How is Your Gender Represented?

I. UNIT OVERVIEW & PURPOSE:
This unit explores issues of gender representation in the media and in parliamentary bodies worldwide.

II. UNIT AUTHOR:
Sue Jenkins, St. Catherine's School

III. COURSE:
Mathematical Modeling: Capstone Course

IV. CONTENT STRAND:
Data Analysis and Probability

V. OBJECTIVES:
Students will:

- Discuss and debate gender issues related to media and political power.
- Create statistical analyses of those issues.

VI. MATHEMATICS PERFORMANCE EXPECTATION(s):
MPE. 1 Solve practical problems involving rational numbers (including numbers in scientific notation), percents, ratios, and proportions.
MPE. 2 Collect and analyze data, determine the equation of the curve of best fit, make predictions, and solve real-world problems using mathematical models. Mathematical models will include polynomial, exponential, and logarithmic functions.
MPE. 22 Analyze graphical displays of univariate data, including dotplots, stemplots, and histograms, to identify and describe patterns and departures from patterns, using central tendency, spread, clusters, gaps, and outliers. Use appropriate technology to create graphical displays.

VII. CONTENT:
Students will investigate gender representation in the media, in the United States Congress, and in international parliamentary bodies.

VIII. REFERENCE/RESOURCE MATERIALS:
Students will require TI-84 (or comparable) calculators, computer access with internet capabilities, and access to a printer.

IX. PRIMARY ASSESSMENT STRATEGIES:

- Student-created Excel spreadsheets with charts
- Teacher-created worksheets (provided in this unit)

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X. EVALUATION CRITERIA:
Rubrics are attached.

XI. INSTRUCTIONAL TIME:
Three 90-minute block classes. Lesson One, two blocks; Lesson Two, one block.

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Lesson 1 How Does the U.S. Media Represent You?

Mathematical Objective
Students will use data analysis to analyze the representation of the sexes in magazine ads over a forty-year period.

Mathematics Performance Expectation
MPE. 8 Compare distributions of two or more univariate data sets, analyzing center and spread (within group and between group variations), clusters and gaps, shapes, outliers, or other unusual features.
MPE. 22 Analyze graphical displays of univariate data, including dotplots, stemplots, and histograms, to identify and describe patterns and departures from patterns, using central tendency, spread, clusters, gaps, and outliers. Use appropriate technology to create graphical displays.

Related SOL

PS.1 The student will analyze graphical displays of univariate data, including dotplots, stemplots,and histograms, to identify and describe patterns and departures from patterns, using central tendency, spread, clusters, gaps, and outliers. Appropriate technology will be used to create graphical displays.

PS.3 The student will compare distributions of two or more univariate data sets, analyzing center and spread (within group and between group variations), clusters and gaps, shapes, outliers, or other unusual features.

NCTM Standards

- Display and discuss bivariate data where at least one variable is categorical.
- Solve problems that arise in mathematics and in other contexts.
- Communicate mathematical thinking coherently and clearly to peers, teachers, and others.
- Understand how mathematical ideas interconnect and build on one another to produce a coherent whole.
- Recognize and apply mathematics in contexts outside of mathematics.
- Create and use representations to organize, record, and communicate mathematical ideas.
- Use representations to model and interpret physical, social, and mathematical phenomena.

Materials/Resources

- TI-84 Calculators (or comparable model) are needed for computations.
- Computers with Microsoft Office (or comparable) software, access to a printer, and Internet access are needed.

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- The original study from which this data is taken can be found at http://virtualworker.pbworks.com/f/Advertising%20gender%20roles.pdf
- Student Worksheets are provided, including a "How To" for the chi-square test.
- Data Sheets (data presented in numerically) are provided for students.
- Data Sheets (data presented in percentages) are provided for teachers.
- Teachers' Solution Sheets for both worksheets and Excel Charts are provided.
- Rubric for grading students' worksheets and Excel products is provided.

Assumption of Prior Knowledge

- Students should have completed Algebra II.
- Students should be familiar with TI-83 or TI-84 (or comparable) graphing calculators.
- Students should be familiar with entering data and creating bar graphs in Excel or comparable utility.
- Students should be familiar with chi-square analyses.
- Students should be willing to engage in an open and honest dialogue about some potentially difficult issues.

Introduction: Setting Up the Mathematical Task

In this lesson, students will investigate common portrayals of males and females in mainstream media advertisements, specifically popular magazines. The objective is to encourage students to consider how media-represented stereotypes of femininity and masculinity may be affecting their beliefs. To that end, they will analyze data from a study that was presented as a white paper at the *International Communication Association* national conference in 2009. That data furthers the techniques and findings of well-known researchers in the field, Soley, Reid, and Kurzbard.

- The teacher may wish to collect a variety of magazines that are popular with students.
- Since this can be a sensitive topic, teachers may want to notify parents that issues of gender stereotyping will be discussed in class.
- Note that a seemingly excessive statistic of 10 hours and 45 minutes of media consumption a day is central to the message in the video. Since students might question that amount (as they should!), it will be helpful to be prepared to discuss the origin of that statistic. The data supporting that statistic, which is based on age 8 to age 18, involves multi-tasking while exposed to media, a point that is not clearly made in the video. The average time per day spent consuming one medium at a time is estimated at 7 hours, 38 minutes. The study on which those statistics are based can be found at http://www.kff.org/entmedia/upload/8010.pdf . Some interesting conversations may be generated around these statistics and how they're presented in the movie.
- It is difficult to find meaningful data that accurately compares the representation of men and women in the media. The statistics provided in this lesson are from a 2004 study conducted by two post-doctoral students, who followed the criteria established in earlier studies by Soley &

Reid, 1988 and Soley & Kurzbard, 1986. The magazines were grouped according to readership. "General Interest" magazines examined were *Newsweek* and *Time*; "Women's" magazines examined were *Cosmopolitan* and *Redbook*; "Men's" magazines examined were *Playboy* and *Esquire*.

- The appearances of males and females in each ad were coded and categorized in one of four ways: 1) Demure, 2) Suggestive, 3) Partially Clad, and 4) Nude. Ads were classified as "Female-only ads," "Male-only ads," "Ads containing both sexes (females)" in which females were coded," and "Ads containing both sexes (males)" in which males were coded."

Student Exploration #1

- Have students watch the 8 minute trailer from *Miss Representation* at http://vimeo.com/28066212
- Allow about 5-10 minutes for students to discuss the video with a partner or small, self-selected groups. Provide magazines such as *Esquire*, *Glamour*, and *Vogue* (or whatever magazines students are interested in) so that students can examine articles and advertisements with a critical eye as they're thinking through the video and making their comments to one another.
- Bring the group back together for roughly 10-15 minutes for students to share their thoughts on the video and their personal experiences/views with the representation of males/females in our culture. Depending on the dynamics of the class, this may well be a sensitive process. Some students may be very uncomfortable having an open discussion concerning the content of the video. It may be advisable to separate the class into single gender groups at this point.
- Some discussion questions to consider: Were you surprised by what you saw? Do you agree with the statistic that teenagers spend 10 hours and 45 minutes of media consumption per day? How many hours a day do you believe you and your friends are engaged with media? What seemed to be the point of the trailer? How do you believe that society depicts men and women in the media? Do you think those depictions affect the way young men and women feel about themselves and others? If so, how? Did you see any suggestive headlines and/or articles in these magazines? If so, what do you think are the effects on young men and women?
- Ask students what questions they have about the video or gender representation in general.
- Give out Worksheet #1. Allow about 10 minutes for students to complete it individually.
- Give out data sheets, and carefully explain the criteria by which the data were categorized. Encourage students to "think like researchers," to reduce the likelihood of overreaction to the content of the data.
- Discuss in a large group how the data would best be presented. The objective is to lead students toward the use of a series of bar graphs in percentage form. Allow about 10 minutes for this process.
- Have students work in groups of two (or no more than three) to enter the data into Excel, convert data to percentages, and create and print bar graphs. Allow about 45 minutes for this process.

- Have students turn in Worksheet #1 and their bar graphs. They will need this information for Student Exploration #2.

Student Exploration #2

- Guide students through the process of creating a chi-square matrix and statistical analysis. Allow about 20 minutes for this process, unless students have no experience. In that case, an hour is much more feasible. A help sheet is located at the end of this lesson, titled: *Students' Chi-Square Test of Independence Reference Sheet.*
- Students will answer questions on the provided worksheet and create a Word document into which they paste their Excel Charts for each category. Allow about 50 minutes.
- They will print and turn in their worksheets and their Excel Charts, labeled accurately according to codes and types of ads. Allow about 10 minutes.
- Bring the class back together for an approximately 10-minute final discussion of their observations and their sense of what they observed.

Extensions and Connections

- Students might be interested in conducting an informal survey at their schools to determine how many hours their friends spend engaged with media.
- Students may want to collect data using their own magazines. Sample sizes will be small, but that's part of their learning curve. Care must be taken to define categories quantitatively.
- Students could collect data at http://bechdeltest.com/ and analyze it in a similar fashion used in this lesson. The *Bechdel Test Movie List* is an informal website that collects data provided by readers. The three criteria for being added to the list are: 1. A movie must have at least two named women in it 2) who talk to each other 3) about something besides a man. Its contents often change daily, so data would have to be collected all in one day, at one sitting. Movies are grouped by year. See VA SOL AFDA.8
- Although existing data are difficult (if not impossible) to locate, students could have discussions around other types of media depictions, including race and even age.

Strategies for Differentiation

- ELL teachers may be needed to provide a bridge between the students' primary languages and the nuances of advertisement and mathematical terminology.
- Visual learners will benefit from the graphics they create in Excel.
- Learning disabled students may need further support in working with Excel.
- Auditory learners may enjoy the partner and group discussions.
- High ability students may benefit from pursuing some of the above extensions.

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Student Worksheet #1: Gender Representation in the Media

Name:

Studies have shown that social situations presented in the media (television, magazines, movies, the Internet, etc.) can influence or even distort your self-perceptions and beliefs. The effects of hearing a repeated message are long-term and cumulative;[1] in other words, if someone tells you or shows you a message often enough, it becomes a part of your belief system. You might not even know why or how you believe a message; you just know that you believe it. This worksheet will be turned in to your teacher.

1. How do you think the media depicts people of your gender, (i.e. realistically, inappropriately, in an exaggerated way, etc.)? Why do you believe that?

2. How do you think the media depicts people that are not your gender, (i.e. realistically, inappropriately, in an exaggerated way, etc.)? Why do you believe that?

3. Did the video clip bring anything new to your attention about the media's representation of the genders? If so, what? If not, what were your observations about the clip?

[1] **Carpenter, C. and Edison, A. "Taking It All Off Again: The Portrayal of Women in Advertising Over The Past Forty Years"** *Paper presented at the annual meeting of the International Communication Association, Sheraton New York, New York City, NY Online* <**PDF**>. 2009-05-25 from http://www.allacademic.com/meta/p14163_index.html

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Student Worksheet #2: Gender Representation in Magazines

Name:

1. Look over your "General Interest" magazine ad charts. Do you see any changes over the three years measured that you consider significant regarding "Partially-Clad" for women in the ads? Which graph are they in? Do the same for statistics for men. Give reasons for both.

2. Look over your "Women's Magazine Ads" charts. In which category do you see the greatest change? Which gender seems to be changing the most and how?

3. Look over your "Men's Magazine Ads" charts. In which categories do you see the greatest changes? Which gender is changing the most and how?

4. Use your calculator to create a chi-square test for the category of "Women's Magazine Ads with Women-Only." (If you need help during this process, use the *Students' Chi-Square Test of Independence Reference Sheet*.) Write your results below. What do these values indicate?

5. Use your calculator to find chi-square for each entry in the matrix (same category as in #4). Write the matrix values below. Explain your observations, using proper statistical terminology.

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6. Pick another category and perform a chi-square test on it in the same manner as you did in #4 and 5 above. Explain your observations, using proper statistical terminology.

7. What overall percent of women in 1964 ads are presented in demure dress? Remember to include only women's ads and include your computations.

8. What overall percent of women in 2004 ads are presented in demure dress? Remember to include only women's ads and include your computations.

9. What do you conclude from the percentages you discovered in #7 and 8?

10. There are many ways in which each gender is depicted in the media, including print, television, movies,and internet media. Do you consider them realistic depictions? Why or why not? Give examples.

11. In what ways might gender depictions in the media affect an individual's identity and body image? Are girls the only gender affected? Explain.

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Student Data Tables: Raw Data

Table One: Advertisements found in General Interest Magazines

Year	1964	1984	2004
Female-only ads	**No. of ads = 11**	**No. of ads = 27**	**No. of ads = 21**
Demure	11	21	16
Suggestive	0	2	1
Partially-Clad	0	2	4
Nude	0	2	0
Male-only ads	**No. of ads = 72**	**No. of ads = 68**	**No. of ads = 44**
Demure	72	60	44
Suggestive	0	1	0
Partially-Clad	0	5	0
Nude	0	2	0
Ads with both sexes (females)	**No. of ads = 44**	**No. of ads = 45**	**No. of ads = 40**
Demure	41	38	30
Suggestive	0	4	8
Partially-Clad	2	3	1
Nude	1	0	1
Ads with both sexes (Males)	**No. of ads = 44**	**No. of ads = 45**	**No. of ads = 40**
Demure	43	41	39
Suggestive	0	0	1
Partially-Clad	1	4	0
Nude	0	0	0

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Table Two: Advertisements found in Women's Magazines

Year	1964	1984	2004
Female-only ads	**No. of ads = 76**	**No. of ads = 199**	**No. of ads = 219**
Demure	44	123	95
Suggestive	8	24	74
Partially-Clad	18	32	23
Nude	6	20	27
Male-only ads	**No. of ads = 9**	**No. of ads = 20**	**No. of ads = 22**
Demure	8	16	18
Suggestive	0	0	1
Partially-Clad	1	4	1
Nude	0	0	2
Ads with both sexes (females)	**No. of ads = 29**	**No. of ads = 65**	**No. of ads = 58**
Demure	25	46	31
Suggestive	2	6	18
Partially-Clad	2	11	6
Nude	0	2	3
Ads with both sexes (Males)	**No. of ads = 29**	**No. of ads = 65**	**No. of ads = 58**
Demure	28	55	48
Suggestive	0	1	4
Partially-Clad	1	9	4
Nude	0	0	2

Table Three: Advertisements found in Men's Magazines.

Year	1964	1984	2004
Female-only ads	**No. of ads = 26**	**No. of ads = 29**	**No. of ads = 40**
Demure	11	7	3
Suggestive	7	7	10
Partially-Clad	2	4	20
Nude	6	11	7
Male-only ads	**No. of ads = 54**	**No. of ads = 95**	**No. of ads = 88**
Demure	50	79	80
Suggestive	0	1	2
Partially-Clad	1	6	6
Nude	3	9	0
Ads with both sexes (females)	**No. of ads = 46**	**No. of ads = 97**	**No. of ads = 36**
Demure	27	64	7
Suggestive	6	7	12
Partially-Clad	10	20	14
Nude	3	6	3
Ads with both sexes (Males)	**No. of ads = 46**	**No. of ads = 97**	**No. of ads = 36**
Demure	43	85	24
Suggestive	0	0	0
Partially-Clad	2	8	8
Nude	1	4	4

Data Tables (Teacher Resource)

Table One: Advertisements found in General Interest Magazines Classified by Percents

Year	1964	1984	2004
Female-only ads	**No. of ads = 11**	**No. of ads = 27**	**No. of ads = 21**
Demure	100%	77.8%	76.2%
Suggestive	0%	7.4%	4.8%
Partially-Clad	0%	7.4%	19.0%
Nude	0%	7.4%	0%
Male-only ads	**No. of ads = 72**	**No. of ads = 68**	**No. of ads = 44**
Demure	100%	88.2%	100%
Suggestive	0%	1.5%	0%
Partially-Clad	0%	7.4%	0%
Nude	0%	2.9%	0%
Ads with both sexes (females)	**No. of ads = 44**	**No. of ads = 45**	**No. of ads = 40**
Demure	93.2%	84.4%	75.0%
Suggestive	0%	8.9%	20%
Partially-Clad	4.4%	6.7%	2.5%
Nude	2.3%	0%	2.5%
Ads with both sexes (Males)	**No. of ads = 44**	**No. of ads = 45**	**No. of ads = 40**
Demure	97.7%	91.1%	97.5%
Suggestive	0%	0%	2.5%
Partially-Clad	2.3%	8.9%	0%
Nude	0%	7.4%	0%

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Table Two: (Teacher Resource) Advertisements found in Women's Magazines Classified by Percents

Year	1964	1984	2004
Female-only ads	**No. of ads = 76**	**No. of ads = 199**	**No. of ads = 219**
Demure	57.9%	61.8%	43.4%
Suggestive	10.5%	12.1%	33.8%
Partially-Clad	23.7%	16.1%	10.5%
Nude	7.9%	10.0%	12.3%
Male-only ads	**No. of ads = 9**	**No. of ads = 20**	**No. of ads = 22**
Demure	88.9%	80%	81.8%
Suggestive	0%	0%	4.5%
Partially-Clad	11.1%	20%	4.5%
Nude	0%	0%	9.1%
Ads with both sexes (females)	**No. of ads = 29**	**No. of ads = 65**	**No. of ads = 58**
Demure	86.2%	70.8%	53.4%
Suggestive	6.9%	9.2%	31.0%
Partially-Clad	6.9%	16.9%	10.3%
Nude	0%	3.1%	5.2%
Ads with both sexes (Males)	**No. of ads = 29**	**No. of ads = 65**	**No. of ads = 58**
Demure	96.6%	84.6%	82.8%
Suggestive	0%	1.5%	6.9%
Partially-Clad	3.4%	13.8%	6.9%
Nude	0%	0%	3.4%

Table Three: (Teacher Resource) Advertisements found in Men's Magazines Classified by Percents

Year	1964	1984	2004
Female-only ads	**No. of ads = 26**	**No. of ads = 29**	**No. of ads = 40**
Demure	42.3%	24.1%	7.5%
Suggestive	26.9%	24.1%	7.5%
Partially-Clad	7.7%	13.8%	50.0%
Nude	23.1%	37.9%	17.5%
Male-only ads	**No. of ads = 54**	**No. of ads = 95**	**No. of ads = 88**
Demure	92.6%	83.2%	90.9%
Suggestive	0%	1%	2.3%
Partially-Clad	1.9%	6.3%	6.8%
Nude	5.5%	9.5%	0%
Ads with both sexes (females)	**No. of ads = 46**	**No. of ads = 97**	**No. of ads = 36**
Demure	58.7%	66.0%	19.4%
Suggestive	13%	7.2%	33.3%
Partially-Clad	21.7%	20.6%	38.9%
Nude	6.5%	6.2%	8.3%
Ads with both sexes (Males)	**No. of ads = 46**	**No. of ads = 97**	**No. of ads = 36**
Demure	93.5%	87.6%	66.7%
Suggestive	0%	0%	0%
Partially-Clad	4.3%	8.2%	22.2%
Nude	2.2%	4.1%	11.1%

Students' Chi-Square Test of Independence Reference Sheet

The basic idea behind a chi-square test is to examine data to determine whether a category (for example, "partially clad") has significantly changed from measurement to another (say from 1984 to 2004).

- We make the assumption that there is *no change*, which is called our "*null hypothesis*." We then investigate to determine if there is sufficient evidence to reject our null hypothesis. This is somewhat similar to our legal system, in which an individual is believed to be innocent, and we look for enough evidence to find the person guilty beyond a reasonable doubt.
- On the calculator, we perform a χ^2 test that computes the "expected" values for each cell in the matrix. In other words, we're computing the matrix that represents what would occur if strict probability drove the statistics, which represents our "null hypothesis."
- Finally, we compute χ^2 for each cell in the matrix. Individual cells' values may then be examined to determine which data are not due to random chance.

We're going to walk through a χ^2 test on the data below, which are quantities of female-only ads found in men's magazines. Work through the steps, and check your work with the results provided.

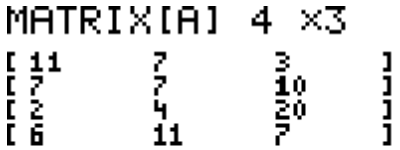
Year	1964	1984	2004
Female-only ads	**No. of ads = 26**	**No. of ads = 29**	**No. of ads = 40**
Demure	11	7	3
Suggestive	7	7	10
Partially-Clad	2	4	20
Nude	6	11	7

1. First, find the "degrees of freedom" value, labeled *df*. Subtract one from the number of rows of data (4), one from the number of columns of data (3), and multiply.

df = (no. of rows - 1)(no. of columns - 1) = 6

2. Use your calculator to compute a χ^2-test:

a. Enter the data above into a 4 by 3 matrix on your calculator. Use matrix [A]. The window will look like this, once you enter your data:



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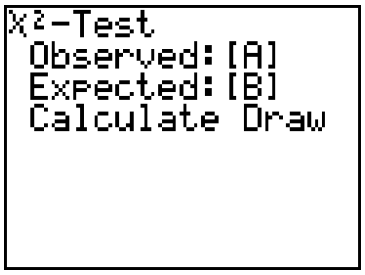
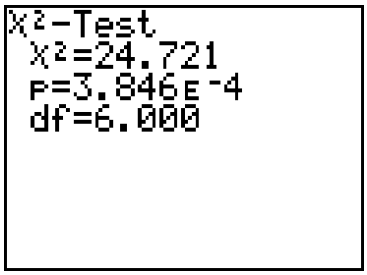
b. Go to STAT $\rightarrow$ TESTS $\downarrow \chi^2$ -Test. (This is choice "C" on the list.) It will look like this:



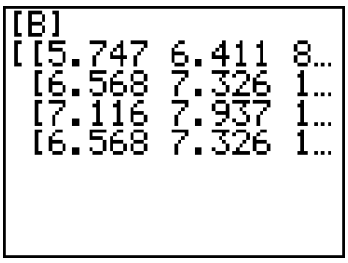
Be sure that your window looks exactly like the window at left. You may have to change to matrix A and B, as is shown at left. (Remember: matrix [A] is the location where you entered your data, and matrix [B] is the location where the expected results will be located after calculator computations.) Arrow down to "Calculate," and hit Enter.



At left are the results of your test.

- χ^2 is the sum of the ratio $\dfrac{(\text{observed - expected})^2}{\text{expected}}$
- p = the probability of the observed data occurring by random chance alone. Note how tiny it is. That indicates that the data is due to something other than random chance.
- df = degrees of freedom, which you computed in #1.

3. Go into "MATRIX" and bring up matrix [B]. It is the "expected" matrix and should look like this:



You can arrow to the right to see the values in the third column, which aren't immediately visible on the calculator screen.

4. Finally, you will compute, by hand (and computing on the calculator, of course), a matrix in which you use each entry in matrix [A] (remember: observed, which you entered into your calculator) and each entry in matrix [B] (remember: expected, which your calculator just computed for you) and perform the ratio below for each entry.

$$\frac{(\text{observed - expected})^2}{\text{expected}}$$

In other words, for the first (Row 1, Column 1) entry, compute: $\dfrac{(11-5.747)^2}{5.747} = 4.801.$

For the second (Row 1, Column 2) entry, compute: $\dfrac{(7-6.411)^2}{6.411} = .05411.$

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Complete all twelve entries and write them as a separate matrix. Your final matrix should contain the entries as follow: $\begin{bmatrix} 4.801 & 0.054 & 3.859 \\ 0.028 & 0.0145 & 0.001 \\ 3.678 & 1.953 & 7.486 \\ 0.049 & 1.843 & 0.954 \end{bmatrix}$ Note how large the value in the third row, third column cell is. That indicates that it is very unlikely that there would be a random event of 20 ads (out of 40) that show partially-clad women in the selected magazines. Hence, the number of partially-clad women in women's ads in men's magazines has increased significantly from 1984 to 2004, which is due to something other than random chance. The large cell values indicate a change from the observed to the expected counts, and they are absolute values, i.e. the change may be up or down. You need to refer to the original data to determine which directions occurred.

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Solution Key:

Student Worksheet #2: Gender Representation in Magazines

Name:

1. Look over your "General Interest" magazine ad charts. Do you see any changes over the three years measured that you consider significant regarding "Partially-Clad" for women in the ads? Which graph are they in? Do the same for statistics for men.

For women, demurely dressed models have decreased; partially-clad models have increased. In mixed ads, suggestively dressed models have increased.

For men, demurely dressed models have stayed about the same; other categories have stayed about the same.

2. Look over your "Women's Magazine Ads" charts. In which category do you see the greatest change? Which gender seems to be changing the most and how?

For women, demurely dressed models have decreased; suggestively dressed models have increased.

For men, demurely dressed models have stayed about the same; partially clad models increased in 1984, but dropped in 2004.

3. Look over your "Men's Magazine Ads" charts. In which categories do you see the greatest changes? Which gender is changing the most and how?

For women, demurely dressed models have dropped significantly; partially-clad models have increased drastically.

For men, demurely dressed models have stayed about the same; when the sexes are mixed, partially-clad and nude male models have increased.

4. Use your calculator to create a chi-square test for the category of "Women's Magazine Ads with Women-Only." [Steps: Enter the data into a 4x3 matrix. Go to STAT, Tests, χ^2-Test. Enter [A] under "Observed," [B] under "Expected," and "Calculate." Write your results below. What do these values indicate?

$\chi^2 = 43.21$; df = 6; p = 1.057×10^{-7}

Matrix:
$$\begin{bmatrix} 40.308 & 105.54 & 116.15 \\ 16.308 & 42.7 & 46.992 \\ 11.231 & 29.407 & 32.362 \\ 8.153 & 21.35 & 23.496 \end{bmatrix}$$

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Chi-square is large, indicating that the distributions are different than expected. The probability of getting the original data by random chance is close to zero.

5. Use your calculator to find chi-square for each entry in the matrix (same category as in #4). Write the matrix values below. Explain your observations, using proper statistical terminology.

$$\begin{bmatrix} .338 & 2.89 & 3.85 \\ 4.23 & 8.19 & 15.522 \\ 4.08 & .228 & 2.708 \\ .568 & .08 & .522 \end{bmatrix}$$

The data indicate that there is a significant increase in female-only advertisements in women's magazines in suggestively dressed models from 1964 to 2004.

6. Pick another category and perform a chi-square test on it in the same manner as you did in #4 and 5 above. Explain your observations, using proper statistical terminology.

Solutions will vary.

7. What overall percent of women in 1964 ads are presented in demure dress? Remember to include only women's ads.

159/232 = 68.5%

8. What overall percent of women in 2004 ads are presented in demure dress? Remember to include only women's ads.

182/414 = 44%

9. What do you conclude from those percentages?

The percentage of demurely dressed female models has decreased from 1964 to 2004.

10, 11. Responses will vary.

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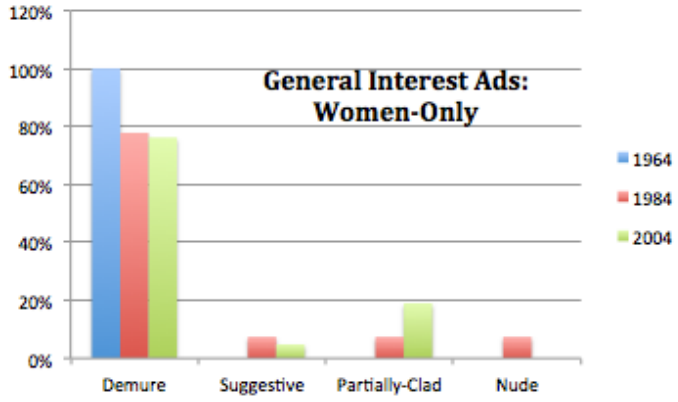
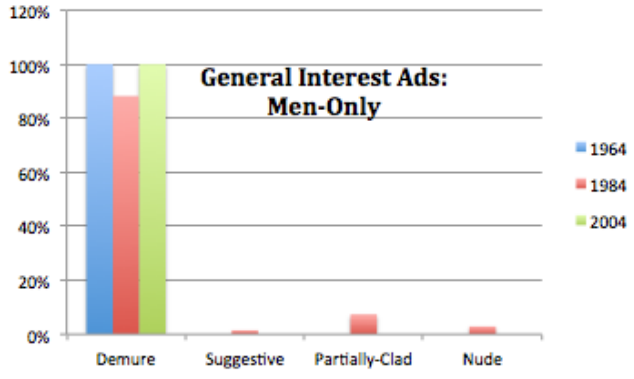
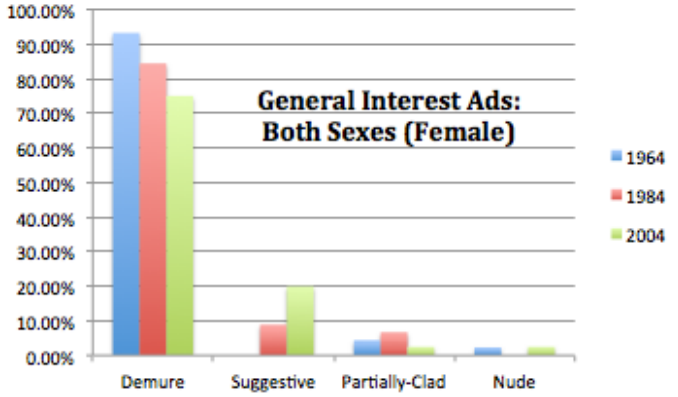
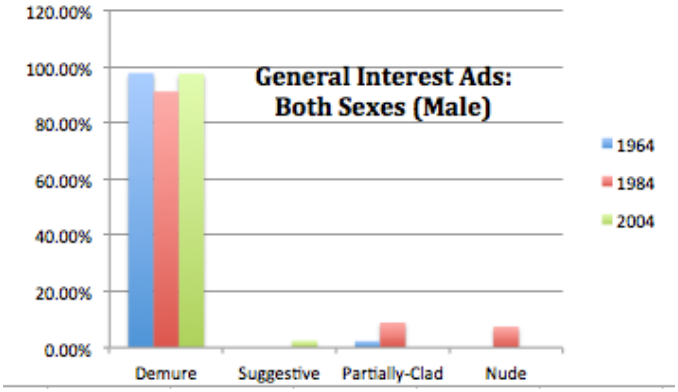
Solution Key: Excel Charts

I. General Interest Magazine Ads:

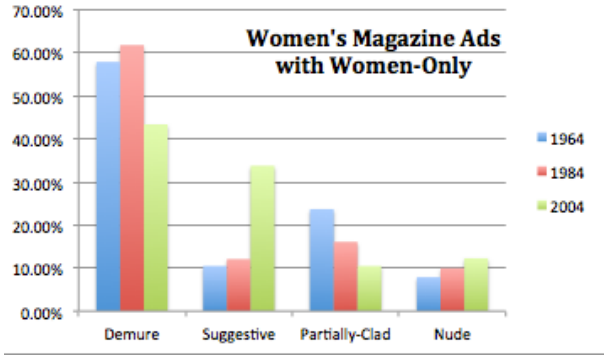


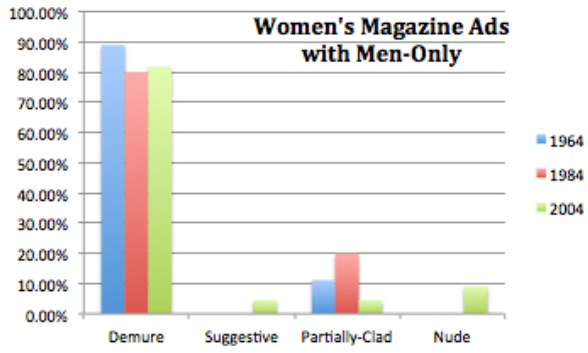






II. Women's Magazine Ads:





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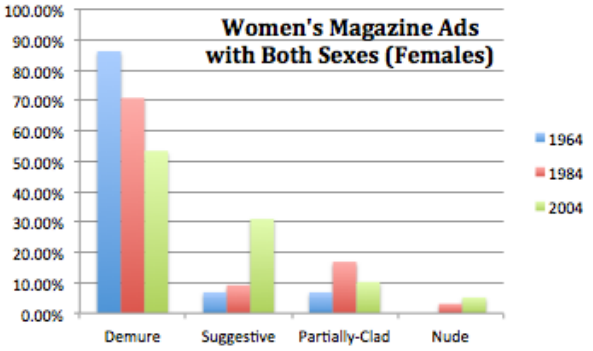
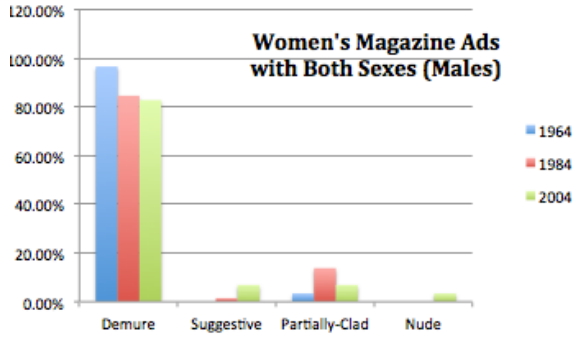
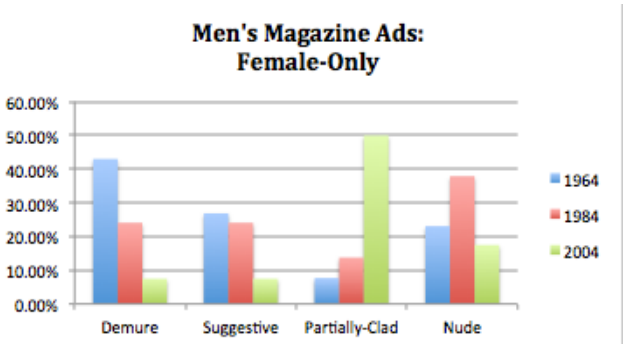
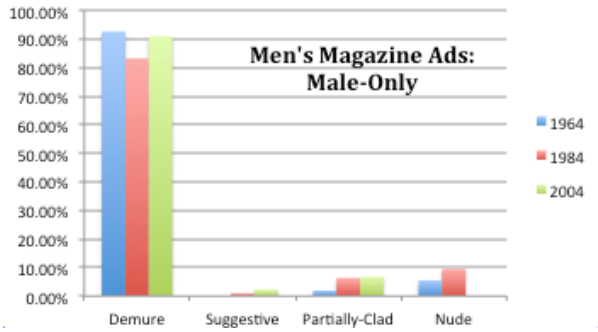
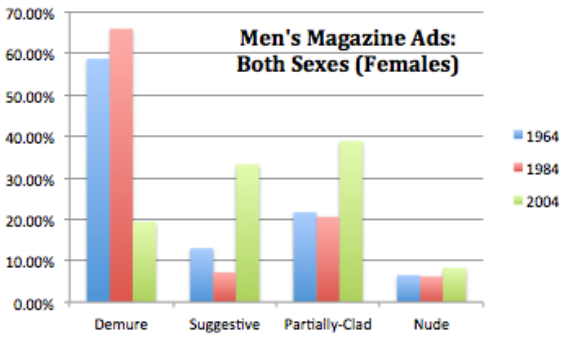


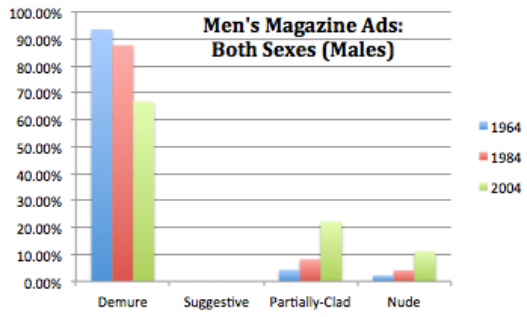


III. Men's Magazine Ads:









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Lesson One Scoring Rubric

	6 points	4 points	2 points	0 points	Total Points
Student participation in group discussions. (6 pts. total) Scores and comments:	Candid and appropriate discussion that is respectful of classmates' opinions.	Contributes rarely, but thoughtfully and appropriately.	Contributes candidly, but shows some lack of respect for others' opinions.	Shows complete lack of respect for others' opinions and/or makes no contributions whatever.	
Worksheet #1 (3 questions; points are per question w/ 18 pts. total) Scores and comments:	Answers are complete and thoughtful.	Answers are fragmented and brief.	A few words are written in each blank.	No answers are given.	
Worksheet #2 (11 questions; points are per question w/ 66 pts. total) Scores and comments:	Answers are complete. Required mathematics is correct.	Answers are complete, but mathematics is incorrect.	A few words are written in each blank and there is some math.	No answers are given.	
Excel Charts (12 charts; points are per pairs of charts, or essentially 3 points per chart w/ 36 pts. total) Scores and comments:	Complete and accurate charts.	Charts are numerically accurate, but no labels are included.	Charts lack some accuracy.	Charts are absent or inaccurate.	
Additional Comments:					Total out of 126:

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Lesson 2 Who's Running Congress?

Mathematical Objective

Students will use data analysis to better understand the numbers surrounding women's representation in the United States Congress. They will consider two or more models with which they may predict future representation of women in Congress.

Mathematics Performance Expectation
MPE. 2 Collect and analyze data, determine the equation of the curve of best fit, make predictions, and solve real-world problems using mathematical models. Mathematical models will include polynomial, exponential, and logarithmic functions.

Related SOL

AFDA.3 The student will collect data and generate an equation for the curve (linear, quadratic, exponential, and logarithmic) of best fit to model real-world problems or applications. Students will use the best fit equation to interpolate function values, make decisions, and justify conclusions with algebraic and/or graphical models.

NCTM Standards List all applicable NCTM standards related to each lesson. Example:

- For bivariate measurement data, be able to display a scatterplot, describe its shape, and determine regression coefficients, regression equations, and correlation coefficients using technological tools.
- Display and discuss bivariate data where at least one variable is categorical.
- Identify trends in bivariate data and find functions that model the data or transform the data so that they can be modeled.
- Solve problems that arise in mathematics and in other contexts.
- Communicate mathematical thinking coherently and clearly to peers, teachers, and others.
- Understand how mathematical ideas interconnect and build on one another to produce a coherent whole.
- Recognize and apply mathematics in contexts outside of mathematics.
- Create and use representations to organize, record, and communicate mathematical ideas.
- Use representations to model and interpret physical, social, and mathematical phenomena.

Materials/Resources

- TI-84 Calculators (or comparable model) are needed.
- Computers with Microsoft Office (or comparable software), access to a printer and the Internet are needed.
- Handout is provided at the end of the lesson.

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- Rubric is provided at the end of the lesson.

Assumption of Prior Knowledge

- Students should be familiar with TI-84 graphing calculators.
- Students should be familiar with entering data, creating a scatter plot chart, and finding a trendline in Excel.
- Students should be familiar with finding a trendline by hand.
- Students should have completed Algebra II.
- Students should be willing to engage in an open and honest dialogue about gender representation in the U.S. Congress.

Introduction: Setting Up the Mathematical Task

In this lesson, as a follow-up to gender representation in the media, students will analyze the percentage of women in the U.S. Congress from 1917 to the present on an annual basis as well as an overall average.

Student Exploration

- Have students watch the short video at http://www.youtube.com/watch?v=exUAUo5UcQY in which President Obama discusses the shortage of women in Congress. (1 minute)
- Bring students into a group discussion to consider what President Obama said in the video. Allow about 10 minutes for discussion.
- Some questions to pose are: Are you surprised that so few women are represented in the US Congress? Why do you believe that is true? As a male/female, how do you feel about that? Do you know when women were allowed membership in the Congress? If so, when? When were women allowed to vote in the US? Do you believe that women have that same right in all countries? What do you believe is the future of women's representation in the US Congress? Why does it matter?
- Ask students what questions they have about numbers of women in Congress.
- Direct students to the webpage representing the numbers of women in the US Congress since 1917 at http://www.cawp.rutgers.edu/fast_facts/levels_of_office/documents/cong.pdf (go to page 2 in that document). Note: Do not allow students to pull the data from Wikipedia, since it already computes percentages of women by year, and a part of this learning experience is to use Excel's computational capacity to find those percentages. An alternate approach to using the Internet is to print out the data sheet so that students have a hard copy of the data. (A hard copy of the data, retrieved from the above website, is included at the end of this lesson.)
- Have students enter their data into Excel, convert raw data to percentages, create a scatter plot, and fit a trendline with an identified (on the chart itself) linear equation. They will print their

results to be turned in at the end of this lesson. Allow about 30-45 minutes, depending on students' comfort levels with Excel.

- Hand out worksheet. Allow students to work in pairs.
- Per instructions on the worksheet, have students make a graph of data points between the years of **1993** to the present on graph paper and find a line of best fit. (They should be allowed to "eyeball" the line and write the equation by hand.) Allow about 20 minutes. An alternative to this approach would be to allow students to use their graphing calculators, particularly if time is an issue. The objective is to consider more recent data points and extrapolate based on their rate of change, rather than including all points since 1917. This graph will be turned in at the end of this lesson.
- Students will answer remaining questions on the provided worksheet, working in pairs. Allow about 30 minutes.
- Students will reconvene for a final discussion of their observations. Allow about 10 minutes.

Extensions and Connections

- Students might be interested in having their social studies teachers visit their mathematics class to discuss the historical events behind the statistics.
- Teachers who are comfortable with logistic curves could help interested students fit a logistic curve to the data. The best software for that process is Logger Pro, and most schools have a site license. That curve could be used to make more accurate predictions about when women might be equally represented in the U.S. Congress.
- An excellent extension would be to investigate the ranking of the percentage of women in the US Congress compared to percentages in other countries' parliaments. The US is, as of 2/1/13, ranked in 77th place. The data is located at http://www.ipu.org/wmn-e/classif.htm ; data could be collected from 1997 to the present.

Strategies for Differentiation

- ELL teachers may be needed to provide a bridge between the students' primary languages and the history of women in Congress.
- Visual learners will benefit from the graphics they create in Excel.
- Learning disabled students may need further support in working with Excel.
- Auditory learners may enjoy the partner and group discussions.
- High ability students may benefit from pursuing one of the above extensions.
- Students may wish to work individually.

Student data sheet for women's representation in the U.S. Congress

WOMEN IN THE U.S. CONGRESS 1917-2013

Please note: table for Congresses prior to the current one shows maximum number of women elected or appointed to serve in that Congress at one time. Some filled out unexpired terms and some were never sworn in.

CONGRESS	DATES	WOMEN IN SENATE	WOMEN IN HOUSE	TOTAL WOMEN
65th	1917-1919	0 (0D, 0R)	1 (0D, 1R)	1 (0D, 1R)
66th	1919-1921	0 (0D, 0R)	0 (0D, 0R)	0 (0D, 0R)
67th	1921-1923	1 (1D, 0R)	3 (0D, 3R)	4 (1D, 3R)
68th	1923-1925	0 (0D, 0R)	1 (0D, 1R)	1 (0D, 1R)
69th	1925-1927	0 (0D, 0R)	3 (1D, 2R)	3 (1D, 2R)
70th	1927-1929	0 (0D, 0R)	5 (2D, 3R)	5 (2D, 3R)
71st	1929-1931	0 (0D, 0R)	9 (5D, 4R)	9 (5D, 4R)
72nd	1931-1933	1 (1D, 0R)	7 (5D, 2R)	8 (6D, 2R)
73rd	1933-1935	1 (1D, 0R)	7 (4D, 3R)	8 (5D, 3R)
74th	1935-1937	2 (2D, 0R)	6 (4D, 2R)	8 (6D, 2R)
75th	1937-1939	2 (1D, 1R)[1]	6 (5D, 1R)	8 (6D, 2R)
76th	1939-1941	1 (1D, 0R)	8 (4D, 4R)	9 (5D, 4R)
77th	1941-1943	1 (1D, 0R)	9 (4D, 5R)	10 (5D, 5R)
78th	1943-1945	1 (1D, 0R)	8 (2D, 6R)	9 (3D, 6R)
79th	1945-1947	0 (0D, 0R)	11 (6D, 5R)	11 (6D, 5R)
80th	1947-1949	1 (0D, 1R)	7 (3D, 4R)	8 (3D, 5R)
81st	1949-1951	1 (0D, 1R)	9 (5D, 4R)	10 (5D, 5R)
82nd	1951-1953	1 (0D, 1R)	10 (4D, 6R)	11 (4D, 7R)
83rd	1953-1955	2 (0D, 2R)	11 (5D, 6R)[2]	13 (5D, 8R)[2]
84th	1955-1957	1 (0D, 1R)	16 (10D, 6R)[2]	17 (10D, 7R)[2]
85th	1957-1959	1 (0D, 1R)	15 (9D, 6R)	16 (9D, 7R)
86th	1959-1961	2 (1D, 1R)	17 (9D, 8R)	19 (10D, 9R)
87th	1961-1963	2 (1D, 1R)	18 (11D, 7R)	20 (12D, 8R)
88th	1963-1965	2 (1D, 1R)	12 (6D, 6R)	14 (7D, 7R)
89th	1965-1967	2 (1D, 1R)	11 (7D, 4R)	13 (8D, 5R)
90th	1967-1969	1 (0D, 1R)	11 (6D, 5R)	12 (6D, 6R)
91st	1969-1971	1 (0D, 1R)	10 (6D, 4R)	11 (6D, 5R)
92nd	1971-1973	2 (1D, 1R)	13 (10D, 3R)	15 (11D, 4R)
93rd	1973-1975	0 (0D, 0R)	16 (14D, 2R)	16 (14D, 2R)
94th	1975-1977	0 (0D, 0R)	19 (14D, 5R)	19 (14D, 5R)
95th	1977-1979	2 (2D, 0R)	18 (13D, 5R)	20 (15D, 5R)
96th	1979-1981	1 (0D, 1R)	16 (11D, 5R)	17 (11D, 6R)
97th	1981-1983	2 (0D, 2R)	21 (11D, 10R)	23 (11D, 12R)
98th	1983-1985	2 (0D, 2R)	22 (13D, 9R)	24 (13D, 11R)
99th	1985-1987	2 (0D, 2R)	23 (12D, 11R)	25 (12D, 13R)
100th	1987-1989	2 (1D, 1R)	23 (12D, 11R)	25 (13D, 12R)
101st	1989-1991	2 (1D, 1R)	29 (16D, 13R)	31 (17D, 14R)
102nd	1991-1993	4 (3D, 1R)[3]	28 (19D, 9R)[4]	32 (22D, 10R)[4]
103rd	1993-1995	7 (5D, 2R)[5]	47 (35D, 12R)[4]	54 (40D, 14R)[4]
104th	1995-1997	9 (5D, 4R)[6]	48 (31D, 17R)[4]	57 (36D, 21R)[4]
105th	1997-1999	9 (6D, 3R)	54 (37D, 17R)[7]	63 (43D, 20R)[7]
106th	1999-2001	9 (6D, 3R)	56 (39D, 17R)[8]	65 (45D, 20R)[8]
107th	2001-2003	13 (9D, 4R)[9]	59 (41D, 18R)[9]	73 (51D, 22R)[9]
108th	2003-2005	14 (9D, 5R)	60 (39D, 21R)[10]	74 (48D, 26R)[10]
109th	2005-2007	14 (9D, 5R)	68 (43D, 25R)[11]	82 (52D, 30R)[11]
110th	2007-2009	16 (11D, 5R)	72 (52D, 20R)[12]	88 (63D, 25R)[12]
111th	2009-2011	17 (13D, 4R)[13]	73 (56D, 17R)[13]	90 (69D, 21R)[13]
112th	2011-2013	17 (12D, 5R)	73 (49D, 24R)[14]	90 (61D, 29R)[14]
113th	2013-1015	20 (16D, 4R)	78 (59D, 19R)[15]	98 (75D, 23R)[15]

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Solution: Excel Spreadsheet Results, with %

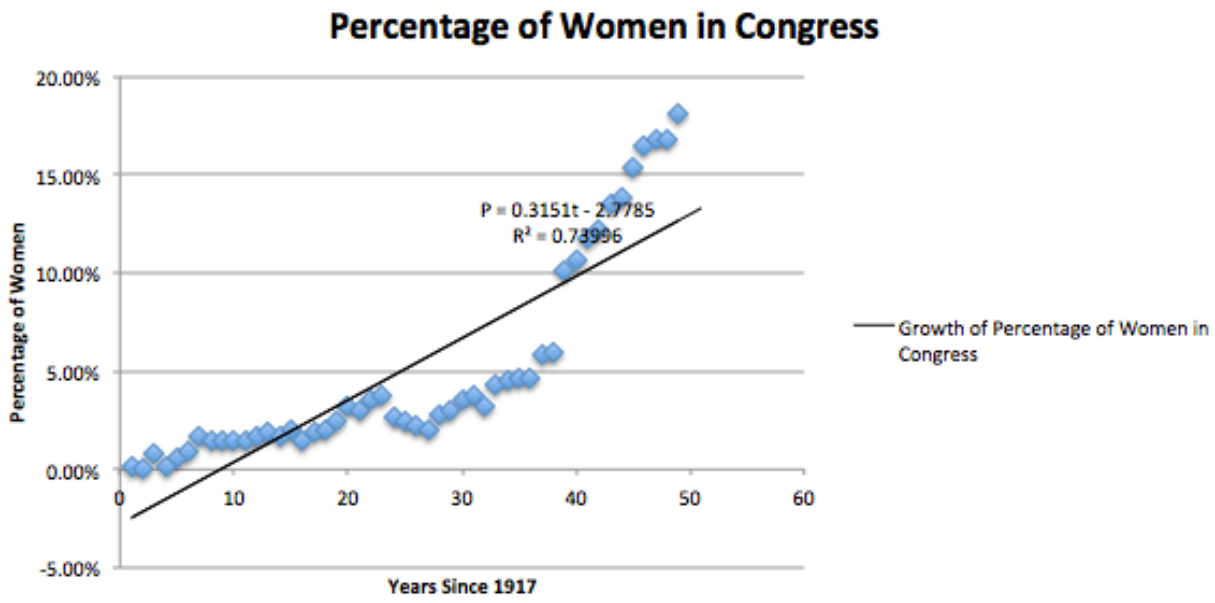
Numbers of Women in the United States Congress

Congress	Dates	Women in Senate	Women in House	Total Women in Congress	% Women in Congress
65th	1917-1919	0	1	1	0.19%
66th	1919-1921	0	0	0	0.00%
67th	1921-1923	1	3	4	0.75%
68th	1923-1925	0	1	1	0.19%
69th	1925-1927	0	3	3	0.56%
70th	1927-1929	0	5	5	0.93%
71st	1929-1931	0	9	9	1.68%
72nd	1931-1933	1	7	8	1.50%
73rd	1933-1935	1	7	8	1.50%
74th	1935-1937	2	6	8	1.50%
75th	1937-1939	2	6	8	1.50%
76th	1939-1941	1	8	9	1.68%
77th	1941-1943	1	9	10	1.87%
78th	1943-1945	1	8	9	1.68%
79th	1945-1947	0	11	11	2.06%
80th	1947-1949	1	7	8	1.50%
81st	1949-1951	1	9	10	1.87%
82nd	1951-1953	1	10	11	2.06%
83rd	1953-1955	2	11	13	2.43%
84th	1955-1957	1	16	17	3.18%
85th	1957-1959	1	15	16	2.99%
86th	1959-1961	2	17	19	3.55%
87th	1961-1963	2	18	20	3.74%
88th	1963-1965	2	12	14	2.62%
89th	1965-1967	2	11	13	2.43%
90th	1967-1969	1	11	12	2.24%
91st	1969-1971	1	10	11	2.06%
92nd	1971-1973	2	13	15	2.80%
93rd	1973-1975	0	16	16	2.99%
94th	1975-1977	0	19	19	3.55%
95th	1977-1979	2	18	20	3.74%
96th	1979-1981	1	16	17	3.18%
97th	1981-1983	2	21	23	4.30%
98th	1983-1985	2	22	24	4.49%
99th	1985-1987	2	23	25	4.67%
100th	1987-1989	2	23	25	4.67%
101st	1989-1991	2	29	31	5.79%
102nd	1991-1993	4	28	32	5.98%
103rd	1993-1995	7	47	54	10.09%
104th	1995-1997	9	48	57	10.65%
105th	1997-1999	9	54	63	11.78%
106th	1999-2001	9	56	65	12.15%
107th	2001-2003	13	59	72	13.46%
108th	2003-2005	14	60	74	13.83%
109th	2005-2007	14	68	82	15.33%
110th	2007-2009	16	72	88	16.45%
111th	2009-2011	17	73	90	16.82%
112th	2011-2013	17	73	90	16.82%
113rd	2013-2015	20	77	97	18.13%

Source: http://www.cawp.rutgers.edu/fast_facts/levels_of_office/documents/cong.pdf

Solution to Excel, page 2.

Chart



Worksheet: Women's Representation in the U.S. Congress

1. Describe the shape of your scatter plot in terms of years vs. numbers of female members of Congress.

2. What is the equation of your trendline from Excel? Use function notation.

3. Use your trendline equation to predict the year in which women will comprise 50% of Congress. Is this a reasonable prediction? Why?

4. Use graph paper to graph the most recent part of the data, from 1993 to 2015. Adjust a trendline (by hand) to fit the data. According to this model, in how many years will women comprise 50% of Congress?

5. Do linear models seem appropriate for this data? Are you aware of models that might provide a more accurate fit? If so, what are they?

6. Do you believe that current numbers of women Congressional members are fair representations for the country? Why/why not? Why should it matter to <u>you</u>, regardless of whether you are male or female?

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Worksheet: Women's Representation in the U.S. Congress

Solutions

1. Describe the shape of your scatter plot in terms of years vs. numbers of female members of Congress.

Answers will vary, but the following is a possibility:

The percentage of women in Congress remained roughly the same until about 1939. There was gradual growth through about 1975. Percentages increased regularly through the present.

2. What is the equation of your trendline from Excel? Use function notation.

$P(t) = 0.3151t - 2.7785$

3. Use your trendline equation to predict in what year women will comprise 50% of Congress. Is this a reasonable prediction? Why?

$0.3151t - 2.7785 = 267$; t is approximately 856 years. This is not a reasonable prediction because the initial year from 1917 to 1981 never rose above 4%.

4. Use graph paper to graph the most recent part of the data, from 1993 to 2015. Adjust a trendline (by hand) to fit the data. According to this model, in how many years will women comprise 50% of Congress?

Answers will vary.

5. Do linear models seem appropriate for this data? Are you aware of models that might provide a more accurate fit?

No, linear models do not seem appropriate. Their rate of growth does not allow for variance in data. A more realistic fit would be a function that grows quickly, but levels off. (Students probably are not familiar with the logistics curve, but may have an idea of its shape.)

6. Answers will vary.

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in collaboration with
Mr. Michael Bolling, Virginia Department of Education

Rubric:

	6 points	4 points	2 points	0 points	Total Points
Student participation in group discussions. (6 pts. total) Scores and comments:	Candid and appropriate discussion that is respectful of classmates' opinions.	Contributes rarely, but thoughtfully and appropriately.	Contributes candidly, but shows some lack of respect for others' opinions.	Shows complete lack of respect for others' opinions and/or makes no contributions whatever.	
Worksheet (6 questions; points are per question w/ 36 pts. total) Scores and comments:	Answers are complete and mathematics is correct.	Answers are complete, but mathematics is incorrect.	A few words are written in each blank and there is some math.	No answers are given.	
Excel Chart (6 pts. total) Scores and comments:	Complete, labeled, and accurate statplot; accurately labeled trendline.	Chart is numerically accurate, but no labels are included. Trendline included.	Chart lacks accuracy and is without labels. Trendline included.	Charts are absent or inaccurate.	
Hand-Drawn Graph with Trendline (6 pts. total) Scores and comments:	Graph is accurate; data represented correctly; reasonable trendline.	Graph of data is accurate; trendline is inaccurate.	Graph of data has errors; trendline is inaccurate.	Graph is poorly constructed; trendline is absent.	
Additional Comments:					Total out of 54:

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