"RISKY BUSINESS"

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Introduction

Probability is defined as the likelihood of a possible outcome of a given event. A very common example used to illustrate probability is the repeated flipping of a coin. Flipping the coin is the event. How the coin lands is the outcome. Since there are two sides to a coin, there is equal likelihood that any given flip will result in heads or tails. So, the probability of landing a "heads" on any flip is 50%, as is the probability of landing a tails. This is not to say that you are guaranteed an equal number of heads and tails over a few flips, but it is a fact that the more flips you make the closer you will get to having 50% heads and 50% tails.

Many of the decisions we make in daily life require that we have some understanding of probability, even though we might not think about it in those terms. For example, when we choose our clothing in the morning we might consider the likelihood that it was going to rain that day. If the weather report says that there is an 80% chance of precipitation, we know that it is quite likely that it will rain.

Oftentimes, our interest in probability is associated with our need to assess risk. **Risk** is a part of most everything we do. When we cross a street there is the risk that we could be hit by a car. Or, when we eat food there is the risk that it could be contaminated and we'll become ill. Thus, we could look at risk as the **probability** of a **negative outcome** resulting from engaging in an event or activity. However, most activities also have the potential of a positive outcome. For example, if we cross the street safely we arrive at a desired destination (e.g., restaurant, movie theater, school); or if we consume safe food we nourish our bodies and grow. Therefore, once we have identified a risk, it is important to determine whether it is a risk worth taking, or not.

One way to assess risk is to understand the relative probability of all potential outcomes. This knowledge allows us to make informed choices and more reliably predict the results of our behavior. With respect to decisions we make about managing our animals, we have learned that certain practices are more likely to be associated with our animals contracting a disease than others. For instance, allowing your animal to share a transport vehicle with many animals from other farms is associated with a higher probability of **disease transmission** than is transporting single animals in cleaned and sanitized vehicles. Therefore, the practice of mixing animals for transport carries more risk (higher probability) of disease transmission (negative outcome).

When making animal care decisions, it is important to manage risk by weighing the consequences of an activity or event by looking carefully at both the potential benefits and potential drawbacks. An additional strategy when dealing with risk is to look at **mitigation strategies**, which are ways to lower a risk. There is no way to eliminate **disease risk**, but one can mitigate it by taking precautionary actions associated with risk factors over which we have some control. Because **pathogens** that cause diseases are spread in a variety of ways, such as **direct contact**, **indirect contact**, and **airborne transmission**, a variety of **bio-security** measures can be used to reduce the likelihood of exposure.

For the most part, managing risk will also involve consideration of cost. Cost may be measured in terms of money, time, or other resources, and is a measure of what is invested into a particular animal care strategy. When making decisions about animal care practices we must weigh the relative cost of different mitigation strategies with the resulting probabilities of positive and negative outcomes. Thinking about investment, risk, and probability in this manner will allow us to use our resources most effectively to reduce the probability of our animals contracting a disease.

Vocabulary Terms:
Probability: The likelihood of an outcome of an event.
Risk: The probability of a negative outcome of an activity.
Mitigation: Steps one can take to lower risk.
Negative Outcome: Undesirable result of an event or activity.
Pathogens: Disease causing organisms.
Indirect Contact: When an uninfected person or animal touches the contaminated surface (e.g., table top) of an inanimate object (e.g., food dish).
Airborne Transmission: Carried by the air, as pollen or dust.
Direct Contact: Physical contact between an ill person or animal and a healthy person or animal.
Bio-security: Precautions taken to protect from attack or interference due to biological organisms that can cause diseases harming humans and/or animals. (Or, a less formal definition: "Keeping the bad bugs off the farm.")

Activity 1:

Materials List:

- Flip chart paper
- Markers
- Pens/Pencils
- 1 die per group
- Small pieces of notebook paper.
- Wrapped candy (e.g., hard candy, mini candy bars, etc.); 15 pieces/youth
- Scoring Sheet* (Appendix I)
- Probability cards* (Appendix II)

*Materials provided in curriculum.

Time Needed: TBD

Suggested Groupings: Small groups of three youth

Getting Ready:

- Print and cut out the Probability Cards
- Print one score sheet for each group of 3 youth
- Form small groups of three youth each.
- Give each group 1 die
- Give each youth 15 pieces of wrapped candy (hard candy, mini candy bars, etc.)

Opening Questions:

1. Explain what you know about probability. Ask the youth to record their ideas on the flip chart paper provided.
2. Explain what the term risk means to you. Ask the youth to record their ideas on the flip chart paper provided.
3. Provide examples of risks you can think of in your life. Provide examples of what you see as risks when raising 4-H project animals. Ask the youth to record their ideas on the flip chart paper provided.

Experience

Overview

The purpose of this activity is for youth to experience making an investment that involves risk. The youth will play a game with dice. Youth will make investments in Probability Cards that will determine how the game is scored. Each group will roll one die 30 times. Each time a roll results in the number matching a player's Probability Card, they will get a point. The points represent risks. The player with the fewest points at the end of the game will be the winner.

Procedure

1. Each youth will need to 'invest' in a Probability Card to determine how the game is scored.
2. Tell the youth that there are three Probability Cards and that each card represents different levels of risk (low, medium and high), but do not show them the cards.
3. Tell the youth that they will need to decide how much of their candy they would like to invest in their Probability Card.
4. The youth may invest between 1 and 10 pieces of candy in buying a Probability Card. Tell the youth that the person who makes the largest investment will get the card with the highest probability of winning the game. The person who makes the second largest investment will receive the card with the middle probability of winning the game, and the person who makes the smallest investment will get the card with the lowest chance of winning the game.
5. Tell the youth to write their name and their investment amount on the small piece of paper. They should not discuss their investment amount with the others in their group.
6. Review the investments. If there is a tie, ask the youth to increase their bid – auction style. If a tie can't be broken, collect all bids and then randomly assign the cards.
7. Collect the candy investments and put them in the "bank". Hand out the Probability Cards according to the youth's bids.
8. Hand out the Scoring Sheet (one per group). Tell the youth to identify their scoring column on the sheet.
9. Commence rolling of die. The youth take turns rolling dice. Make sure that each youth marks an X on their score sheet for each roll that matches their assigned number(s). For example, for roll 1, if the number showing is a 5, then the person who has the Probability Card with 5 on it would mark an X row 1 of their column. At the end of 30 rolls, have the youth tally up their points.
10. Tell the youth the results of the game:
    a. The person with the most points gives all their remaining candy to the bank. They keep no candy.
    b. The person with the fewest points keeps the candy they have remaining **and** gets all the candy in the bank.
    c. The person with the middle amount of points keeps the candy they have remaining.

*Collect candy at the end of Activity 1 and use it again for Activity 2. You may let the youth keep their candy after Activity 2.

Share, Process, Generalize

Follow the lines of thinking that have been developed by the youth through their explorations and sharing of their observations and comparisons. Specific questions/prompts might include:

1. Explain how the outcome of this is game similar or different from what you expected. Ask the youth to record their ideas on the flip chart paper provided.
2. Explain how it made you feel to make an investment without knowing what was on the cards. Ask the youth to record their ideas on the flip chart paper provided.

3. Discuss the type of information that would have made it easier for you to make a smart investment. Ask the youth to record their ideas on the flip chart paper provided.

Volunteer Tip: Ask youth to present their thoughts and ideas to the other youth. Discuss similarities and differences.

Activity 2:

Materials List:

- Flip chart paper
- Markers
- Pens/Pencils
- 3 dice per group
- Small pieces of notebook paper.
- Wrapped candy (e.g., hard candy, mini candy bars, etc.); 15 pieces/youth
- *Scoring sheet (Appendix III)
- *Probability Charts (Appendix IV)

Time Needed: TBD

Suggested Groupings: Small groups of six youth

Getting Ready:

- Print one Scoring Sheet and one set of Probability Charts for each group
- Form small groups of 6 youth
- Give each group 3 dice.
- Give each youth a small piece of paper and pencil.

Overview:

In Activity 2, the youth will again roll dice to determine the outcome. They will also make investments that will determine their probability of winning the game. However, youth will now have the opportunity to compare the different probabilities for each option before they make their investment.

1. Hand out the Probability Charts (Appendix IV) and give the youth a few minutes to look them over. Each Probability Chart shows the chances of scoring a point on each roll.
2. Tell the youth that they will need to decide how much of their candy they would like to invest in buying a card. Each card represents one of the Probability Charts.
3. The youth may invest between 1 and 10 pieces of candy in buying a Probability Chart.
4. Remind the youth that the card with the lowest probability of scoring points will be most likely to win the game.
5. Ask the youth to write their investment down on a small piece of paper with their name. They should not discuss their investment choice with the others in their group.
6. Review the investments. If there is a tie, ask the youth to increase their investment– auction style. If a tie can't be broken, collect all bids and then randomly assign the cards.
7. Collect the bids and put them in the "bank". Hand out the cards according to the order of the youths' investments (see chart below).
8. Make sure that each youth understands the circumstances under which they will score a point (see diagrams on left of Probability Charts).
9. Commence rolling of die. Within each group, the two youth with 1 Die options will take turns rolling. The two youth with 2 dice options will take turns rolling and the two youth with 3 dice options will take turns

rolling. All pairs of youth should roll 30 times in total. Youth should record each matching roll as a point on their recording sheet.

Volunteer Tip: There are two options for scoring sheets for this activity. All 6 youth in a group may use the same scoring sheet (Appendix III Option 1) or the pairs of youth (1 Die, 2 Dice, 3Dice) can each work on a separate score sheet (Appendix III Option 2). Please note that the scoring of the game this round is for all 6 youth.

10. Tally up the scores and compare the results for all 6 youth in each group.
    a. The top two scorers will give all their remaining candy to the bank.
    b. The lowest two scorers will keep all their remaining candy **and** split all the candy from the bank.
    c. The middle two scorers will keep their remaining candy.

Reference for 4-H volunteers:

# of Dice	Sum of all Dice	Probability	Investment Order
3	3	0.46%	1 (highest investment)
3	6	5%	2
2	3	6%	3
2	6	14%	4
1	3	17%	5 or 6 (Lowest 2 investments)
1	6	17%	

Share, Process, Generalize

Follow the lines of thinking that have been developed by the youth through their explorations and sharing of their observations and comparisons. Specific questions/prompts that volunteers might present to the youth include:

1. Explain the strategy you used in making your bid. Ask the youth to record their ideas on the flip chart paper provided.
2. Explain how the outcome of this game is similar or different from what you expected. Ask the youth to record their ideas on the flip chart paper provided.
3. Explain what types of risks you have when raising a 4-H project animal. Ask the youth to record their ideas on the flip chart paper provided.
4. How, if at all, might you relate what you've done in this game to bio-security with your 4-H project animal? Ask the youth to record their ideas on the flip chart paper provided.

Concept and Term Introduction/Discovery

Volunteer Tip: The goal is to have the youth develop an understanding of the concepts through their exploration and define the terms using their own words.

Concept Application

The "Bio Security and Financial Risk" activity is recommended as the application component for this activity.

Appendix I Score Sheet for Activity 1

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Roll #	Roll 1	Roll 2 or 4	Roll 3, 5, or 6

Appendix II
Probability Cards for Activity 1: Each group needs **one** set of 3 cards.

Highest Investment Probability Card

1

Score a point when this number is rolled

Highest Investment Probability Card

1

Score a point when this number is rolled

Middle Investment Probability Card

2 or 4

Score a point when either number is rolled

Middle Investment Probability Card

2 or 4

Score a point when either number is rolled

Lowest Investment Probability Card

3, 5 or 6

Score a point when any of these numbers is rolled

Lowest Investment Probability Card

3, 5 or 6

Score a point when any of these numbers is rolled

Appendix III (Option 1) Scoring Sheet for Activity 2

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Roll #	Roll 3 with One Die	Roll 3 with Two Dice	Roll 3 with Three Dice	Roll 6 with One Die	Roll 6 with Two Dice	Roll 6 with Three Dice

Appendix III (Option 2)
Score Sheet for Rolling with 1 Die

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Roll #	Roll 3 with One Die	Roll 6 with One Die

Appendix III (Option 2)
Score Sheet for Rolling with 2 Dice

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1		
Roll #	Roll 3 with Two Dice	Roll 6 with Two Dice

Appendix III (Option 2)
Score Sheet for Rolling with 3 Dice

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Roll #	Roll 3 with Three Dice	Roll 6 with Three Dice