Lesson Topic: Theoretical & Experimental Probability  Grade: 7  Subject: Math 7

Student Teacher: Jordan Hunt

Virginia Standards of Learning Objective
- Standard 7.9
- Strand: Probability and Statistics
- Grade Level 7
  - “The student will investigate and describe the difference between the experimental probability and theoretical probability of an event.”

Lesson Objective
- By the end of this lesson, students will be able to define and understand both theoretical probability and experimental probability. Furthermore, students will be able to differentiate between the two types of probability. The student will also understand as the number of trials increases, the experimental probability gets closer to the theoretical probability.
- The students will demonstrate their understanding of this lesson in several ways:
  - Think-pair-share worksheet activity
  - Whole class discussion/experiment
  - Experimenting and recording results with a partner
  - Ticket to leave

Task Analysis
- Essential understandings, knowledge, and skills:
  - Determine the theoretical probability of an event.
  - Determine the experimental probability of an event.
  - Describe changes in the experimental probability as the number of trials increases.
  - Investigate and describe the difference between the probability of an event found through experiment or simulation versus the theoretical probability of that same event.
- Do students know what theoretical probability is?
  - Yes, students should know what theoretical probability is. However, since the students learned theoretical probability and then had to focus on taking benchmarks all week, the pre-assessments for today’s lesson will aim to remind them of what theoretical probability is.
- Do students know what experimental probability is?
  - Yes, students should know what experimental probability. However, again, since students were taught experimental probability before they had to focus on benchmarks, the pre-assessment will serve as a good reminder.
**Key Terms (Teacher Input)**

- **Theoretical Probability**: The expected probability of an event and can be found with a formula. It is the ratio of the number of possible favorable outcomes to the total number of possible outcomes.

- **Experimental Probability**: Determined by carrying out a simulation or experiment. It is the ratio of the number of times a desired outcome occurs to the number of trials in the experiment.

**Sequence of Lesson**

- **Anticipatory Set**:  
  - Today's lesson will start with a warm-up. This warm-up will include questions on finding theoretical and experimental probability. These two topics were covered in previous lessons.  
    - Students will work on the questions independently.  
    - When students are finished, as a class we will discuss the answers.  
  - When this warm-up activity is complete, have students pass their books back and pass out probability worksheet.  
    - This worksheet is quite important to this lesson. The students had a long break in the middle of this probability unit due to benchmarks. It also covers a lot of the types of questions they might be asked in a small amount of time.  
    - To break up the monotony of the worksheet, students will work on this worksheet independently, and then share with their elbow buddies. Instruct students that this is a time for students to work together to answer each other’s questions and to check to make sure answers are correct. As students finish working in pairs (about 5-10 minutes) the teacher should walk around to each pair to see which questions gave students the most difficulty. The questions that most students had difficulty with are the ones the teacher should go over with the whole class.

- **Teacher Input**:  
  - When the warm-up PowerPoint and the practice probability worksheet is complete, we will start talking about comparing theoretical and experimental probability.  
  - Since the students should already understand the concepts of theoretical and experimental probability (especially after the warm-up PowerPoint and practice sheet), we will jump right into comparing the two concepts. This is when we will start using the SmartBoard.
The first slide explains the objectives of today’s lesson.
The second slide has a picture of a spinner and asks what the theoretical probability of spinning the spinner and landing on green would be. Allow students to think about this question before asking for the answer. Students should come up ¼ or 25%.
The third slide starts talking about experimental probability. On this slide, every student will come up to the board to spin the spinner. Therefore, the number of trials will be the number of students in the class (this will be around 23). As the students spin the spinner, the teacher should record a tally mark every time the spinner lands on green. When all students have spun the spinner, the teacher should calculate the experimental probability. Then, the teacher should lead a discussion on how the theoretical probability compares to the experimental probability.
After this discussion, the teacher should ask what the students think would happen if we increased the number of trials. The students should come up with a hypothesis with their elbow buddies. Ask for some ideas before actually increasing the number of trials.
Then, have students come up to the board and spin again. This will double the amount of trials and continue adding to the tally marks. When all students have spun the spinner for a second time, the teacher should again calculate the experimental probability and compare it to the theoretical probability.
Students should come to the realization that as the number of trials in an experiment increases; the experimental probability gets closer to the theoretical probability.
The fourth and fifth slide explain what the students will be doing during independent practice. The fifth slide should be left so students can refer to it throughout the class.

- **Modeling**
  - By using the spinner on the SmartBoard, the teacher is modeling how to compare experimental and theoretical probability.
  - The teacher is also modeling how students will go about conducting their own experiments later in this lesson.
  - Besides modeling how to solve probability questions, the teacher should model how to come up to the board to spin the spinner to ensure that everyone knows
the rules. Also, the teacher should model how to flip a coin, roll the die, and choose a card so students are clear on how to do that as well.

- **Check for Understanding**
  - After the teacher guides and models the experiment on the SmartBoard, the teacher should check for understanding. To do this, the teacher should ask some key questions:
    - What would happen if we increased our number of trials to 100?
    - What would happen if we did a very small amount of trials?
  - Also, the teacher will check for understanding as the pairs complete and hand in their experiment sheets.

- **Guided Practice**
  - Before we start comparing experimental and theoretical probability, students will do a worksheet using a think-pair-share strategy. This will serve as guided practice. Also, the teacher will be guiding and modeling how to compare experimental and theoretical probability using the SmartBoard.
  - Also, as partners finish their experiments, they will turn their materials and sheets into the teacher. The teacher should look over the sheets quickly before handing students their next experiment sheet. If the teacher notices any major problems, the teacher should take the time to work with the students.

- **Independent practice**
  - After the activity involving the use of the SmartBoard, students will work in pairs to complete the activities and questions outlined on the attached worksheets. Students will be responsible for completing the activities with a partner and handing them in as they complete the worksheets. Each pair will have one worksheet per experiment. These experiment sheets will be graded on the basis of effort and completeness.

- **Differentiation**
  - Bodily/Kinesthetic learners will like coming up to the board to spin the spinner. They will also enjoy all of the hands on activities outlined in the worksheets.
  - Auditory learners will most likely learn best from the discussion that is created from the SmartBoard activity. They will also learn from listening to their partners during think-pair-share.
Interpersonal learners will like working with a partner to complete the first worksheet and to complete the multiple activities. Intrapersonal learners will like working on the first worksheet by themselves before getting with a partner.

Visual learners will like using real objects to actually see how probability works.

Logical/mathematical learners will enjoy thinking about questions like what happens if I increase the number of trials and what happens if I decrease the number of trials?

**Closure**

- Students will work on the experiments outlined for them for the rest of class. Students are responsible for completing all three experiment sheets before the end of class.
- Also, before leaving, students should write on a piece of paper what they learned from the activities they did today. This will be considered their “ticket to leave”.
- Next class, we will review student findings in the anticipatory set. Also, the teacher should compile all class data to get a very large number of trials to show how close we get to theoretical probability.

**Assessment**

- The pre-assessment will be the warm-up. The warm-up is a way to see how the students much students remember about theoretical and experimental probability since benchmarks interrupted the unit. Also, the worksheet will give them necessary practice to refresh their memories.
- The formative assessment for this lesson will be when the teacher notes which questions each pair has the most problems with. Also, after the SmartBoard activity, the teacher will check for understanding as a form of formative assessment.
- The summative assessment will be the ticket to leave and also students work and answers to the activities outlined for them during independent practice.

**Materials**

- Warm-up
- Theoretical and experimental probability worksheet
- SmartBoard slideshow, including spinner
- SmartBoard
- 3 experiment sheets
- Dice, coins, decks of cards
• **Technology Integration**
  - The SmartBoard will be used to model and guide how to compare experimental and theoretical probability.
  - Students will be engaged utilizing the interactive spinner from the SmartBoard gallery.

• **Reflection**
**Experiment 1—Dice**

*Counter(s): ____________________ Tallier: ____________________*

1. What is the theoretical probability of rolling a 5?

   **Fraction (simplest form): ____________ Percent: ____________**

2. Now, roll the die 25 times. Tally how many times you roll a 5 below.

3. What is the experimental probability of rolling a 5 when you rolled the die 25 times?

   **Fraction (simplest form): ____________ Percent: ____________**

4. How does the theoretical probability found in question 1 compare to the experimental probability found in question 3? Please write a sentence to answer this question below. (i.e. are the probabilities close?)

5. Now, roll the die 25 more times. Tally how many times you roll a 5 below.

6. Now, what is the experimental probability of rolling a 5 when you rolled the die 50 times? (Hint: Add your tally marks in number 5 to your tally marks in number 2 to find the top of your fraction.)

   **Fraction (simplest form): ____________ Percent: ____________**

7. Now that you have increased the number of trials, is the experimental probability even closer to the theoretical probability that you found in question 1?
EXPERIMENT 2—COINS

Counter(s): ____________________________ Tallier: ____________________________

1. What is the theoretical probability of the coin landing tails up?

Fraction (simplest form): _____________ Percent: _____________

2. Now, flip the coin 30 times. Tally how many times the coin lands tails up.

3. What is the experimental probability of the coin landing tails up when you flipped the coin 30 times?

Fraction (simplest form): _____________ Percent: _____________

4. How does the theoretical probability found in question 1 compare to the experimental probability found in question 3? Please write a sentence to answer this question below. (i.e. are the probabilities close?)

5. Choose the best answer. If you flipped the same coin 300 times, then you should expect that for these 300 flips—

   a. Less than 60 flips will land tails up
   b. Close to 150 flips will land tails up
   c. Between 250 and 300 flips will land tails up
   d. More than 250 flips will land tails up.
EXPERIMENT 3—CARDS

Counter(s): ___________________ Tallier: ___________________

1. Shuffle the cards once or twice and remember, there are 52 cards in a deck and 13 hearts, 13 clubs, 13 spades, and 13 diamonds.

2. What is the theoretical probability of choosing a heart out of the deck of cards?

   Fraction (simplest form): ____________ Percent: ____________

3. Now, fan the cards out and randomly pick a card 40 times. Every time you pick a card, remember to put it back! Tally how many times you choose a heart below.

4. What is the experimental probability of choosing a heart when you randomly chose a card 40 times?

   Fraction (simplest form): ____________ Percent: ____________

5. How does the theoretical probability found in question 2 compare to the experimental probability found in question 4? Please write a sentence to answer this question below. (i.e. are the probabilities close?)

6. If you randomly chose a card 564 times, how many hearts would you expect to choose? (Hint: Proportion!) Show your work and record your answer below.