

# Chapter 12

## Using Technology to Rethink the Intersection of Statistics Education and Social Justice

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### ABSTRACT

*A critical consumer is able to ask questions and discern information about data—its collection and analysis, and is able to judge whether conclusions are warranted (GAISE, 2007; Best, 2001). Promoting statistical knowledge by exploring social issues that create disparities helps individuals foster initiative for positive change and engage in equitable practices (Moses & Cobb, 2001; Gutstein, 2006). This chapter explains investigations suitable for use with pre-service/in-service teachers and middle school or high school students. Investigations were structured to help participants: 1) Engage in statistical problem solving using real data; 2) Focus on the process of statistical investigation (Rossman & Chance, 2012); and 3) Consider statistics as a means of promoting social change. A description of investigations and sample artifacts are included.*

### INTRODUCTION

*Will saving the poor children of the world from dying of disease lead to overpopulation?* This stunning question was recently posed by Hans Rosling of the Gapminder Foundation (<http://gapminder.org/videos/will-saving-poor-children-lead-to-overpopulation/>). Rosling was obviously not suggesting that this is the case; rather he was drawing awareness to the fact that sometimes erroneous beliefs may, consciously or unconsciously, influence people's actions or their failure to act. Beliefs and opinions concerning such

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questions are critical, as some individuals serve in positions of power and are able to make decisions that can impact world problems, such as funding aid to poorer countries. Others will influence policy-makers by their votes and by voicing public opinion, or through engagement with private corporations or foundations. Beliefs motivate individuals to spur action or may cause serious societal harm. The following sections describe this chapter's theoretical foundations, including the use of critical statistics pedagogy to promote social justice, the role of specialized technologies in statistical explorations, and an explanation of how this work is framed in connection to the development of technological pedagogical content knowledge (TPACK). Investigations suitable for use with middle school or high school students or with pre-service/in-service teachers are illustrated and some samples of student work are shared.

## **Background**

Critical statistics acknowledges the political nature of knowledge and how data can be construed and misrepresented when used in a public arena. Understanding how statistical knowledge is valued and who is making decisions helps individuals better understand social realities and how power struggles are enacted and sustained. Garfield and Ben-Zvi (2008) note that in the realm of statistics, "context provides meaning for the numbers, and data cannot be meaningfully analyzed without paying careful consideration to their context" (p. 8). Critical consumers of data are able to think and reason about statistics and use statistical tools to better explore and understand issues that are significant to their immediate community and the broader world.

## **Critical Statistics Pedagogy to Promote Social Justice**

The mathematics education community acknowledges that the study of mathematical knowledge has a value dimension and that such study is a social and cultural phenomenon (Bishop, 1988). This is apparent in the morality of the question posed by Rosling in this chapter's introduction. Critical pedagogy, the umbrella under which critical statistics falls, is an "attempt to be discerning and attentive to those places and practices in which social agency has been denied and produced" (Giroux, 2011, p. 3). Critical pedagogy brings attention to oppression and allows individuals to become agents of change that promote social change over time (Frankenstein, 1987). Skovsmose (1985) states that when implementing critical education pedagogy two criteria, subjective and objective, need to be used when selecting problems for the classroom. First, the subjective, requires that the problem appears relevant to the students and within the realm of their conceptual understanding. The second, the objective, requires using an existing social issue to help students build deeper understanding. Thus, the activities that are described in this chapter focus on teaching students to pose questions pertaining to real-world problems and to use actual data from reliable sources to hypothesize mathematically-grounded answers to their inquiries and to consider the ethical nature of their observations or proposed solutions.

Frankenstein (1995) explains critical statistics as asking students to, think "critically by examining its [statistics] underlying interests and methods of collection, description and inference, and by considering historical, philosophical, and other theoretical insights along with statistical knowledge" (p. 192) to build the capacity to enter into meaningful conversations. Skovsmose (2011) furthered the idea of critical mathematics (*statistics*) by discussing the notions of *situation*, *students' foreground*, *landscapes of investigation*, *critical conceptions*, *mathematics in action* and *mathemacy*. He referred to *situation*

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