**LEARNING OBJECTIVE:** We will use row relative frequencies and column relative frequencies to determine if there is an association between two categorical variables. (Lesson 66)

*relationship*

**CONCEPT DEVELOPMENT:**

| ASSOCIATION BETWEEN TWO CATEGORICAL VARIABLES | |
|---|---|
| **NO ASSOCIATION** | **ASSOCIATION** |
| This means that knowing the value of one variable **provides no** information about the value of the other variable. | Knowing the value if one variable **will provide** information about the value of the other variable. |
| If **row relative frequencies** (or column relative frequencies) are about the same for all of the rows (or columns), it is reasonable to say there is no association between the two variables. | If the **row relative frequencies** (or column relative frequencies) are quite different for some of the rows (or columns), it is reasonable to say there is an association between the two variables. |
| *Example: Smartphone Use and Gender* | *Example: Smartphone Use and Age* |

| | Use Smart phone | Do not Use Smart phone | Total |
|---|---|---|---|
| **Male** | 30  .75 | 10  .25 | **40**  1.00 |
| **Female** | 45  .75 | 15  .25 | **60**  1.00 |
| **Total** | **75**  .75 | **25**  .25 | **100** |

$\frac{3}{4}$ of all surveyed use smartphones
$\frac{3}{4}$ of all males   "    "
$\frac{3}{4}$ of all females "    "    //

No Association

| | Use Smart phone | Do not Use Smart phone | Total |
|---|---|---|---|
| **Under 40 years of age** | 45  .90 | 5  .10 | **50** |
| **40 years of age or older** | 30  .60 | 20  .40 | **50** |
| **Total** | **75**  .75 | **25**  .25 | **100** |

People who are under 40 tend to use smartphones more than 40+ year olds

## Guided Practice:

Steps for Determining Whether or Not There is an Association
1. Calculate Row Relative Frequencies and Column Relative Frequencies.
2. Observe the row relative frequencies for each row. If they are similar, there is no association.
3. If there are differences, state the association.

**Below is the data collected from our survey that captures gender and our favorite sport to WATCH.**

| | Baseball | Basketball | Football | Hockey | Soccer | Grand Total |
|---|---|---|---|---|---|---|
| Female | 10 | 8 | 7 | 3 | 12 | 40 |
| Male | 12 | 9 | 8 | 4 | 14 | 47 |
| Grand Total | 22 | 17 | 15 | 7 | 26 | 87 |

.25 .20 .17 .08 .30

1. Fill in the table below with the **row relative frequencies** of each sport watched for the male row and the female row.

| | Baseball | Basketball | Football | Hockey | Soccer | Grand Total |
|---|---|---|---|---|---|---|
| Female | .25 | .20 | .18 | .08 | .30 | 1.00 |
| Male | .26 | .19 | .17 | .09 | .30 | 1.00 |

2. Is there an association between gender and the type of sports we like to watch? Explain. No association. Row relative frequencies are even. The same proportion of boys & girls like to watch each sport.

3. Fill in the table below with the **column relative frequencies** of each gender for the columns related to sports we watch.

| | Baseball | Basketball | Football | Hockey | Soccer |
|---|---|---|---|---|---|
| Female | | | | | |
| Male | | | | | |
| Grand Total | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |

4. Is there an association between the type of sports we like to watch and our gender? Explain.

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Mr. Rogove                                      Date:_____

Below is data collected from our survey capturing gender and movie preference.

1. Fill in the table below that summarizes the data.
- There were 47 boys surveyed and 87 people total
- 18 girls liked comedies
- 27 students overall liked action movies
- 5 students overall liked dramas
- 18 boys liked action movies
- 1 boy liked dramas
- 33 students overall liked comedies

| | Movie Preference | | | | |
|---|---|---|---|---|---|
| | **Action** | **Comedy** | **Drama** | **Science Fiction** | **TOTAL** |
| **Male** | | | | | |
| **Female** | | | | | |
| **TOTAL** | | | | | |

2. If there were NO association between gender and movie preference, would you expect more boys than girls to like dramas or less boys than girls to like drama movies?  Explain.

3. Fill in the table below with **row relative frequencies** of each movie preference for both genders.

| | Movie Preference | | | | |
|---|---|---|---|---|---|
| | **Action** | **Comedy** | **Drama** | **Science Fiction** | **TOTAL** |
| **Male** | | | | | |
| **Female** | | | | | |

4. If you were to select a student at random, what movie type would you think they prefer?  Explain why you made this choice.

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5. If you found out that the randomly selected student is male, would you predict that they preferred comedies? Why or why not?

6. Does knowing the gender of a student help you make predict what type of movie they will like?

7. Fill in the table below with the **column relative frequencies** of each gender for the movie preferences.

| | Movie Preference | | | |
|---|---|---|---|---|
| | **Action** | **Comedy** | **Drama** | **Science Fiction** |
| **Male** | | | | |
| **Female** | | | | |
| **TOTAL** | | | | |

8. If you were to select a student at random would you expect them to be a boy or a girl?  Explain your answer.

9. If you were told that the randomly selected student preferred to watch dramas, would you think they were a boy?

10. Is there an association between the movies we like and our gender?

## Independent Practice:

Our survey also looked at the amount of sleep and how students got to school.
Below is the data presented in a two way table.

| | | Amount of Sleep | | | |
|---|---|---|---|---|---|
| | | Less than 6 hours | Between 6 and 8 hours | More than 8 hours | **Total** |
| **Mode of transportation** | Bike | 0 | 9 | 12 | **21** |
| | Walk | 0 | 9 | 9 | **18** |
| | In car/ scooter | 3 | 20 | 25 | **48** |
| | **Total** | **3** | **38** | **46** | **87** |

1. If there was no association between how students get to school and the amount of sleep they get each night, would you expect that more bike riders get over hours of sleep or less than 8 hours of sleep? Explain your answer.

2. Draw a row relative frequency table of each of the nightly sleep amounts for the specific modes of transportation.

| | | Amount of Sleep | | | |
|---|---|---|---|---|---|
| | | Less than 6 hours | Between 6 and 8 hours | More than 8 hours | **Total** |
| **Mode of transportation** | Bike | | | | |
| | Walk | | | | |
| | In car/ scooter | | | | |

3. Do these data suggest an association between the amount of sleep students get and how they get to school? Explain your answers.

## Activating Prior Knowledge:

A pregnant woman will often undergo an ultrasound test to monitor her baby's health. These tests can also be used to predict the gender of the baby, but it's not always 100% accurate. Below, data on gender predicted by ultrasound and actual gender of the baby for 1,000 babies is summarized below.

|  |  | Predicted Gender | |  |
|---|---|---|---|---|
|  |  | **Female** | **Male** |  |
| **Actual Gender** | **Female** | 432 | 48 | 480 |
|  | **Male** | 130 | 390 | 520 |
|  |  | 562 | 438 |  |

1. What is the proportion of the 1,000 babies who were predicted to be female but were actually male?   $\approx .13$   $.23$   $\dfrac{130}{562} = .23$

2. For the babies predicted to be female, what proportion of the predictions were correct?

3. For the babies predicted to be male, what proportion of the predictions were incorrect?

## Closure:

Give exit Ticket from Lesson 14? (can be page 5 of the lesson handout)

**Notes:** This is lesson 14 from Module 6 Grade 8