ENHANCING STATISTICS TEACHER EDUCATION WITH E-MODULES

Modeling Real-World Scenarios Using Simulation to Promote Inferential Reasoning

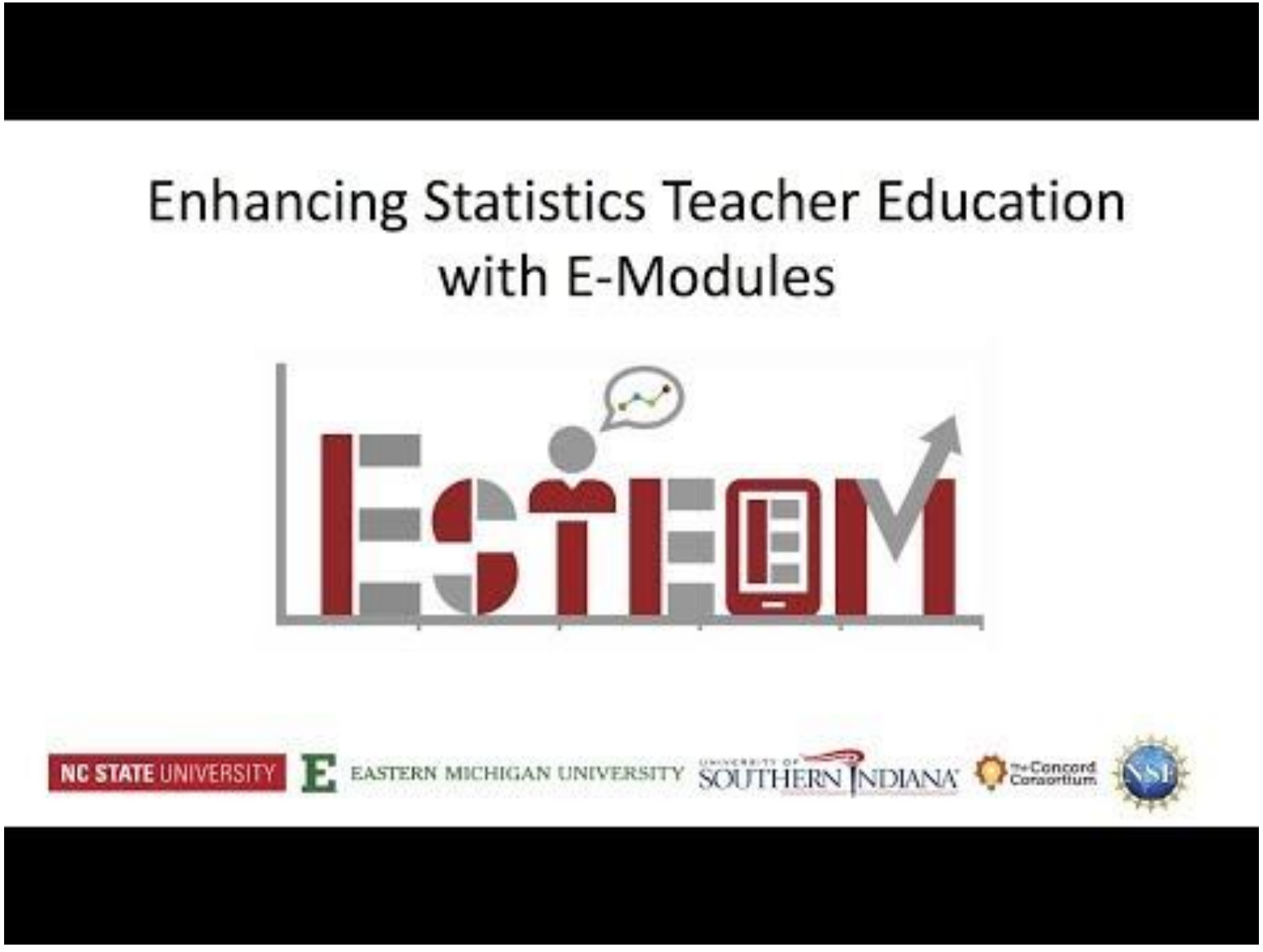
Christina Azmy, Heather Barker, and Gemma Mojica
NC State University

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

Why inferential reasoning?

- Describe inferential reasoning using your own words.
- What are some situations you can think of in which making an inference might be useful?
- Think 1 min
- Pair 3 min
- Share 3 min

Promoting Key Aspects of Inferential Reasoning



Inference from a Model in the Common Core Standards

Understand and evaluate random processes underlying statistical experiments

CCSS.MATH.CONTENT.HSS.IC.A.1
Understand statistics as a process for making inferences about population parameters based on a random sample from that population.

CCSS.MATH.CONTENT.HSS.IC.A.2

Decide if a specified model is consistent with results from a given data-generating process, e.g., using simulation. *For example, a model says a spinning coin falls heads up with probability 0.5. Would a result of 5 tails in a row cause you to question the model*?

Modeling a Carnival Game Scenario

Let's consider an example of a carnival Duck Pond game that has a collection of rubber ducks in a pond where **20% of ducks are marked** on their belly (unseen under the water) for a prize.

If a player picks one of these marked floating ducks, they **win a prize**. Once a duck is picked it is returned to the pond and the booth operator swirls them around in the pond to mix them up.

The booth owners **expect about 50 students to play** the game at the carnival.

Each player pays **$1.00 to pick 3 ducks (one at a time with replacement)**.

Image taken from: https://www.pinterest.com/pin/490962796856301064/

Modeling a Carnival Game Scenario

Consider some questions we could pose about this situation:

- How many prizes should they be prepared to give away after 50 students play the game? What variation might we expect in the total number of prizes that would be won after 50 students play?
- After choosing 3 ducks, how many prizes will most students win? 0, 1, 2, or 3?
- If the owners of the booth expect to make $50 from students paying to play, how much should they spend on buying the prizes for their booth to make a good profit?
- If at the end of the day only 10 prizes were won, would you think the owners were telling the truth about 20% of ducks being marked?

Let’s use CODAP to simulate!

http://tinyurl.com/duckpondsampler

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Let’s consider another task...

Paul the Octopus!

Paul the Octopus

In the news

Paul the Octopus

Music Video

Posing a Statistical Question

Paul the Octopus is 8 for 8 in selecting the winner of World Cup soccer games.

What statistical question can we ask?

How do we answer this question?

- If Paul were guessing, what would we expect his chances of being correct to be?
- How can we simulate the situation repeatedly using physical objects?
- What does each observation represent? How many observations per trial? How many trials should we run?
- What are we recording per 8 predictions?

Hands On Simulation

Instructions:

- Each person gets 8 coins in a cup (random.org/coins)
- Generate 10 sets of 8 predictions
- Plot your results here: https://tinyurl.com/PaulGuesses

CODAP Simulation

Instructions:

- Visit codap.concord.org
- Try to set-up a simulation that mirrors what we did with the coins

Is Paul the Octopus psychic?
http://tinyurl.com/PaulSampler

Pedagogical Considerations

How can a task like this...

- help support our students' understanding of a null model?
- build up the concept of a p-value?
- demonstrate how a sampling distribution is created?

Other considerations...

- What is the importance of the physical simulation?
- How can we help students make the connection between an empirical and theoretical distribution?

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

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