ENHANCING STATISTICS TEACHER EDUCATION WITH E-MODULES

Granola Graphs Galore: Exploring Categorical Data with Dynamic Statistical Tools

Connect to Internet: NCTM NCTM2019

Rick Hudson[1], Stephanie Casey[2], Hollylynne Lee[3]

University of Southern Indiana[1], Eastern Michigan University[2], NC State University[3]

April 4, 2019 NCTM San Diego, CA

NC STATE UNIVERSITY · EASTERN MICHIGAN UNIVERSITY · UNIVERSITY OF SOUTHERN INDIANA · The Concord Consortium · NSF

Workshop Goals

In this workshop, we will...

- introduce approaches to statistics tasks that promote statistical reasoning;
- learn about representations of bivariate categorical data;
- investigate nutrition of granola bars by examining association and independence of bivariate categorical data using the Common Online Data Analysis Platform (CODAP),
- investigate common conceptions that students have about bivariate categorical data by viewing video of students' statistical reasoning.

Statistical Investigation Cycle

Statistical Habits of Mind

Key Elements of Productive Statistics Tasks

Real Data with Engaging Contexts

- Need a launch to connect students with context
- Collected by students or curated by teacher

Larger, sometimes messy, Data (more cases and/or attributes, missing values, nonsensical values, need for recoding)

Opportunities to explore data to ask questions (notice and wonder)

Using technology with multiple ways to represent data

Emphasize sense-making of distributions and statistical measures

Interpret results, support claims, connect to context

Categorical Data in the Standards

CCSS.Math.Content.8.SP.A.4

Understand that patterns of association can also be seen in bivariate categorical data by **displaying frequencies and relative frequencies** in a two-way table. Construct and interpret a two-way table summarizing data on two categorical variables collected from the same subjects. Use relative frequencies calculated for rows or columns to **describe possible association between the two variables**.

CCSS.Math.Content.HSS.ID.B.5

Summarize categorical data for two categories in two-way frequency tables. **Interpret relative frequencies** in the context of the data **(including joint, marginal, and conditional relative frequencies)**. **Recognize possible associations** and trends in the data.

CODAP

https://codap.concord.org

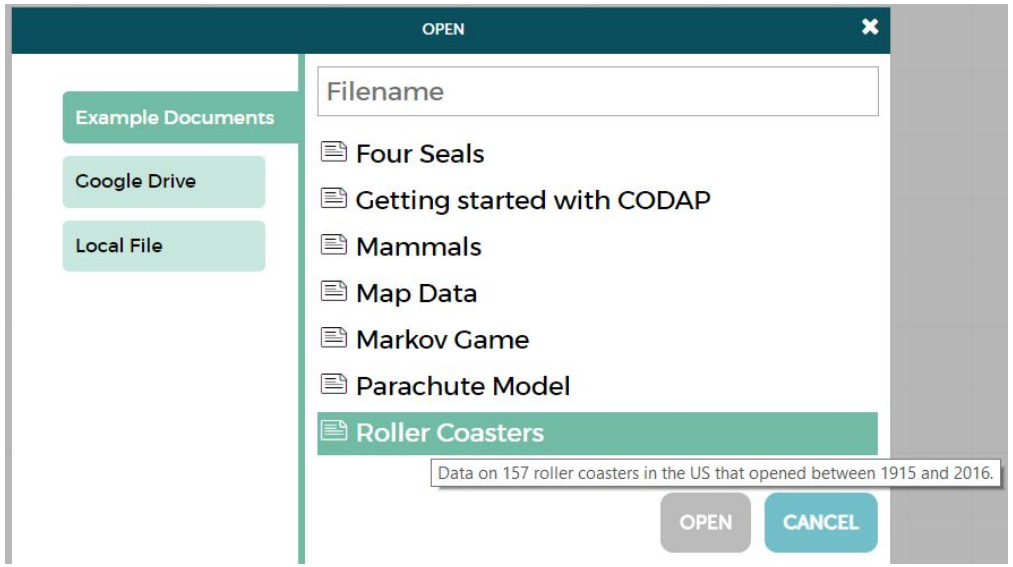
Common
Online
Data
Analysis
Platform

CODAP is supported on Firefox 46+, Chrome 50+, Windows Edge 14+, and Safari 10+. CODAP is not actively supported on other browsers at this time.

Getting to Know CODAP

https://codap.concord.org

- Codap.concord.org
- Click Try Codap in upper right
- Choose Open Document or Browse Examples
- Choose Roller Coasters

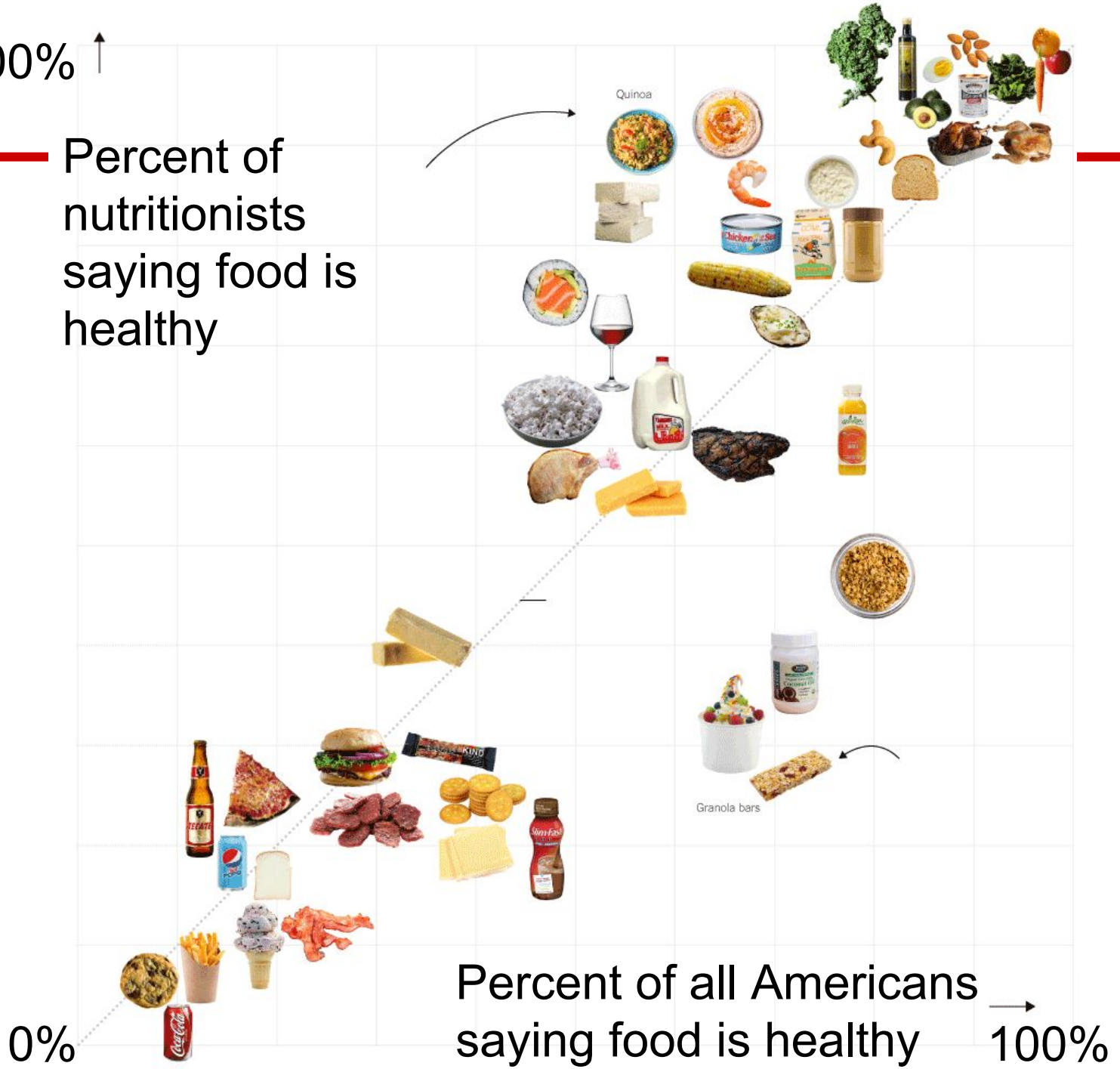


Investigating Granola Bars

Analyzing Categorical Data in CODAP

What do you notice?

What do you wonder?



Finding

Among all the foods surveyed, the greatest difference was observed for granola bars. Although 71% of the public thought of granola bars as “healthy,” only 28% of nutritionists agreed.

New York Times, 2016

What attributes do you care about when you eat granola bars?

What attributes of granola bars might a nutritionist care about to determine whether a granola bar is 'healthy?’

Granola Bars in CODAP

A New Investigation: Granola Bars

Open http://tinyurl.com/granolabardata in a web browser.

What attributes are included in this data set?

Work with a partner to answer question #1 on the handout about granola bars.

Question 1

a. 43% of the chewy granola bars have nuts.

b. 18% of the granola bars are crunchy and do not have nuts.

c. 30% of the granola bars are crunchy.

Question 1

a. 43% of the chewy granola bars have nuts.

Conditional Relative Frequency (CODAP row or column percents)

b. 18% of the granola bars are crunchy and do not have nuts.

Joint Relative Frequency (CODAP cell percent)

c. 30% of the granola bars are crunchy.

Marginal Relative Frequency

Segmented Bar Graph

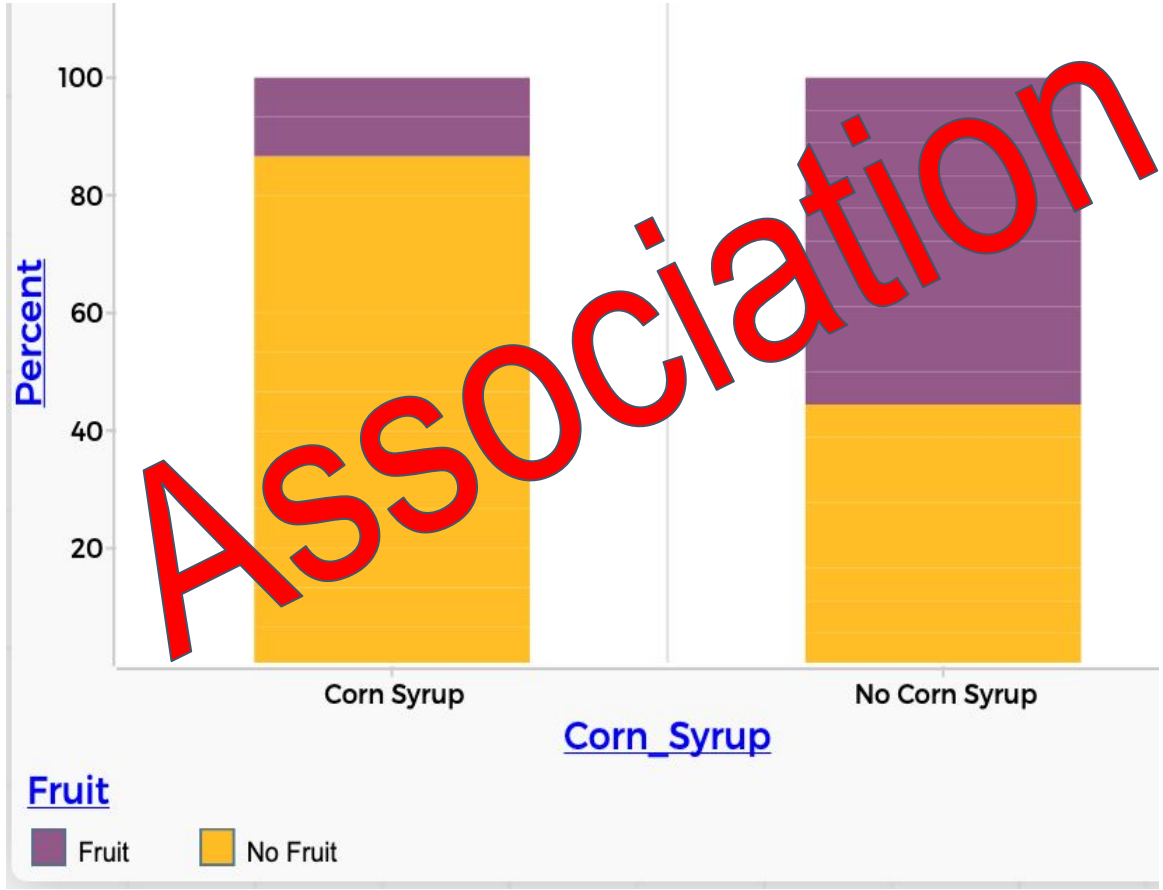
Making a segmented bar graph in CODAP looking at the association between texture and nuts

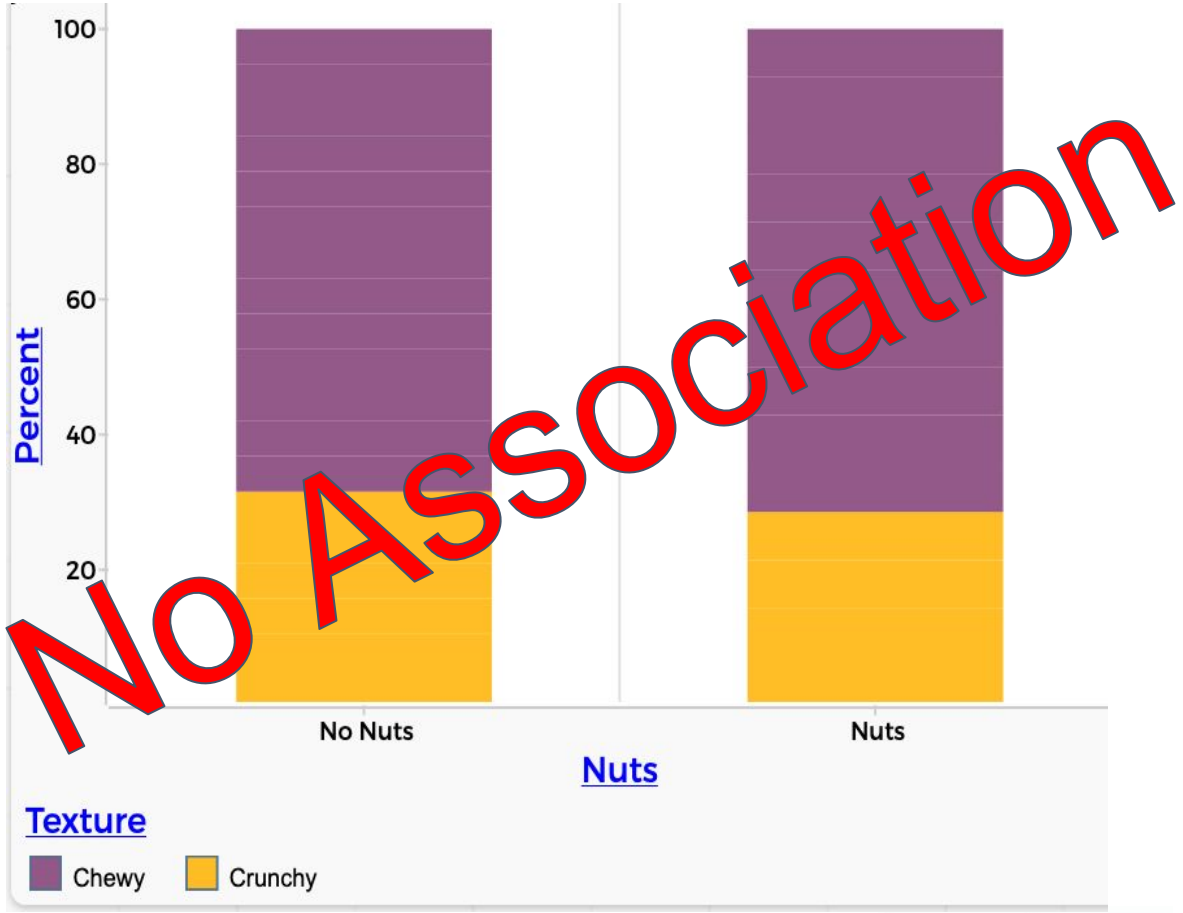
Continue with CODAP

Work with a partner to answer questions #2-5 on the handout about granola bars.

Association of Categorical Variables

How do you know if two categorical variables are associated?





Categorical Data in the Standards

CCSS.Math.Content.8.SP.A.4

Understand that patterns of association can also be seen in bivariate categorical data by **displaying frequencies and relative frequencies** in a two-way table. Construct and interpret a two-way table summarizing data on two categorical variables collected from the same subjects. Use relative frequencies calculated for rows or columns to **describe possible association between the two variables**.

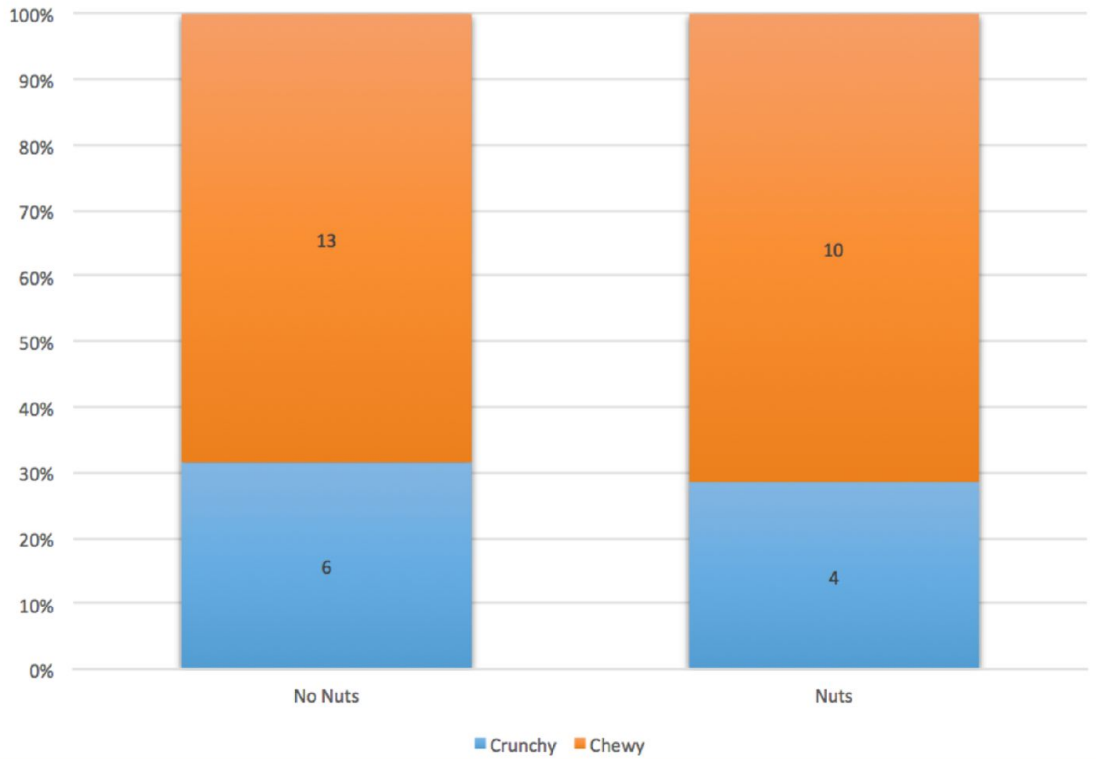
CCSS.Math.Content.HSS.ID.B.5

Summarize categorical data for two categories in two-way frequency tables. **Interpret relative frequencies** in the context of the data **(including joint, marginal, and conditional relative frequencies)**. **Recognize possible associations** and trends in the data.

Middle School Students' Interpretations of a Segmented Bar Graph

Is there a relationship between whether a granola bar has nuts and its texture (chewy/crunchy)?

	NO NUTS	NUTS
CHEWY	13	10
CRUNCHY	6	4



Students' Interpretations

- 4 student videos
- Notice how the student is interpreting the graph
- Consider why the student may have interpreted the graph that way
- Consider how you would respond to the student

Lana

Enhancing Statistics Teacher Education with E-Modules

NC STATE UNIVERSITY · EASTERN MICHIGAN UNIVERSITY · UNIVERSITY OF SOUTHERN INDIANA · The Concord Consortium · NSF

ESTEEM

Students' Interpretations

- Discuss how the student is interpreting the graph
- Consider why the student may have interpreted the graph that way
- Consider how you would respond to the student

Trina

Enhancing Statistics Teacher Education with E-Modules

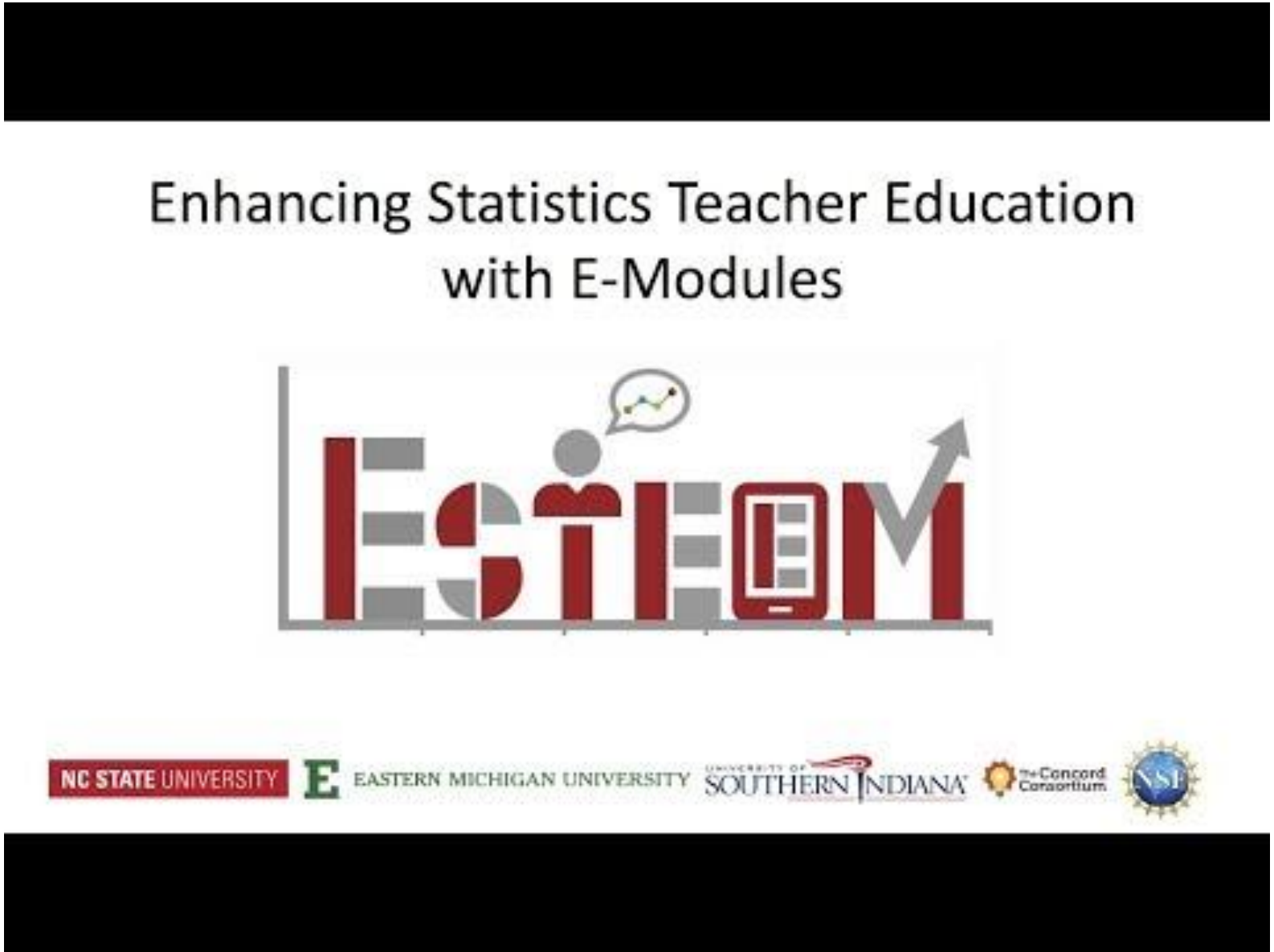
NC STATE UNIVERSITY EASTERN MICHIGAN UNIVERSITY UNIVERSITY OF SOUTHERN INDIANA The Concord Consortium NSF

ESTEEM

Students' Interpretations

- Discuss how the student is interpreting the graph
- Consider why the student may have interpreted the graph that way
- Consider how you would respond to the student

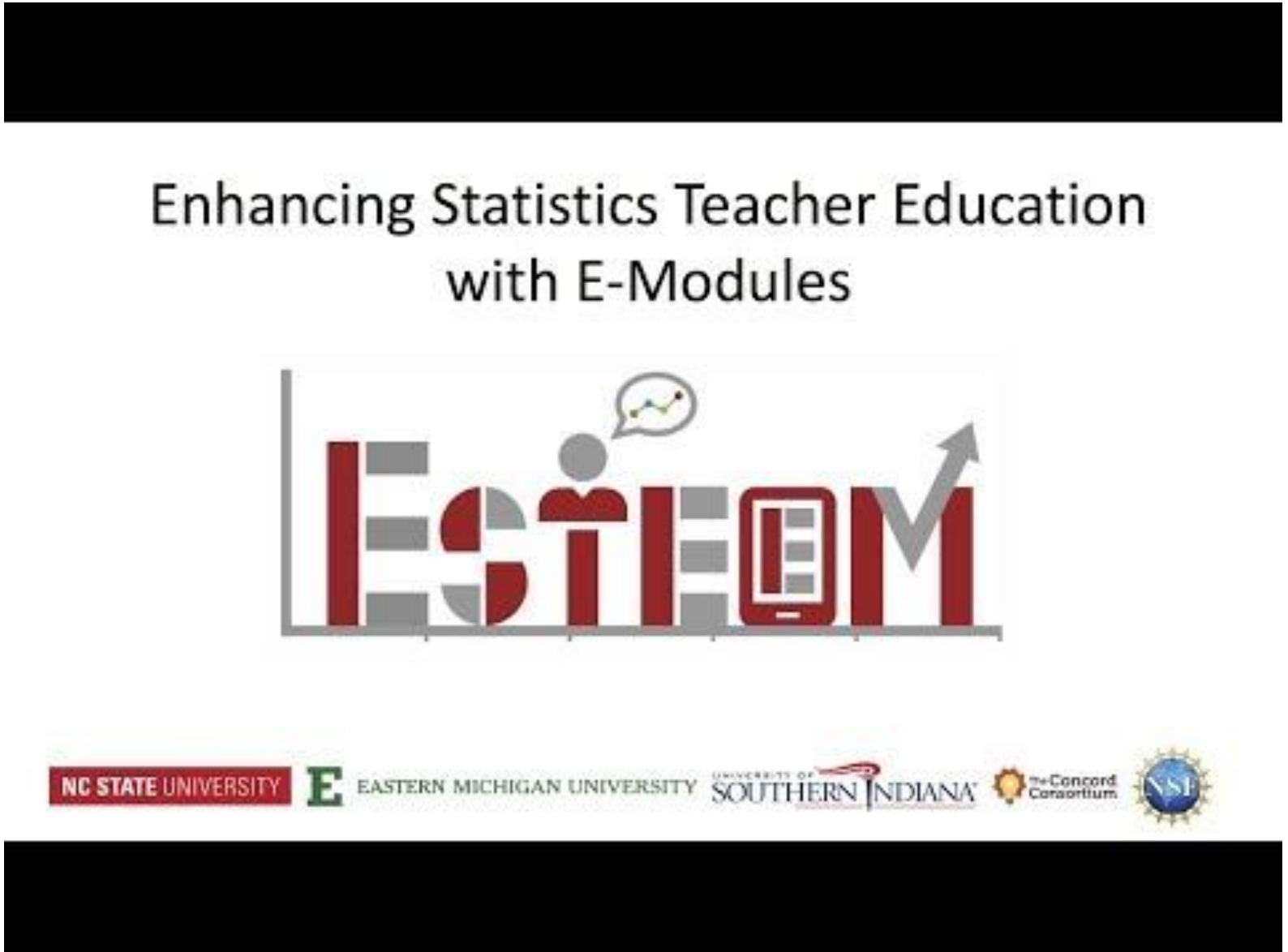
Andrea


Enhancing Statistics Teacher Education
with E-Modules
NC STATE UNIVERSITY
EASTERN MICHIGAN UNIVERSITY
UNIVERSITY OF SOUTHERN INDIANA
The Concord Consortium

Students' Interpretations

- Discuss how the student is interpreting the graph
- Consider why the student may have interpreted the graph that way
- Consider how you would respond to the student

Hector


Enhancing Statistics Teacher Education
with E-Modules
NC STATE UNIVERSITY
EASTERN MICHIGAN UNIVERSITY
UNIVERSITY OF SOUTHERN INDIANA
The Concord Consortium
NSF

Students' Interpretations

- Discuss how the student is interpreting the graph
- Consider why the student may have interpreted the graph that way
- Consider how you would respond to the student

Wrap-Up

How did CODAP support your investigation about categorical data?

How did different representations we used today help you make sense of categorical data?

What is one thing you will take back to your classroom?

ESTEEM ENHANCING STATISTICS TEACHER EDUCATION WITH E-MODULES

Principal Investigators:

Hollylynne Lee, North Carolina State University
William Finzer, The Concord Consortium
Stephanie Casey, Eastern Michigan University
Rick Hudson, University of Southern Indiana

Research Associate:

Gemma Mojica, North Carolina State University

This project is supported by the National Science Foundation under Grant No. DUE 1625713 awarded to North Carolina State University. Any opinions, findings, and conclusions or recommendations expressed herein are those of the principal investigators and do not necessarily reflect the views of the National Science Foundation.

hirise.fi.ncsu.edu/projects/esteem/