Lesson 2.1.3: Conditional Relative Frequencies and Association

Targets:
1. I can calculate and interpret conditional relative frequencies from two-way frequency tables.
2. I can use conditional relative frequencies to determine whether there is association between two variables.

Warm Up: Introduction

After further discussion, the students involved in designing the superhero comic strip decided that before any decision is made, a more careful look at the data on the special powers a superhero character could possess was needed. There is an association between gender and superpower response if the superpower responses of males are not the same as the superpower responses of females. Examining each row of the table can help determine whether or not there is an association.

Recall the two-way table from the previous lesson

	To Fly	Freeze Time	Invisibility	Super Strength	Telepathy	Total
Females	49	60	48	1	70	228
Males	51	71	27	25	48	222
Total	100	131	75	26	118	450

A *conditional relative frequency* compares a frequency count to the marginal total that represents the condition of interest. For example, the condition of interest in the first row is females. The row conditional relative frequency of females responding "invisibility" as the favorite superpower is $\frac{48}{228}$, or approximately 0.211. This conditional relative frequency indicates that approximately 21.1% of females prefer "invisibility" as their favorite superpower. Similarly, $\frac{27}{222}$, or approximately 0.122 or 12.2%, of males prefer "invisibility" as their favorite superpower.

Practice 1

1. Use the frequency counts from the table in Exploratory Challenge 1 to calculate the missing row of conditional relative frequencies. Round the answers to the nearest thousandth.

	To Fly	Freeze Time	Invisibility	Super Strength	Telepathy	Total
Females			$\frac{48}{228} \approx 0.211$			
Males	$\frac{51}{222} \approx 0.230$					$\frac{222}{222} = 1.000$
Total						

Practice 2

1. Suppose that a student is selected at random from those who completed the survey. What do you think is the gender of the student selected? What would you predict for this student's response to the superpower question?

2. Suppose that a student is selected at random from those who completed the survey. If the selected student is male, what do you think was his response to the selection of a favorite superpower? Explain your answer.

3. Suppose that a student is selected at random from those who completed the survey. If the selected student is female, what do you think was her response to the selection of a favorite superpower? Explain your answer.

4. What superpower was selected by approximately one-third of the females? What superpower was selected by approximately one-third of the males? How did you determine each answer from the conditional relative frequency table?

Association: Are the variables Associated?

Two categorical variables are associated if the row conditional relative frequencies (or column relative frequencies) are different for the other rows (or columns) of the table. For example, if the selection of superpowers selected for females is different than the selection of superpowers for males, then gender and superpower favorites are associated. This difference indicates that knowing the gender of a person in the sample indicates something about their superpower preference.

The evidence of an association is strongest when the conditional relative frequencies are quite different. If the conditional relative frequencies are nearly equal for all categories, then there is probably not an association between variables.

Practice 3

Examine the conditional relative frequencies in the two-way table of conditional relative frequencies you created in earlier. Note that for each superpower, the conditional relative frequencies are different for females and males.

1. For what superpowers would you say that the conditional relative frequencies for females and males are very different?

2. For what superpowers are the conditional relative frequencies nearly equal for males and females?

3. Suppose a student is selected at random from the students who completed the survey. If you had to predict which superpower this student selected, would it be helpful to know the student's gender? Explain your answer.

4. Is there evidence of an association between gender and a favorite superpower? Explain why or why not.

5. What superpower would you recommend the students at Rufus King High School select for their superhero character? Justify your choice.

Exit Ticket

Juniors and seniors were asked if they plan to attend college immediately after graduation, seek full-time employment, or choose some other option. A random sample of 100 students was selected from those who completed the survey. Scott started to calculate the row conditional relative frequencies to the nearest thousandth.

	Plan to Attend College	Plan to Seek Full-Time Employment	Other Options	Totals
Seniors	$\frac{25}{55} \approx 0.455$	$\frac{10}{55} \approx 0.182$	$\frac{20}{—} \approx ???$	$\frac{55}{55} = 1.000$
Juniors	$\frac{35}{—} \approx ???$	$\frac{5}{—} \approx ???$	$\frac{5}{45} \approx 0.111$	$\frac{45}{45} = 1.000$
Totals	$\frac{60}{100} = 0.600$	$\frac{15}{100} = 0.150$	$\frac{25}{100} = 0.250$	$\frac{100}{100} = 1.000$

1. Complete the calculations of the row conditional relative frequencies. Round your answers to the nearest thousandth.

2. Are the row conditional relative frequencies for juniors and seniors similar, or are they very different?

3. Do you think there is a possible association between grade level (junior or senior) and after high school plans? Explain your answer.