

Chapter 7 Project

Misleading Graphs

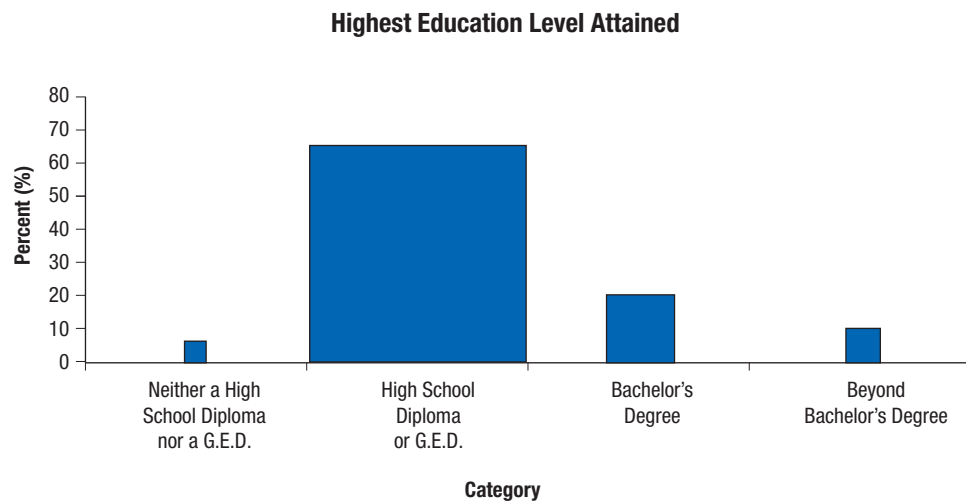
An activity to demonstrate the use of bar graphs in real life.

Unfortunately, we can be intentionally or unintentionally misled by statistics, particularly when graphs are used to convey findings. In this project, you'll learn how to spot when this occurs with a bar graph and how to fix the representation.

Suppose the following table reported education levels among all young adults (18–24 years old) within the United States for a specific year.

Highest Education Level Attained	Percent (%)
Neither a High School Diploma nor a G.E.D.	5
High School Diploma or G.E.D.	65
Bachelor's Degree	20
Beyond Bachelor's Degree	10

1. The percent value in the first category is lower than all the others. For the other three categories, calculate how many times bigger the percents are compared to the percent value in the first category.
2. Suppose a graphic designer presents the information in the following bar graph. For each of the four categories, calculate the area of the bar shown. (Recall that the area of a square is $A = s^2$.)



3. Similar to Problem 1, the area in the first category is smaller than the areas for all the other categories. Calculate how many times bigger the area of each of the other three are compared to the area in the first category.
4. There is a relationship between the area comparisons in Problem 3 to the percent comparisons in Problem 1. What is it? (**Hint:** What type of geometric figures are shown in the graph and what calculation does this suggest?)
5. Review Section 7.3. Which step of constructing a vertical bar graph was skipped, whether intentional or not? How could this alter the perceptions of those reading the graph in Problem 2?
6. Construct a vertical bar graph that follows all the steps shown in Section 7.3.

7. Although we are able to do the calculations and make the comparisons to spot the misrepresentation, why do you think the skipped step mentioned in Problem 5 is important? (**Note:** Whether for short reading or a deep dive, look into the works of psychologist Jean Piaget.)
8. Suppose that one year later the information was updated and presented in the following table. While it may be understandable that the information was presented this way, it cannot be used to construct a bar graph for educational levels of young adults in the US. Why?

Educational Level	Percent (%)
At Least a high School Diploma or G.E.D.	96
At Least a Bachelor's Degree	24
Beyond a Bachelor's Degree	11

Chapter 7 Project: What's My Average?

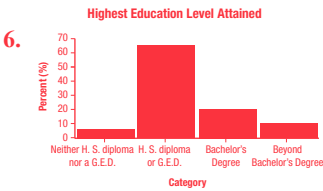
1. mean = 80, median = 96
2. mean = 81, median = 81
3. a. No, the median is much higher than the mean.
b. Yes, they are the same.
c. Tristen
d. Jonathan
4. Answers will vary. For example: Tristen, because all his scores are in the 70 to 90 range. Jonathan has a very low test score of 24.
5. a. The mean for each student would be higher by 2 points.
b. The median for each student would be higher by 2 points.
6. a. Jonathan: 44, Tristen: 39
b. Jonathan
c. Jonathan: 97.5, Tristen: 95
d. Jonathan
7. Answers will vary.

Chapter 7 Project: Misleading Graphs

1. 13 times as many have earned a high school diploma or G.E.D. as have not. 4 times as many have earned a bachelor's degree as those that have not earned a high school diploma nor G.E.D. 2 times as many have earned a degree beyond a bachelor's degree as those that have not earned a high school diploma nor a G.E.D.
2. The areas are, from left to right, 25, 4225, 400, and 100.
3. The area of the second square is 169 times bigger than the area of the first. The area of the third square is 16 times bigger than the area of the first. The area of the fourth square is 4 times bigger than the area of the first.
4. $13^2 = 169$, $4^2 = 16$, and $2^2 = 4$. The area comparisons are larger than the percent comparisons. In particular, squaring the percent comparisons yields the area comparisons.

9. Use the information from the table in Problem 8 to do the following.
- a. Construct a new table like the one from the beginning of the project. (**Hint:** Subtraction is required.)
- b. Explain why subtraction was required to construct the table in part a.
- c. Construct a vertical bar graph to go along with the table in part a.

5. The widths are not the same. Thus, when comparing any pair of categories, the size ratios are greatly exaggerated.



7. The step is included for at least two possible reasons. One is that younger readers may only be able to focus on one dimension. Even with older graph readers, though the calculations and comparisons can be done, if reading quickly, they will believe the greatly exaggerated size ratios.
8. The categories overlap. (For example, someone that has a degree beyond the bachelor's level also already has a bachelor's degree.)
9. a. Based on Problem 8; $24 - 11 = 13$, $96 - 24 = 72$, and $100 - 96 = 4$.

Highest Education Level Attained	Percent (%)
Neither a High School Diploma nor a G.E.D.	4
High School Diploma or G.E.D.	72
Bachelor's Degree	13
Beyond Bachelor's Degree	11

- b. Subtraction is needed because the categories overlap. For example, the category of those who have at least a high school diploma or G.E.D. contains those who have at least a Bachelor's degree, so the difference between those categories ($96 - 24$) tells us the percent of people who have a high school diploma or G.E.D and do not have a Bachelor's degree (72).

