



Working with the Lowest Third in Senior Year: Statistics as an Alternative to Developmental Math

Critical Issues in Mathematics Education 2015:
Developmental Mathematics: For Whom? Toward What Ends?

Mathematical Sciences Research Institute

Berkeley, CA

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Math for America

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School Profile:

- Small public high school in East Harlem
- Title I
- 61% Hispanic, 31% Black
- 94% enter the school below grade level in Math

previously *SINI* list: low State math exam scores

Current Math Sequence

9th grade: Algebra (98% pass State Regents Exam)

10th grade: Geometry

11th grade: Algebra II & Trigonometry

12th grade: AP Calculus / PreCalculus / *Lowest third: Statistics*



*Most who attend college
end up in developmental math*

12th Grade Statistics

- Aligned to college curriculum
- Fresh perspective: different branch of math
- Real data
- Real world applications motivate learning

Students discuss the value of Statistics

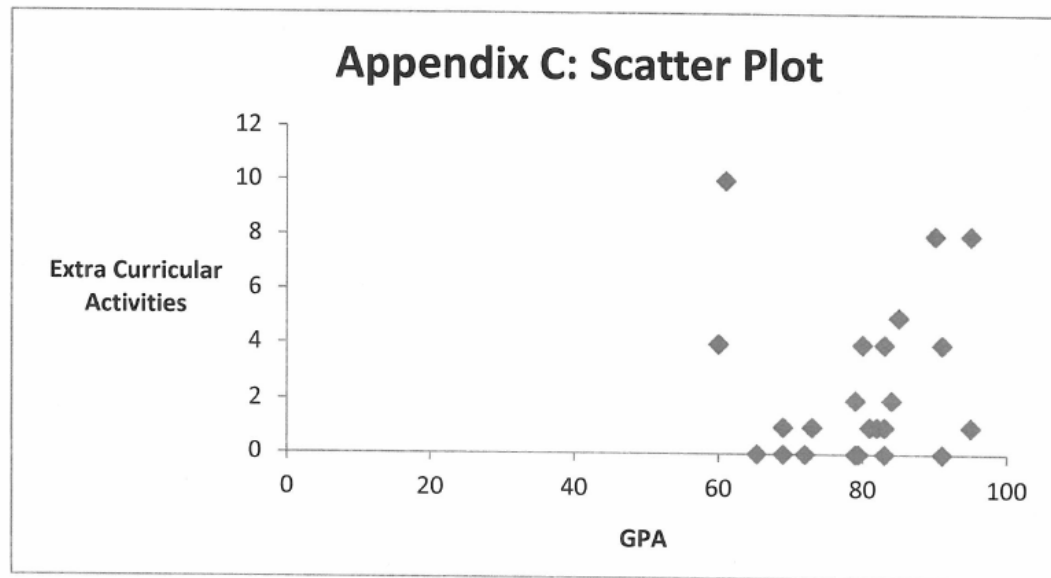


The Research Process

- Quantitative and nominal variables
- Inferential Statistics
- Experimental design
- 2 independent bivariate research projects

Quantitative Variables

- Students pose questions
- Design surveys
- Represent data: e.g. scatter plots



**Student
Work**

Nominal Variables

Census Letter Project

- Differentiate race & ethnic origin
- Write letters to U.S. Census Bureau, critiquing questions



Student
Work

Figure 1.
**Reproduction of the Questions on
Hispanic Origin and Race From**

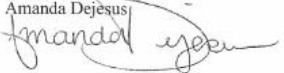
1966 1st Avenue Apt #2C
New York, NY 10029
October 7, 2010

Frank A. Vitrano
United States Department of Commerce
Economics and Statistics Administration
Washington, D.C 20233-0001

Dear Mr. Frank A. Vitrano,

I am Amanda DeJesus and I am currently a senior in Park East High School. One of my classes that I am taking is called College Statistics and we were assigned a project on the U.S Census. Now I know what a U.S Census is but I never knew it would be so difficult to pick and answer for a question that being asked of us. Now I'm not writing this letter to congratulate you on how wonderful of a job you put this Census together, but I'm also not here to be rude and obnoxious on my feelings on the Census form. I took it on my best interest to express some of my concerns.

I am from a Hispanic origin (Puerto Rican & Cuban). My teacher included some of the 1990, 2000, & 2010 Census questions that were asked. Now if you notice sometimes on the Hispanic origin question, you are only allowed to pick one now why is that? Which one would I pick? I think you should give people the opportunity to pick more than one chose that applies to them. Now as for the race question. I didn't like the fact that I sat there confused and frustrated when I came across the question on race. In order to really find out what race I am, I would have to trace back my ancestors' and hey who has time to do that now-a-days right? I don't want to be pressured to pick a race that I'm not. To me if a person has to do this there's a dilemma that needs to be fixed promptly. If people are picking a race that they aren't you have false information. I hope that you fix some of the issues because I know issues like the one's I had are rising concerns for people in the United States. Maybe you should give a little brief history on how people who come from a Hispanic origin can be White, African American or even Indian. Hope all goes well in the nearby future & when I do my census form I won't go through the same problems I dealt with before.

Sincerely yours,
Amanda Dejesus


Source: U.S. Census Bureau, 2010 Census questionnaire.

Class Visit: Chief, Racial Statistics Branch & Associate Director, 2020 Census

Dear census makers

I still fail to realize why Spanish, Hispanic, and Latino fall under the ethnic category. Although it was recently explained, I still feel it was wrong. As a young Puerto Rican, I'm highly upset with the way you had purposed the races. I am much as you and it is wrong to place us under a different category. If that's how you honestly feel then that is your opinion. In my opinion and many others if us the people of Spanish decent fall under the category of ethnicity, shouldn't "black" citizens fall under ethnicity. If your doing this based off slavery in Europe, Latinos and blacks were both abused so the white nation due to the fact they were open to exploring and felt the need to kill and abused anyone who is not of there decent.

As for trying to really make citizens take your census, you shouldn't follow them around or call there phones at all hours of the day. If they did not answer the next call, you think harassment will make them all citizens are open to freedom choice, correct me if I am wrong. We as the citizens aren't obligated to take such test or survey we feel isn't going to benefit us in any way possible. As for the 1990 census you had sent out did not allow a citizen to have two or even more races. Not everyone is one race, not all people are familiar with the terms American native, or Hawaiian native. So force yourself to receiving no response, or a response error. But you had corrected this in correction and progressed better towards the year 2000 and 2010. I'm hoping you realize by the changes you make in 2020 will be putting Hispanic, Latino, and Spanish decent will fall under a race. If not the citizens will continue to put it under race.

Inferential Statistics

correlation, t-test, chi square

SSx:

X	$x - \bar{x}$	x^2
2	2-1=1	(1) ² =1
1	1-1=0	(0) ² =0
0	0-1=-1	(-1) ² =1

$\bar{x} = \frac{\sum x}{N} = \frac{(2+1+0)}{3} = \frac{3}{3} = 1$

SSx = 2

SSy:

Y	$y - \bar{y}$	y^2
2	2-3=-1	(-1) ² =1
2	2-3=-1	(-1) ² =1
5	5-3=2	(2) ² =4

$\bar{y} = \frac{\sum y}{N} = \frac{(2+2+5)}{3} = \frac{9}{3} = 3$

SSy = 6

SPxy:

xy
(1)(1)=1
(0)(1)=0
(1)(2)=2

SPxy = -3

$r = \frac{SPxy}{\sqrt{SSx \cdot SSy}} = \frac{-3}{\sqrt{2 \cdot 6}} = -0.866 = \text{obtained } r$

Significance

obtained $r = .866$ $.866 < .997$
df = $n - 2 = 3 - 2 = 1$ no significant relationship
critical $r = .997$ $r(1) = -.866, p \rightarrow .05$

Computation by hand:
Pearson Correlation Coefficient
& evaluation of significance

Student
Work

Experimental Design



Hypothesis Good Friday & Ron-Nisha.

There is a relationship btw number of hrs a person plays video games & Amount of friends they have.

Reason

The more hours a person plays video games the less social they are ^{with} other people.

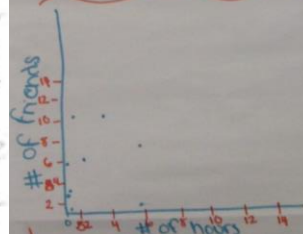
Variables

- Number of hours person plays video games
- Amount of friends they have

Table

# of hours person plays video games	Amount of friends they have
2	10
5	10
6	10
5	10
0	10
0	10
0	10
0	10
0	10
0	10

Scattered Plot



Interpretation

There is a ^{NOT} relationship btw number of hours a person plays video games & Amount of friends a person has (No Correlation)

Significance

obtained $r = .152$ $.152 < .666$
 $df = n - 2 = 9 - 2 = 7$ no significant relationship
 critical $r = .666$ $r(7) = .152, p > .05$

Theory

I think there's no relationship btw the two variables because it varies person to person.

Explain in detail how a
 The researcher
 common cold
 be the exper
 they will get
 & control group
 doesn't work. I
 the control g

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 and they will
 + cold-eze
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Student Work

Correlation Research Project

- Investigate 2 quantitative variables
- Design survey & collect data
- Calculate Pearson Correlation Coefficient
- Write formal research paper in APA format
- Orally present/defend results

Past Student Research Questions

- Do people who cheat on tests also cheat in relationships?
- Are there higher pass rates in smaller classes?
- What is the correlation between age and total number of times in love?

- d. Number of people actually included in the sample: $N = \frac{70 - 13}{(part\ b - part\ c)} = 57$
- e. State your hypothesis and reason.

AFTER – INTERPRETATION & THEORY

For the first study the researcher believes the results came out this way because of the way the participants took the meaning of love into consideration. It was the issue of operational definition when the researcher believed to think that the participants would understand love the way the researcher does. The theory is there are people who feel comfortable with their significant other but feel like they should hold back for what they want to say about themselves. Their way of expressing their love and emotion depends on the way they see themselves.

For the second study the researcher believes that the results came out this way because this time the participants understood the meaning of love and what was actually considered to be counted as 'love'. Yet at the same time the edits of the actual questions made more sense for the data to be more reliable and understandable for the participants to be more honest. The theory is that now possibly there isn't a deeper understanding in the relationships but as well to know that sometimes letting go of the past may actually help for future relationships.

- h. Go back and fill in the interpretation and theory.

$$\begin{aligned} &= r^2 \cdot 100 \\ &= .7^2 \cdot 100 \\ &= 49\% \end{aligned}$$

Correlation Research Project

**Student
Work**

Chi Square Research Project on a Stereotype

- Select a stereotype, split into 2 nominal variables
- Collect data
- Compute chi square
- Write formal research paper in APA format
- Orally present/defend results

Appendix C: Table

Frequency of Music Preference Among Blacks and Non Blacks

	<u>Enjoy rap</u>	<u>Does not enjoy rap</u>
Blacks	14	1
Non Blacks	12	12

$\chi^2 (1, N = 39) = 7.80, p < .05$

Chi Square Research Project on a Stereotype

**Student
Work**

Explicitly Teaching Non Cognitive Skills

Obtain an envelope. Put your home address as both addresses (the return address and the recipient's address). Place a stamp on the envelope. Mail it to yourself. When you receive the envelope back in the mail, tape or staple it on the next page. (Note: it should be postmarked to indicate that it actually went through the mail.)

FORMAT TO ADDRESS AN ENVELOPE

YOUR NAME
STREET ADDRESS (STREET NUMBER & NAME, & POSSIBLY APT.)
CITY, STATE AND ZIP CODE



NAME OF RECIPIENT
COMPANY NAME
STREET ADDRESS (STREET NUMBER & NAME, & POSSIBLY APT.)
CITY, STATE AND ZIP CODE

**Student
Work**

Outcomes

- 97% of students pass the college-aligned Statistics course
- Most who attend college end up in developmental math
- Students who take Statistics in college usually report success

Skills Acquired

- computation of inferential Statistics by hand
- identification of bias
- contextual evaluation of the appropriate Statistic
- experimental design
- develop hypotheses and draw conclusions
- data collection
- literature review
- bivariate research papers in APA format
- present and defend original research
- noncognitive skills

Remaining Questions

- Are my students college ready?
- Should I teach seniors Statistics or re-teach basic skills they have seen throughout their schooling?
- Is Statistics a meaningful alternative to developmental math, as basic Algebra is not requisite skill?