (see description in assessments).
- Counting Chip Activity: To introduce the students to experimental and theoretical probability, have students flip a counting chip 20 times and record the results. Explain in the context of the experiment the differences between their experimental results and the theoretical probability. Also, use this time to make a prediction if you were to flip the coin 100 times.
- Goldfish Activity: Students will work in groups and each group will be given a paper lunch bag that contains Pretzel Goldfish crackers mixed in with traditional Goldfish crackers. Each bag will contain a set number of Pretzel Goldfish crackers. Students will use a plastic cup and take multiple samples from their bag. They will count the number of Pretzel Goldfish crackers and the total number of crackers that are in each of their samples. They will use the results of their samples and the known amount of Pretzel Goldfish in their bag to make a proportion and predict how many total crackers are in their bag. This activity models how animal populations are counted using animal tags and the capture-recapture method.

Activities to Differentiate Instruction

Differentiation for special education:

- General modifications may include:
    - Modifications & accommodations as listed in the student's IEP
    - Assign a peer to help keep student on task
    - Modified or reduced assignments
    - Reduce length of assignment for different mode of delivery
    - Increase one-to-one time
    - Working contract between you and student at risk
    - Position student near helping peer or have quick access to teacher
    - Break tests down in smaller increments

- **Content specific modifications may include:**
    - Provide personal handout for integer rules
    - Provide manipulative, such as Uniflex cubes or counting chips, for students to use when calculating probabilities
    - Provide completed examples for practice work and homework.

- Provide calculator to assist with calculations.

Differentiation for ELL's:

- General modifications may include:
  - Strategy groups
  - Teacher conferences
  - Graphic organizers
  - Modification plan

- **Content specific vocabulary important for ELL students to understand include:** probability, likelihood, expected value, predictions, experimental, theoretical, compound probability, independent events, dependent events, sample, population, biased, un-biased, box and whisker plot, measure of variability, variation, measure of center, median, mean, interquartile range, mean absolute deviation

Differentiation to extend learning for gifted students may include:

- Self directed lesson for students to calculate the permutations and combinations for a given situation.
- When dealing with compound events give students three or 4 separate events instead of just two.

Integrated/Cross-Disciplinary Instruction

ELA: Practice formulating complete and grammatically correct responses to open-ended questions.

Game Design: Have students come up with a game in which they need to calculate the probability of winning. Make them come up with different variations of the game to elicit different outcomes.

Science: The Goldfish Activity models how animal populations are counted in particular locations using animal tags and the capture-recapture method. The Pretzel Goldfish crackers represent tagged animals and the traditional Goldfish represent untagged animals.

Resources

- Digits teacher materials and support: www.pearsonrealize.com
- Digits student access and support: www.mymathuniverse.com
- SMART Exchange: http://exchange.smarttech.com/index.html#tab=0
- IXL practice: www.ixl.com
- Digits video examples
- SMART Board lessons
- Punchline/Pizzazz worksheets (self-correcting)
- Kuta software generated worksheets

21st Century Skills

CRP.K-12.CRP2	Apply appropriate academic and technical skills.
CRP.K-12.CRP4	Communicate clearly and effectively and with reason.
CRP.K-12.CRP6	Demonstrate creativity and innovation.
CRP.K-12.CRP7	Employ valid and reliable research strategies.
CRP.K-12.CRP8	Utilize critical thinking to make sense of problems and persevere in solving them.