Developing Statistical Thinking in a Social Justice Context

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Goals

1. Discuss a framework for how students’ statistical thinking develops

2. Discuss the use of social justice contexts for helping students develop their statistical thinking skills, and

3. Consider the importance of covering social justice issues in statistics.
IMPACT describes engagement through the development of student-centered learning environments that promote discourse, critical thinking, and students’ self-monitoring of their learning.

“when students have the ability to apply [statistics] to real-world problems they have moved beyond observing and executing a series of isolated skills to the realm of critical thinking” (p. 24)
“Recommendation 3: Integrate real data with a context and a purpose: Statistics can be thought of as the science of learning from data, so the context of the data becomes an integral part of the problem-solving experience” (p. 17)

Suggestions for Teachers:

- Consider opportunities to align the data sources you select to institutional objectives at your school. For example, you may want to seek out datasets related to expanding students’ global awareness, focusing on social justice concerns, or exploring issues of local importance (emphasis added).
- Use real data ... to enliven your class, motivate students, and increase the relevance of the course to the real world.
- Use data with a context as the catalyst for exploration, generating the questions, and informing interpretations to conclusions (p. 17).
Importance of Engaging with Examples

- One way to incorporate social justice issues into the classroom is via examples used to further explain concepts and procedures ... BUT
- Students’ focus will be on the concepts and procedures first and foremost ("will we be tested on this?")
- Engaging with the context as well as the concepts and procedures can increase student engagement and interest
- How we engage students determines how much or how little they will think statistically
- Early examples should be used by instructors to model statistical thinking
Critical thinking is the intellectually disciplined process of actively and skillfully **conceptualizing, applying, analyzing, synthesizing, and/or evaluating information gathered from, or generated by, observation, experience, reflection, reasoning, or communication, as a guide to belief and action**” (Michael Scriven & Richard Paul, presented at the 8th Annual International Conference on Critical Thinking and Education Reform, Summer 1987).
"We propose that it is essential to work on the development of skills that will allow students to think critically about statistical issues and recognize the need for data, the importance of data production, the omnipresence of variability, and the quantification and explanation of variability. In other words, statistical thinking – the type of thinking that statisticians use when approaching or solving statistical problems – should be taught and emphasized in introductory courses" (GAISE, 2016, p.12).
“The development of statistical thinking should be seen by educators as crucial for understanding and operating in today’s environment and for perceiving a world reality” (Pfannkuch & Wild, 2004, p. 42).

In this 2004 chapter, Pfannkuch & Wild expressed the need for a “developmental pathway for statistical thinking” – are we there?

If statistical thinking can be described as “think[ing] critically about statistical issues” (GAISE, 2016, p. 12), we can borrow developmental pathways from the work done with critical thinking.
Applying Perry’s Scheme to Statistical Thinking

**Dualism:** “knowledge is received, not learned … there is a correct answer”
Example: This histogram tells us the true state of affairs.

**Multiplicity:** “there may be more than one solution to a problem, or there may be no solution; students recognize that their opinions matter”
Example: This histogram is one representation of many. I think it is questionable because …

**Relativism:** “knowledge is seen as contextual; students evaluate viewpoints based on source and evidence”
Example: Where did this data come from?

**Commitment within Relativism:** “integration of knowledge from other sources with personal experience and reflection”
Example: Here is what I think of this histogram based on what I know about it and my own experience.

Source: https://ii.library.jhu.edu/2013/12/13/perrys-scheme-understanding-the-intellectual-development-of-college-age-students/
Most Minority Groups Make up a Larger Share of the Homeless Population than They Do of the General Population

Race and ethnicity of those experiencing homelessness compared with the general population

Race

Homeless Population

US Population

Some Responses I See

“How old were the participants”
“Not every homeless person will talk to survey people”
“How was this data collected”
“How does this compare to now”
“This is a sample, so {insert error} is possible”
“Was this sample local”
“I don’t know the sample size, so this is meaningless”
Context & Statistics Together

FINDING OUT

Questions for Data

Moving Between Spheres

Statistical Sphere

Features Seen in Data

Context Sphere

WHAT DOES THIS MEAN?

Discuss the statistics – what values do we see here? How were they calculated?

Make sure students can read the graph appropriately.

This is also a time to explain characteristics some students may not understand. For example, here, the graph is about 4th/8th grade proficiency scores – any international students, students not from Ohio, or home-schooled students may not have experience with that.

Source: https://www.ohiobythenumbers.com/
"How old were the participants"

"What race/ethnicity/gender/etc. were the participants"

"How was this data collected"

"It looks like poor people aren’t as smart as rich people"

"This is a sample, so {insert error} is possible"

"Economically disadvantaged students find math hard"
Applying Perry’s Scheme to Statistical Thinking: How Do We Help Students Shift from Dualism to Multiplicity?

**Dualism:** “knowledge is received, not learned … there is a correct answer”
Example: This graph tells us the true state of affairs.

**Multiplicity:** “there may be more than one solution to a problem, or there may be no solution; students recognize that their opinions matter”
Example: This graph is one representation of many. I think it is questionable because …

Source: https://ii.library.jhu.edu/2013/12/13/perrys-scheme-understanding-the-intellectual-development-of-college-age-students/
Modified Investigative Process (GAISE, 2016, p. 13)

- **Formulate**
  - Formulate questions

- **Seek**
  - Seek Information [collect data]

- **Evaluate**
  - Evaluate Information [analyze data]

- **Answer**
  - Answer Question or Determine Additional Needs [interpret data]
Statistical Thinking: Interrogative Cycle (Wild & Pfannkuch)

"A person’s ‘dispositions’ are problem dependent – they change according to the degree to which the person is engaged by the problem" (p. 235)

Putting It All Together

Statistical thinking needs to be explicitly taught and modeled by instructors to engage students and move them beyond “statistics = math.”

Statistical thinking is a skill that develops, so building a series of discussions with questions that move students beyond dualistic thinking is important.

Using any model of “investigation” will encourage students to think more systematically and more broadly about the issue at hand.
Putting It All Together

Students’ dispositions toward thinking statistically should be discussed.

The connection between social justice and statistics can be emphasized in many ways, but the social justice context should be part of the assessment process.

Discussions need to be monitored by instructors, so students are pushed beyond the “quick” and “easy” responses.
Questions & Discussion
Thank You!

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