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Seeing Race in Statistics

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Introduction

This unit is called “Seeing Race in Statistics”, and it will be used as the first unit in an introductory statistics course. I currently teach two introductory high school statistics courses: Advanced Placement Statistics and Statistics for Health and Business at an interdistrict magnet school in New Haven, Connecticut. Our students come from over ten towns and reflect many educational, social, and cultural backgrounds. The unit is designed with my students in mind, diverse in both social background as well as background knowledge. Within this unit, I will take a three level design that is planned to make these courses more relevant to students and promote questions that interrogate the authority of statistics that students will encounter throughout the course and in their lives.

The skill of interrogating statistics is crucial for all adults in our society to become thinking consumers and users of data. In addition, it is important to deconstruct data to see implicit ideas of domination and subjugation that travel through numbers that can appear nuetral. Statistics shares a creation story with the field of Eugenics. Francis Galton, a mathematician who contributed many of the major ideas to statistics was also one of the originators of eugenics. The influence of eugenic thinking in statistics drives a notion of superiority, fitness and ranking alongside measurements. Milton Reynolds describes this in *Shifting Frames:*,” The term “eugenics” refers to a scientifically based, ideological movement dedicated to the reiification of race. It is the wellspring of scientific theories used to construct taxonomies of difference within the human family and to legitimize the subjugation of different groups.”.[1] Statistics often does the work of justifying this subjugation through its “innocent” and authoritative work as a logical system. These embedded assumptions of superiority are validated by the seeming neutrality of mathematical calculations. The “taxonomies of difference” he describes are invalid and biased assumptions about difference that dominate our interpretations of data, however they appear as factual products legitimized by math.

Statistics is a unique mathematical discipline, an adjunct to and tool to both the natural and social sciences. At root, it is a way to characterize, analyze and quantify the natural world and the conceptualized world both through direct measurement and predictions based on those measurements. Statistics uses these empirical results to construct models of behavior that help us to plan, predict and problem solve. As a mathematical practice it is very modern, unlike its partners of Geometry, Algebra and even Calculus. Statistics has always combined a conceptualized world-view with specific calculations to understand probability and error

management. Statistics arose in the seventeenth and eighteenth century from three disparate fields of study; the ancient art of record keeping, the study of astronomy and finally, the study of games and chance. However, as it arose during this period, it also coincided with ascendant notions of eugenics, imperialism, colonialism and white dominance.

Statistical inferences are based on probability theorems. It is a tool to create predictions. These models are not as pure as many mathematical models based only within the closed intellectual system of mathematics. Statistics likes to get its feet messy by drawing on assumptions and then alchemizing those conditions, through beautiful calculations, into a plausible and predictable future. However, inferential statistics are models, and models can be useful but should not be mistaken for reality. Drawing conclusions based on assumptions can only be as accurate as our human conception of the world. The weightiness that mathematical inference carries can disguise assumptions that are threads of the final cloth. As sociologist Tufuku Zuberi says in *Thicker than Blood*:" Mathematical statements follow one another in a definite order according to certain principles and are accompanied by proofs. The numbers from mathematics are the result of logical calculations. In mathematics the numbers are either exact or have a known or estimable error. Statistics is a system of estimation based on uncertainty. Statistics is a form of applied mathematics. Often in statistics, the numbers are no more than the axioms applied and may have little to do with the conditions of the correct applicability in the real world."[2]

Conflating modeling and truth is an issue of concern in our statistically driven society. Within social settings, our communities, education systems, governments and belief systems; the product of our statistical measurement drives political thought and can also become the belief. Models and their assumptions, when repeated often and widely can become our reality. The notion of "alternate facts" that arose during the Trump era, is tied to this idea. If we are to believe statistics and science and use them to guide our thinking, then what do we do with the presence of conflicting models and their mutual assertions of truths with 99% confidence?

How we create our models is then not an arbitrary question. For the AP Statistics students, this "checking of conditions and assumptions" has become a joke-like memorized gauntlet that they must run in order to produce the delicious mathematical product of a confidence interval or a p-value. But at the start, how we collect and identify information is one of the most critical pieces of the puzzle. That is the most dangerous moment where our blind spots and biases will endanger our ability to see and seek truth.

How can we expect that statistics derived by measurement tools that are embedded in our racialized society are not also racialized? Again Zuberi, "Race is a socially constructed process that produces subordinate and superordinate groups. Racial stratification is the key social process behind racial classifications."[3] This point is crucial. It refutes the notion that race classification is a neutral variable. The codes of racial dominance are so pronounced in the United States that racial classification can't be separated from stratification. Any statistical measurement that uses race and racial proxies as variables, imports the cultural meanings of race and embeds those meanings into the inferences that are intended to be drawn from these models.

Three level planning of this Unit

The base layer of this unit is pedagogical. The goal is to incorporate practices that have been identified to increase equity in the mathematics classroom, particularly for students who have been historically excluded in the dominant conversations about mathematical excellence. The second level is focused on challenging the dominant propositions and undercurrents of power in the study of statistics through lessons that examine the history and role of statistics within our racialized society. Specifically we will scrutinize variables that are accepted as truths and look at their role in shaping our perceptions of data. We will also look at examples of resistance statistics and in doing so, introduce the important work of these resistance mathematicians. Level three is the statistical content. This unit introduces students to the basic notions of data collection and organization, raising such questions as: "How can we collect data while minimizing bias?" "What types of data are there?" And finally: "How can we organize the data numerically and visually? "

Level 1: Pedagogical Moves to Increase Equity in the Mathematics Classroom.

Equity in the math classroom is a fundamental issue to address. Within the math classrooms in which I teach, students are majority students of color, therefore ensuring that the teaching design serves those students is paramount. One of the core tenets of Critical Race Theory (CRT) is that racism is so embedded in the culture as to be difficult to see. Racism is embedded in the practice of mathematics so as to be almost invisible. American mathematical university departments, curriculum design experts and mathematics educators, will assert that the study of math is ability-based, neutral and colorblind. However, Danny Martin describes in his paper "*Researching Race in Mathematics Education* "this structure is clearly "a highly racialized (and gendered) space that normalizes and privileges Whiteness (and maleness) and influences societal beliefs about who can and cannot do mathematics." He continues, "Designing mathematics classroom practices that promote the development of positive racial and mathematical identities and that situate the learning of mathematics in the social (and racial) realities confronting students should be goals for all mathematics teachers."[4] In order to provide high quality math education, my work requires me to address the effects of this racialized system.

The case for more equitable math instruction has been made exhaustively through scores of papers and books that examine the importance and opportunity costs associated with changing the instructional and learning outcomes in mathematics for students of color. The "achievement gap" is a predominant theme in mathematics education, driving studies, legislation, teacher training and curricular resource developments. However, the attention paid to this comparison of non-white students to white students, called the "achievement gap" does so in a manner that frames the disparities as race-effects rather than as the result of racism in the education and assessments systems that students are operating within. Despite the years of scholarship around the racialized education system and the standardized testing industry, the focus remains a deficit focus. Instead of working against the injustices of SATs and punitive policies such as No Child Left Behind, the focus of this relentless measurement reinforces white dominance and centrality. As Larnell, Bullock and Jett state:"Whether inside or outside of school, mathematics is political. Mathematics teaching and learning are certainly political acts connected to the preservation of privilege, the maintenance of oppression,

and the capacity to see both clearly."[5]

Educational statistics reinforce the deficit view of non-white students in mathematics, leading to lowered expectations among teachers of these students and stereotype threat among the students themselves. Mathematical achievement is used as a filter or gatekeeper for upper level courses as well as college and career opportunities. This is an accepted and normalized part of K-12 tracking and promotions and college entrance criteria. This structure is also clearly part of what CRT describes as a way that societal racism works to maintain white supremacy. Colorblindness argues that our educational system is desegregated and equal in opportunity for all. Standardized testing in support of federal programs such as NCLB and Race to the top, are designed to measure, compare and ferret out individual "failing schools." Yet insufficient attention is paid to the embedded racism of these comparisons and the testing models. This approach to creating equity across the schools has not succeeded in changing the dynamics that the approach states as its goal despite decades of efforts and the proportion of "failing schools" has not changed significantly.

A constructivist CRT approach to education is described by Marvin Lynn in his paper *Toward a Critical Race Pedagogy*. Within this work, he interviewed several African American education practitioners who were committed to an activist and justice focused pedagogy; what he calls a "liberatory pedagogy". Based interviews with these teachers, Lynn proposes 4 components of this pedagogy: 1) teaching children the importance of their culture, 2) encouraging classroom dialogue, 3) engaging in self- affirmation with students and 4) being active in resisting dominant practices that promote the white power structure.[6]

In upper high school mathematics it is often hard to integrate mathematical concepts into areas of concern and interest for the students in a particular classroom. It can be a challenge for a teacher of mathematics to find relevant social justice topics as examples of mathematical functions without careful planning. The focus of much of the policy around math education reflects a challenging tension between achievement and engagement. This tension is explored by Larnell, Bullock and Jett, in their paper *Rethinking teaching and learning for Social Justice from a Critical Race Perspective*. They describe a "critical mathematical literacy"[7] approach which focuses on students changing to a positive view of mathematics through engaging in writing and reading of the world through mathematics. This approach emphasizes positive engagement over achieving a high percentage of content objectives. This is contrasted with the approach that centralizes achievement in math as a civil right, and focuses on using mathematics as a route to changing the life trajectories of the students.

Tonya Gau Bartell, in her study. *Learning to Teach Mathematics for Social Justice: Negotiating Social Justice and Mathematical Goals*. Describes the struggle to integrate social justice goals and mathematical content. She concludes that ongoing professional development in social justice is crucial for teachers of mathematics, as well as access to relevant data for teaching these topics. She observed teacher challenges in integrating the two pedagogical goals and suggested that rather than lesson focused changes, the shifts in teaching for social justice may better be viewed as yearlong integration.[8]

Steps to Increase Equity in the Curriculum

The dominant approach in math curriculum is to "cover the curriculum" and is measured by students being able to solve sample problems within a selection of the approximately 190 common core content standards at the high school level. If using the study of mathematics as a social justice tool, then covering as much of the curriculum as possible is a goal. If students achieve the content standards of the common core at a high level, it follows that college and career options will open up to them. This is somewhat problematic as it assumes

that the college and career landscape is truly ability based and neutral. It also presents a time constraint in engaging students in deep mathematical problem solving and thinking. There is mention of the need for students to work persistently and independently at solving unique problems, however, the time pressure for students and teachers to cover the breadth of the curriculum is enormous. The coverage of topics leaves little time and space for conversation and engagement in authentic and relevant work.

Focusing the curriculum on the standards of practice is a way to build a student-centered and engaged classroom that provides high quality mathematics. It is as important as following a complete progression in the content standards. It is important because it raises expectations for the classroom by asking students to engage fully in the practice of math, rather than simply completing "content practice problems." Seeking input from students throughout the year using conversation, investigation and reflection can strengthen the connection that students make to higher level mathematics and reinforce their relationship to doing math. Providing the opportunity for students to model with mathematics, based on problems within the context of their lives makes the practice deep and relevant.

I believe that the teaching of statistics itself provides opportunities for equity. Statistics is naturally accessible and authentic. Data can be collected from almost any area of interest. Measurement is one of the most concrete entry points into mathematics and it builds natural curiosity. Measuring something extends our understanding and builds our interest in the world around us. It only takes one measurement to realize that you might want to compare it to another and that builds a foundation for mathematical modeling. Students can build confidence in analyzing quantitative information by building their own understanding of a topic from the ground up. This makes statistics a great equalizer. Students can create a quantitative model of their ideas and world. Creating quantitative models and learning to verbalize the key features of these models is a very important piece of mathematical development for students that is equally important to the traditional canon of high school algebra and geometry. The dominant framework for high school mathematics often ignores statistics as it does not fit the algebraic pathway to calculus, however many more college students will take statistics than calculus.

The book *Choosing to See: a Framework for Equity in the Mathematics Classroom*[9] outlines a teaching protocol ICUCARE. This protocol is the work of Pamela Seda and Kendall Brown, two leading practitioners and scholars in equitable math education. The protocol is an acronym to assist teachers as well as students to ensure equity considerations are forefront in the planning and execution of instruction Seda and Brown's work puts CRT into practice with the ICUCARE protocol. The practices promoted by these scholars puts a focus on student-centered classrooms that encourage dialogue between students, that draw from and affirm knowledge bases within students and their home communities, that encourage and affirm mathematical process and reasoning and that interrogate the dominant myths and cultural messaging within the content area. I have chosen to use the guidance of the ICUCARE protocol in planning the unit. The protocol can help guide my work in equity pedagogy. The purpose of pedagogy and process is " not to control what participants feel", as Milton Reynolds says in *Shifting Frames*, but to "create a context or a container in which the participants will be allowed to access a broader range of emotions in the process of learning" "Ultimately, the goal is for them to construct knowledge together."[10] I want to utilize this container to allow for students to construct knowledge in the classroom together, while ensuring that I am providing students access to equitable mathematics. In doing so, the hope is that students will build their interest and expertise as actual practitioners rather than as those who try to measure up.

Level 2: Role of Statistics in amplifying the racialized lens of society

The issue of racial classification is central to both the history of statistics and how it is used to model problems and solutions in the current day. Historically, the rise of statistics in the nineteenth and twentieth century coincided with emerging social theorems about race and power. Statistical discoveries in western science communities were interwoven with the American and European worldview that centralized whiteness. The mathematicians who codified the methodology of modern statistics were steeped in the worldview of western traditions.

Eighteenth century western viewpoints to justify the inhumanity of slavery and colonization are embedded in the field of demographics. As societies grew in size and complexity throughout Europe and the Americas, and colonization became widespread, the counting and classification of humans became increasingly important to the governments of these nations. The creation of marked racial strata within demography was based on notions from theology, and later justified by biology and eugenics. The separation of humans into racial groups was used to justify slavery and colonial domination. There distinctions were used to form hierarchies that elevated whiteness above all. This stratification and power relationship is what cannot be eliminated when racial signifiers are used as variables within statistical studies. The output of the studies are always non-neutral but embedded in the cultural stratification.

Now as then, notions of personal qualities and social fitness, became embedded as assumptions within racial grouping. Deconstructing the beliefs stemming from statistical findings means that interrogating the ideas of what can be accurately and fairly measured is as important as examining how those measurements are interpreted. Zuberi criticizes social statistics, “Statistical populations consist of observed measures of some characteristic ; yet no observational record can capture completely what it is to be a human being. “[11]

Given that so many of our statistics now and throughout the nineteenth and twentieth century explicitly incorporated racial strata, it is important to wonder who this process serves and whether it achieves its intended purpose. Race is a socially constructed classification, not a naturally occurring phenomenon. Whether respondents in a study are classified by the researcher or classify themselves into racial groupings both the notion of difference and the validity of classification are reinforced. The socially constructed classification of race in America is not simply a set variable but it is a label that is associated with a power relationship.

In addition, the classification and acute study of differences based on this abstract social construct ignores the oppression of the dominant class by returning focus to the differences of those who are oppressed. Not only is it important to ask who decides the classification to which a person “belongs” but to what purpose is the classification itself. The U.S. Census defers to the U.S. Office of Management and Budget to define racial classifications and then asks people to “self-select” their own identity from this bureaucratic menu as though the self-selection can remove the data from cultural ideas of dominance.

The idea of race as a discernible, neutral or fixed variable disguises the power that racial demarcation carries. Is racial identity measurable? What does that variable measure? Does slicing our statistical studies along “racial lines'' help to identify inequalities to effectively dislodge them or does it reinforce the status quo by continually restating the norm of racialized data? Is this social construct of race a worthy way to divide our human community, and does it help us attain progressive aims? Even within progressive thinking does it reinforce the dominant narrative?

These questions about the role of classification and the domination inherent in deciding how to frame the measurements are vital. Students need to ask questions about who collects data, who the data is intended to influence and who has the power deferential in the situation in which the data is playing a role. These questions will pervade the discussions of the introductory unit as we explore census data and build a skepticism and critical sensibility into our examination of data throughout the class.

As a way of contrasting the dominant narrative with the resistant narrative, we will examine non-governmental data sets that have been critical to understanding and making change in society. Often these are topics that have been politically off limits for the government and yet are existentially important for many people in the country. These include the work WEB DuBois created for the 1900 Paris Exposition, the work of Monroe Work to study lynching. Some of the future exploration in the class depends on student interest and will look at data to explore historical and contemporary issues.

Level 3: Introductory Unit Content Objectives

Main Questions:

What types of data are there?

- Students will learn vocabulary around data collection, including variable, categorical variable, quantitative variable, count, frequency, relative frequency.
- Students will be able to organize data into tables with cases and columns of variables; paying attention to types of variables and asking meaningful questions about quality of the data collection and the intended use of the variables.

How can we organize the data numerically and visually?

- Students will understand that there are both visual and numerical ways to summarize and display statistics.
- Students will be able to identify the type of variable and the appropriate numerical and visual summary strategies for that variable.
- Students will be able to verbally describe the relationships displayed in a graph.

How can we collect data while avoiding bias?

- Students will be critical about the documentation or lack thereof about how data was collected.
- Students will be critical about the meaning and use of variables that have been defined in a study.
- Students will begin to recognize the role of representation in data and generalizability.

Unit

Notes on Pedagogy and Social Justice Integration for this unit.

This introductory unit is designed with both the ICUCARE protocol in mind, using the protocol in all lessons. In addition, it is planned with the advice of Tonya Gau Bartell in integrating social justice teaching with yearlong

and not lesson long design. I am sketching five lessons here along with a summative task that introduce the statistical unit objectives of recognizing and characterizing variables, as well as laying the foundation for students to take a questioning approach to the methodology of data collection and the intended and unintended implications of the strategic decisions that researchers make when designing data collection.

ICUCARE Protocol in Unit

	Protocol step	Strategies
I	Include others as experts	Surveying students for applications in math within their life and their family and integration into summative projects. Using group work that relies on expertise and individual contributions. Selective reinforcement by teacher when listening to group discussion. Build classroom trust through group work and share out discussions so that all students are respected as experts.
C	Critical Consciousness	“Be color-conscious not color blind” Explicit teaching about racial statistics, looking at historical and present census categories, demographic data. We will examine the culture in which statistics arise, paying attention to the way that data is collected and directed. Ensuring that students take time to wonder why data is being collected and who benefits from the outcome of a set of statistics. Exploring context through listening, reading and discussion in history of statistics and demography (lesson 5) Exploring demographic data from WEB DuBois.
U	Understanding students	Surveying students to understand connections to mathematics and potential areas of projects. Having students review each other’s data to create displays and summarize ideas. Students working in groups to relate to each other and learn from each other. Through collective information sharing and knowledge building, allowing for humanity and connection to combat the idea of one person or group holding all knowledge/ to lessen stereotype threat.
C	Culturally relevant curriculum	Allow opportunities for cultures to be seen (non-assimilationist approach) Examination of racial categories, worldwide and in the US. Examination of the history of racial categories in the US. Time for discussion and reaction. Summative projects will be built in the actual lives of students. Throughout this and other units, we will turn to the technique of measuring our own worlds to build mathematical models that describe our own lives. Students will be exposed to explicit teaching about how the origination of statistics is tied to the eugenics movement and will take time to discuss and process these ideas. In addition, students will explore datasets produced by resistance mathematicians and celebrate the accomplishments of these culturally relevant organizations and individuals.
A	Assess Prior Knowledge	Lesson building design, allow for group discussion to access and assess knowledge base that the class is building together. Incorporate a prior knowledge engagement as part of any group work and activity.
R	Release control	Project based work, allowing students to create dynamic work in response to class lessons and materials (group work, collaborative graphs, summary project) Working as teams to analyze and communicate their findings, thereby allowing students to create models and be the owners of knowledge in the classroom.
E	Expect more	Define and assess student work on Common Core practice standards within lessons

Lesson 1 - Opening/ Centering activity and discussion

Narrative and rationale: Poster walk, collaborative analysis and discussion:

Students will react to statements in the posters, allowing open ended data to be produced that describes student reactions to Math in school and on the Job as well as assessing prior knowledge about the ideas of

statistics, graphs, measurements. The data will be used by the students to practice organizing it. However, the data is relevant in that it will provide individual and group-wide information about areas in which mathematics intersects in students' lives. This information will be used to build future lessons or projects that relate to the knowledge base of students and are embedded in students' lived experiences in order to give student expertise a main role in building classroom models. The group work will allow for students to collaboratively build the understanding of the notions of quantitative and categorical data while building rapport and community around examining shared interests or differences in reactions to the posters.

Content Objective:

Students will identify variables as categorical or quantitative

Students will collaboratively to collect data and sort into categories

Students will create a collaborative dotplot

Practice standards:

1) Look for and make sense of structure: Students will be able to select categorical and quantitative variables from the data gathered. Students will use these as a way to collate and describe the data.

2) Use tools strategically: Students will use discussion, sticky notes and posters to create numerical and visual displays of data.

Activities:

Create posters around the room with headings:

Math in School Statistics Math on the Job Graphs Measurements

Students will be given 10 minutes to interact with the posters. No specific direction is given about how to interpret the headings. Students are given 3 sticky notes and can have as many more as needed. Expectation that students use all 3 sticky notes and to add comments to at least 3 posters. At the end of 10 minutes, students will be assigned a group and a poster:

The group has 4 tasks (each person has a task) works for 10 minutes

- Counter: Count the number of comments that the poster received and post the number on the board dotplot
- Sorter: Create as many categories as needed by moving the sticky notes around the poster and sorting the comments into categories
- Summarizer: Writes a sentence or two to describe the responses on the posters including the number of comments and the types and sizes of categories
- Reporter: Will report summary out for group

Students will report out after 10 minutes with a 2 minute report per group.

Definition of Categorical and Quantitative variables will be given. Example of a quantitative variable and graph is number of comments/ dotplot. Example of categorical variable is the sorted categories with

percentage of comments in each category (bar graph can be formed from sticky notes)

Students can take time to re-sort their poster data by quantitative and categorical data.

Lesson 2

Narrative and rationale: Pairs reading and collating demographic information.

In groups, students will examine census forms from countries around the world to assess their understanding of quantitative and categorical variables. Students will collaboratively build a bar graph using the data that they have sorted to examine as a whole group which types of questions are universal across countries, and how countries may differ in the types of questions asked. Students are working in pairs to provide the opportunity that all students are engaged in the sorting and all have the chance to share their expertise about their assigned country. Varying between groups and pairs allows students to build collaborative skills. Students will be deconstructing census questions to begin to think critically about the collection of variables about people in diverse societies. We will follow up in the next lesson to interrogate the purpose of data classifications and implications of these categories.

Content Objective:

- Students will identify variables as categorical or quantitative
- Students will collaboratively build categorical data display: Bar graph
- Students will work in small groupings to analyze bar graph and to actively interrogate sources and purposes of data

Practice standards:

1) Make sense of problems and persevere to solve them: Students will work as a whole class to compile raw information about the purpose of census data by comparing questions from forms from a number of diverse countries.

2) use tools strategically: Students will use census forms, sticky notes and conversation to build a visual display of data.

3) to look for and make use of structure: Students will use their understanding of categorical and quantitative data to summarize world-wide census data.

Activities:

- Pairs will be given a (in some cases translated) set of questions or categories from census forms worldwide (using at least 2 from each continent). Students will be given 2 piles of small sticky notes. The color represents Categorical or Quantitative, for example yellow Categorical and Blue Quantitative.
- Teacher will model using the US form, noting on sticky notes the name of the category for example: Age (blue), Gender or Sex (yellow), married or single (yellow)
- Students will work in pairs to create a label for each data point in blue or yellow. Once the group is done, they will bring their sticky notes to a class graph on chart paper. New Categories will be added as needed, and if a category already exists; the students will add their sticky note to the chart.

Once the groups have completed their work, students will be asked to jot answers to the following questions in their notes:

- What are the most common categories worldwide (how can you tell from the graph?)
- What are the least common categories?
- Which categories does the US Census collect that your country's example did not?
- Which categories did your country example collect that the US does not?

Students will turn and talk, comparing answers and share out by pairs

Lesson 3

Narrative and rationale: Introduction to data collection design for studies analyzing race and census.

In groups and as a class, students will be introduced to the idea of designing measurements of variables as part of data collection and the idea of how those variables are analyzed and then lead to inferences. Students will compare outcomes from the census study in the previous class and look at racial and ethnic classifications across the examples. Students will discuss the similarities and differences found and explore the implicit meaning of the outcomes. Group discussion and individual reflection will examine the question of whether racial classification implies racial stratification. Students will reflect on whether these numbers can neutrally describe experience or whether they carry the implicit meanings of racial domination within the data displays.

Content Objective:

- Students will interrogate purpose and use of data collection
- Students will understand that the design of a survey determines the way variables are measured and that these measurements may affect how the data is interpreted and expressed.

Practice standards:

Construct viable arguments and critique the reasoning of others: Students will analyze the choices made in worldwide census questionnaires to determine if they are measuring similar or different attributes in the populations of each country. Students will formulate ideas about potential inferences that may form from these data and compare and contrast the outcomes.

Activities:

Teacher will post the outline of a bar graph on the board. Students will be asked to put an x in the category that best answers the question What color is your shirt?

As questions arise in the data collection those will be written on the board: Some of these questions may be:

What if I have more than one color on my shirt? What if I have 2 layers/ 2 shirts?

POST DIAGRAM of DATA COLLECTION DESIGN

As a whole group, and while using the flowchart we will add steps to the shirt color question to examine the decisions that were made in the process.

Working in groups students will look at the bar chart from the day before.

1. Director: Leads the group through the questions and steps of activity allots 2 minutes or so per question.

2. Reader: Reads each question for group members to respond to
3. Notetaker: collects answers/ types or writes them
4. Reporter: Will report summary out for group

Answer Questions:

- Are Race/ ethnicity/ religion/ language-spoken the same category or different?
- What use would the government have to collect this info?
- How is it important?
- How accurately are these categories measured?
- What are some potential sources for mis-measurement?

Teacher shows the recent test questions by US Census (ethnicity questions)

- What are the purposes of these questions?
- What information is being collected? How can it be used in positive and negative ways?
- Are there ways that the data empowers or disempowers people across demographic groups?
- What inferences could be drawn from data that divides people into racial categories?

Individual reflection closure:

Do you agree that “racial classification (sorting individuals by race) and racial stratification (ordering races into a hierarchy) are inseparable in the US”? - Zuberi

Lesson 4:

Narrative and rationale: Historical context of race and census/race and statistics

As a class, students will listen to a portion of a podcast about the history of race in the census. Students will watch a slide deck about the history of racial classification and the history of eugenics and statistics. Students will be given time to discuss and write about these materials.

Content Objective:

Students will use a critically conscious approach to examine the collection of data about race, in a historical and in the current context.

Practice standards:

1) Construct viable arguments and critique the reasoning of others: students will look at data critically to notice the explicit and implicit messaging along with the numbers.

Activities:

Slideshow galton and eugenics

Handout Pew history of census and race

Partner questions: choices to discuss:

What surprised you? How does this knowledge affect your trust of statistics?

What is the relationship between Eugenics, racial stratification, white dominance?

Are the ideas put forth by Eugenicists still a part of the statistics we examine in the census?

Lesson 5

Narrative and rationale: analyzing categorical graphs using examples from W.E.B. DuBois data visualizations from 1899.

In groups, students will compare and contrast categorical graphs of data. Students will work in groups to build collaboration skills and give all students an opportunity to provide expertise in the analysis. Students will compare graphs from W.E.B. DuBois with contemporary US Census graphs. W.E.B. DuBois worked with his students at Atlanta University to measure aspects of the lives of African-American residents of Georgia. The data and graphs were collected to be shown at the Paris World Fair in 1900. The resulting graphs are both historically unique, beautifully conceived and rendered and present an accurate and compellingly positive vision of the lives of African Americans in the late nineteenth century. We will contrast this with the minimal information that was presented in the US Census.

Content Objective:

Students will examine data visualizations looking for physical features in the graphs that express categories

Students will examine data visualizations looking for physical features in the graphs that express quantities

Students will compare and describe effective features of graphs

Practice standards:

1) Look for and make sense of structure: Students will compare physical features of graphs and identify how color, line shape and proportion describe numerical data

2) Attend to precision: Students will compare the effectiveness of the graphical displays.

3) Construct viable arguments and critique the reasoning of others: Students will compare the implicit and explicit meanings of the data displays

Activities:

Students will be broken into groups. Each group receives two graphs with similar contents. Students receive sticky notes to jot answers on.

The group has 4 tasks (each person has a task) works for 10 minutes

1. Director: Leads the group through the questions and steps of activity allotted 2 minutes or so per question.
2. Reader: Reads each question for group members to respond to
3. Notetaker: collects information and writes it down
4. Reporter: Will report summary out for group

Group will compare these two graphs.

What is the content of these two graphs?

How does the graph tell the story (visual language) (color/ line/ area/ proportion)?

What does the graph emphasize?

What story do you think the author is conveying with this graph?

Group share out and class discussion. Discussion of graph authors and audience and how/where data was presented.

Lesson 6

Narrative and rationale: preparing for a summative project: creating a graph of categorical data.

As a class, students will re-examine responses to the posters of the first class (posted in the room). Students can choose a categorical variable that they would like to examine from the topics or ideas posted on posters or they can create another idea. Using the flowchart of planning for variable measurement, students can plan how they intend to collect data about the chosen topic. Students can prepare the measurement tool (survey or observational checklist) and plan for the type of intended visual display (pie chart, bar graph, segmented bar graph)

Content Objective:

Students will collect categorical data and display in a graph

Practice standards:

Model with mathematics: Students will create a model of the distribution of answers from their topic of choice

Use appropriate tools strategically: Students will select and create an appropriate graphAttend to precision: Students will collect data accurately and display it correctly.

Activities:

Students will complete a graphic organizer to prepare for a summative project that they will submit for feedback.

	Your information	Another person's information
Categorical variable (or variables) that you would like to measure. You can reference the posters we did on the first day for ideas about math, reference census questions or invent a new topic. ***Categorical variables take on values that are names or labels***		
How will you collect the data? Survey questions Observations		

Who will you survey? or
who/what will you observe?

What tool will you use?
Survey questions (platform: paper/text/social media)
Observational checklist

Have you clearly defined your variable?
Are there cases you have to rule in or out as you measure? (think of shirt color example)
What meanings can occur that make your variables non-neutral?
What other meanings or inferences can be drawn from your variables?

What type of data display will you use?

Notes

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[1] Martin Reynolds *Shifting Frames: Pedagogical Interventions in Colorblind Teaching Practices, in Seeing Race Again. Countering Colorblindness across the Disciplines 356*

[2] Tukufu Zuberi, *Thicker Than Blood: How Racial Statistics Lie,* xvi

[3] Tukufu Zuberi, *Thicker Than Blood: How Racial Statistics Lie,* xviii

[4] Danny Martin, *Researching Race in Mathematics Education*, 312

[5] Gregory V. Larnell, Erika C. Bullock, and Christopher C. Jett., *Rethinking Teaching and Learning Mathematics for Social Justice from a Critical Race Perspective.*", 26

[6] Marvin Lynn**,** "Toward a Critical Race Pedagogy: A Research Note, 616

[7] Gregory V. Larnell, Erika C. Bullock, and Christopher C. Jett., *Rethinking Teaching and Learning Mathematics for Social Justice from a Critical Race Perspective.*", 21

[8] Tonya Gau Bartell , *Learning to Teach Mathematics for Social Justice: Negotiating Social Justice and Mathematical Goals,* 160

[9] Pam Seda, Kyndall Brown, *Choosing to See;A Framework for Equity in the Mathematics Classroom,* Appendix D

[10] Martin Reynolds *Shifting Frames: Pedagogical Interventions in Colorblind Teaching Practices, in Seeing Race Again. Countering Colorblindness across the Disciplines 365-366*

[11] Tukufu Zuberi, *Deracializing Social Statistics:Problems in the Quantification of Race,* 176

Appendix on Implementing District Standards

The Unit uses all of the Common Core Math Standards for Practice as well as several content standards for High School Statistics and Probability

CCSMATHPRACTICE MP1 Make sense of problems and persevere in solving them

CCSMATHPRACTICE MP2 Reason abstractly and quantitatively

CCSMATHPRACTICE MP3 Construct viable arguments and critique the reasoning of others.

CCSMATHPRACTICE MP4 Model with mathematics

CCSMATHPRACTICE MP5 Use appropriate tools strategically.

CCSMATHPRACTICE MP6 Attend to precision.

CCSMATHPRACTICE MP7 Look for and make use of structure.

CCSMATHPRACTICE MP8 Look for and express regularity in repeated reasoning.

CCSS.MATH.CONTENT.HSS.ID.A.1Represent data with plots on the real number line (dot plots, histograms, and box plots).

CCSS.MATH.CONTENT.HSS.ID.A.2Use statistics appropriate to the shape of the data distribution to compare center (median, mean) and spread (interquartile range, standard deviation) of two or more different data sets.

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

CCSS.MATH.CONTENT.HSS.IC.B.3Recognize the purposes of and differences among sample surveys, experiments, and observational studies; explain how randomization relates to each.

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