Ne‘epapa Ka Hana 2.0
Seventh-Grade Mathematics Resources
STEMD² Book Series

STUDENT ACTIVITIES

LET'S TAKE CARE OF THE LO‘I

STEMD² Research & Development Group
University of Hawai‘i at Manoa

STEMD^2 Research & Development Group
Center on Disability Studies
College of Education
University of Hawai'i at Mānoa

http://stemd2.com/

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Ne‘epapa Ka Hana Seventh-Grade Mathematics Resources

Let’s Take Care of the Lo‘i

Student Activities

Project Director — Kaveh Abhari

Content Developers — Robert G. Young, Justin S. Toyofuku

Creative Designer — MyLan Tran

Publication Designer — Robert G. Young

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Unit 6: Probability

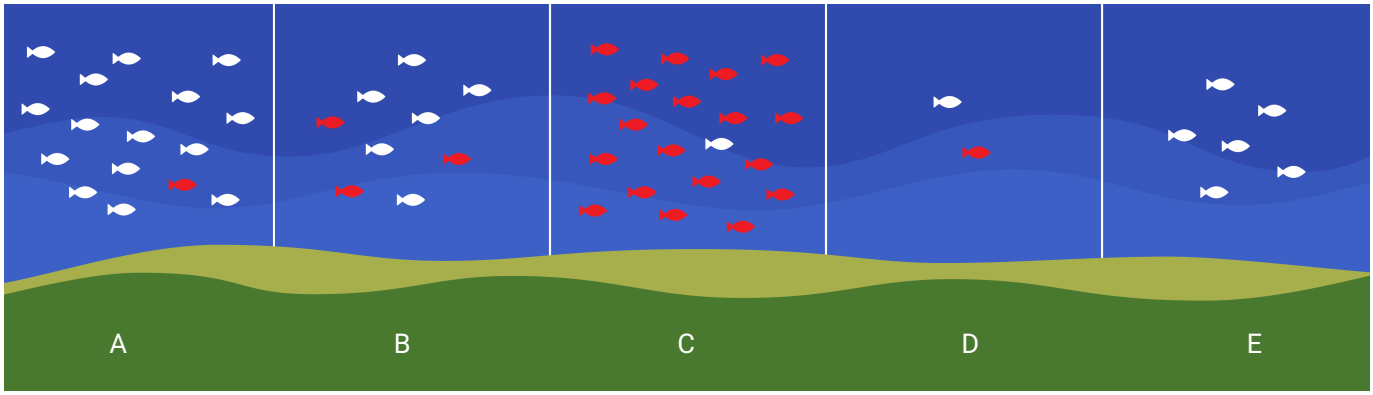
In this unit, we'll learn how to use probability to make predictions and study random events through exploration of the traditional Hawaiian drink, ʻawa, cultivating kalo, and making a plate lunch. There are four activities in this unit. *Module 12* involves experimental probability by tossing a slipper. *Module 13* evaluates true kava from false kava with the use of theoretical probability and simulations. There are two cumulative activities in this unit. Each of the cumulative activities incorporate concepts from each of the previous activities in this unit.

For some of the activities in this unit, students will need a slipper or a flip-flop.

Module 12: Experimental Probability *Activity*

In this activity, you will need a slipper or a flip-flop.

Let's take a look at the fishing spots, A, B, C, D, and E. At these spots, there are white fish and there are red fish.



Fishing spots

1. Look at the picture above and match each fishing spot with the probability of a red fish being caught. Use a line to connect each fishing spot with one item on the column to the right that best matches that fishing spot. There will be extra ones on the right that do not match with anything.

Fishing spot	Probability that a caught fish would be red
A	• Less than 0
	• Exactly 0
B	• A little more than 0
	• Between 0 and $1/2$
C	• Close to or equal to $1/2$
	• Between $1/2$ and 1
D	• A little less than 1
	• Exactly 1
E	• More than 1

You want to catch red fish, so you go to the spot that gives you the best chance of catching red fish. However, another fisherman arrives at the same time. To be fair, you decide to flip a coin to see who will get to stay at the spot. But... neither one of you have any coins, so you decide to flip something else. What about a slipper?!

Top up

Bottom up

2. Let's get a slipper and toss it gently in the air twice. Be sure to toss the same slipper two times and not a pair of slippers one time. Then, we will note whether it lands with its top up both times, top then bottom, bottom then top, or bottom up both times. Do this 24 times. Use the table below or one like it to create a frequency chart.

		First toss: Top up	First toss: Bottom up
Second toss	Top up		
	Bottom up		

3. Did each of the possible events occur the same number of times? Why or why not?

4. Use your data to calculate the experimental probabilities of each of the four possible events. Write your results as a simplified fraction.

   (a) Top up both times

   (b) Top up first then bottom up

   (c) Bottom up first then top up

   (d) Bottom up both times

5. If you were to do this experiment a total of 1200 times, based on your results in part 4, about how many times do you expect "top up both times" as a result? Please show your work.

There are several ways to use your slipper to decide who "wins" the fishing spot.

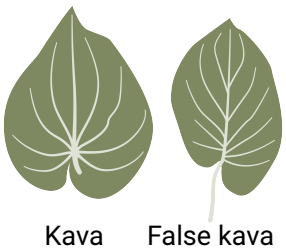
6. If you wanted to make this as **fair** as possible, which of these contests should you choose and why? How do the results of your experiment show that this choice is more fair? (Circle your choice then explain.)
   (a) **Both top up** versus **both bottom up**, otherwise, try again.
   (b) **Top up then bottom up** versus **bottom up then top up**, otherwise, try again.

7. If you wanted to make this as **unfair** as possible, which of these contests should you choose and why? How do the results of your experiment show that this choice is less fair? (Circle your choice then explain.)
   (a) **Both top up** versus **both bottom up**, otherwise, try again.
   (b) **Top up then bottom up** versus **bottom up then top up**, otherwise, try again.

8. Play the **unfair** game from part 7 with a partner. Did you end up having an advantage? Was it a small advantage or a large one?

Module 13: Theoretical Probability and Simulations *Activity*

Kava is an important plant in Polynesia. Originally from Marquesas Islands and Tonga, kava means “bitter” and is also known as ‘awa in Hawai‘i and ‘ava in Samoa. The root can be chewed or ground up and pounded into a saucy texture. After that, the root is mixed with cold water or other ingredients. Kava can be consumed as part of a meal, used as medicine, or as an important part of a ceremony.

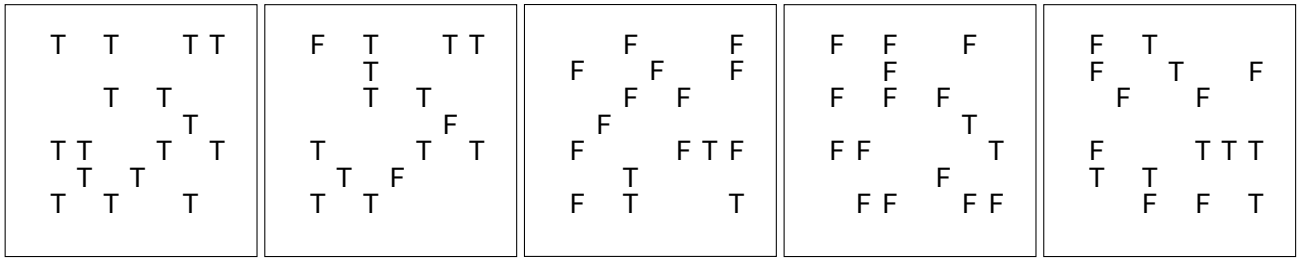


Kava False kava

Unfortunately, there is another plant that looks like kava but that doesn’t act like it. This impostor, called the false kava, does not have any of the medical properties of real kava, and it grows much more aggressively. The false kava will spread twice as fast as real kava, covering other plants and taking over entire areas.

Two (2) nature experts and ten (10) student volunteers decide to hike through Nāhiku on Maui to pull out the false kava. However, there are some true kava, and although the experts can easily tell them apart, the volunteers can’t.

The experts have found five (5) areas where kava is growing. Here is a rough map of where the true kava (labeled “T”) and the false kava (labeled “F”) are in each area. Each area had 16 total plants.



Area A Area B Area C Area D Area E

1. For each area, if you were to pull a plant by random, what is the probably that it would be a false kava? Give your answer as a number between 0 and 1. It is okay to give your answer as a simplified fraction.

   (a) Area A

   (b) Area B

   (c) Area C

   (d) Area D

   (e) Area E

2. Suppose a volunteer randomly picks a plant area to pull plants.
   (a) What is the probability of choosing an area (A, B, C, D, or E) that has false kava?

   (b) What is the probability of choosing an area (A, B, C, D, or E) that does not have any false kava?

   (c) What is the probability of choosing Area C and pulling a false kava?

The twelve people will split up and work in different areas at the same time. They want to pull out the false kava while leaving as much of the true kava as possible.

- As we mentioned before, there were two experts who can tell the plants apart and ten volunteers who cannot.
- If an area has at least one expert, they will guide everyone who is with them. All of the false kava will be correctly pulled out, leaving the true kava to thrive.
- If an area only has student volunteers, they will randomly pull out plants since they can't tell the difference between the true and the false kava.

3. How would you distribute the experts and volunteers to each area? Explain your reasoning. The experts and volunteers do not have to be distributed evenly among the areas.
   (a) Area A

   (b) Area B

   (c) Area C

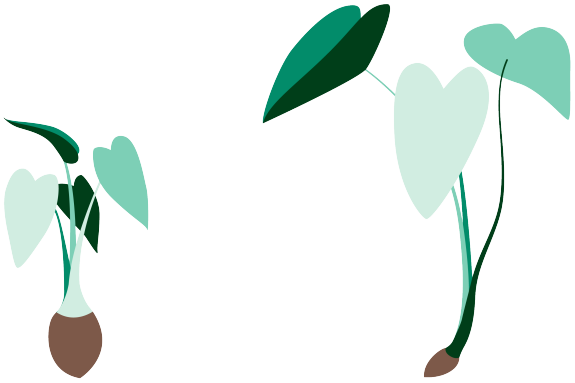
   (d) Area D

   (e) Area E

Unit 6: *Cumulative Activity 1*

Kalo is one of the most important crops the Native Hawaiian people cultivated. In modern times, we make kalo into bread, chips, and even mochi. Traditionally, kalo is pounded into poi, but not all kalo varieties can be used in this process. Only wetland kalo and a few varieties of upland kalo can be made into poi. The difference between wetland and upland kalo is that wetland kalo is grown underwater in a loʻi and upland kalo isn't. There have been over 300 different kalo named in Hawaiʻi; about half of which is believed to be the same species, just with a different name.

Two important upland kalo are the piko ulaula and the iliuaua. The piko ulaula is great for making poi, and the leaves of the iliuaua are great for laulau.



Piko ulaula Iliuaua

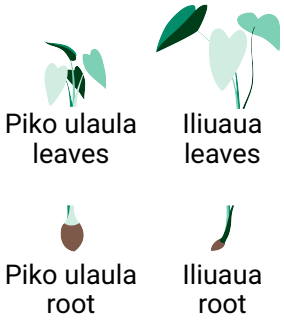
You have to gather a lot of kalo for an upcoming party, so you ask your neighbors for donations. Your neighbors grow a mix of piko ulaula and iliuaua, which they randomly choose to give you.

Neighbor A: 30% of the kalo in this loʻi are piko ulaula.
Neighbor B: 60% of the kalo in this loʻi are iliuaua.
Neighbor C: $1/3$ of the kalo in this loʻi are piko ulaula.
Neighbor D: There are 3 iliuaua for every 1 piko ulaula in this loʻi.

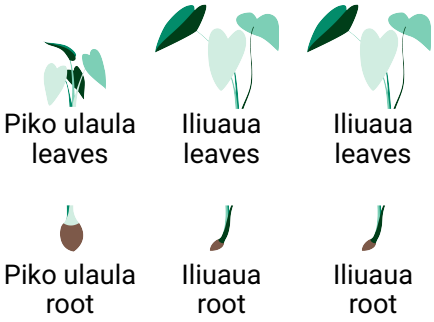
1. Order your neighbors from least likely to most likely to give you a piko ulaula. Show your work and explain.

2. Your neighbors are not giving you the whole kalo plant because they need parts of it to grow more kalo. After randomly choosing a kalo (piko ulaula or iliuaua), they will cut it and randomly give you either the leaves or the main root. This means that you will either get piko ulaula leaves, piko ulaula roots, iliuaua leaves, or iliuaua roots.

   Explain why the model on the right is a more useful model than the one on the left for representing the kalo that make up **Neighbor C**'s loʻi.



Model



Better model

3. Make a similar model to represent the kalo in **Neighbor D**'s loʻi.

4. The roots of piko ulaula are great for making poi. What is the probability that **Neighbor D** will give you the root of a piko ulaula?

5. The leaves of iliuaua are great for laulau. What is the probability that **Neighbor D** will give you the leaves of a iliuaua?

6. If you receive 64 kalo parts from **Neighbor D**, how many of them do you expect to be the leaves of piko ulaula or the roots of iliuaua? Show your work.

7. With a partner or in the online comment section, make a hypothesis about why one type of kalo is better for poi and the other type is better for laulau.

Unit 6: *Cumulative Activity 2*

In this activity, you will need a six-sided die and a coin.

We are at a lūʻau and making ourselves a plate lunch. Let's grab a protein, a plant starch, and a drink.

Proteins	Starches	Drinks
Iʻa (fish)	Poi (taro)	Coconut water
Moa (chicken)	ʻUala (sweet potato)	Māmaki tea
Puaʻa (pork)	ʻUlu (breadfruit)	

Plate lunch

Let's look at the different kinds of plate lunches that can be made with this menu.

1. Part 1: On the next page, complete the first part of the table by writing all of the possible menu combinations that are missing.
2. Part 2: Let's do an experiment to see what happens when we have to choose our menu randomly.
   (a) Roll a die two times and flip a coin to see which menu combination you would get.

First roll	Protein
1 or 2	Iʻa
3 or 4	Moa
5 or 6	Puaʻa

Second roll	Starch
1 or 2	Poi
3 or 4	ʻUala
5 or 6	ʻUlu

Coin flip	Drink
Heads	Coconut water
Tails	Māmaki tea

   For example, if you roll and flipped a 3, 6, and tails, then you get a moa-ʻulu-māmaki tea combination.

   (b) On the next page, complete the second part of the table by adding a tally for each meal combination that you got in your experiment.

   (c) Repeat until you've gotten 36 meals.

Part 1: Menu combinations			Part 2: Random choices
Proteins	Starches	Drinks	Frequency
Iʻa	Poi	Coconut water	
Iʻa	Poi	Māmaki tea	
Iʻa		Coconut water	
Iʻa	ʻUala		
Iʻa	ʻUlu	Coconut water	
Iʻa		Māmaki tea	
Moa	Poi	Coconut water	
Moa			
Moa	ʻUala	Coconut water	
Moa	ʻUala	Māmaki tea	
		Coconut water	
Moa	ʻUlu	Māmaki tea	
Puaʻa	Poi	Coconut water	
Puaʻa	Poi	Māmaki tea	
Puaʻa	ʻUala	Coconut water	
Puaʻa	ʻUlu	Coconut water	
Puaʻa	ʻUlu	Māmaki tea	

Key for Part 2:

First roll	Protein
1 or 2	Iʻa
3 or 4	Moa
5 or 6	Puaʻa

Second roll	Starch
1 or 2	Poi
3 or 4	ʻUala
5 or 6	ʻUlu

Coin flip	Drink
Heads	Coconut water
Tails	Māmaki tea

Use the table to answer the questions on the following page.

3. How many menu combinations are possible?

4. Let's look at the pua'a-'uala-coconut water combination.
   (a) Out of 36 tries, what is the **theoretical** probability that someone would get this menu combination?

   (b) Based on your results, what is the **experimental** probability that someone would get this menu combination?

5. Let's look at the menu combinations that have pua'a as the protein.
   (a) Out of 36 tries, what is the **theoretical** probability that someone would get this menu combination?

   (b) Based on your results, what is the **experimental** probability that someone would get this menu combination?

6. Let's look at the menu combinations that have māmaki tea as the drink.
   (a) Out of 36 tries, what is the **theoretical** probability that someone would get māmaki tea as their drink?

   (b) How many times did these combinations actually appear in your experiment?

7. How well does the results from your experiment match with the **theoretical** probabilities? Explain why your results did or did not match.

8. Which of the menu combinations would you prefer? Share with a partner or in the online comment section.