Data Visualization Makeover

As educators, we gather data to gain insight, draw conclusions, and make improvements in educational contexts. These data are often shared with various interest holders such as school board members, teachers, families, and students, so it is important that the data are presented in ways that can be easily understood across different audiences. This article follows one fictional school administrator's journey as she strives to improve the presentation of data to her school board through accurate and comprehensible data visualizations.

The Scenario

A suburban school district has conducted a comprehensive needs assessment and determined that an area of focus for improvement should be establishing and maintaining a supportive learning environment. The results of an annual school climate survey indicate that some facilities at the high school received more positive ratings than others.

The superintendent has asked a committee made up of students, parents, teachers, and administrators to make a recommendation to the school board about how best to spend funds that are earmarked for facilities improvements at the high school.

The committee determined that more information was needed before they could make a recommendation; they will survey the high school students to gather their input.

We will witness the administrator's progress as she makes improvements to her data visualizations, resulting in a final version that the committee presents to the school board. We will explore each of the administrator's attempts and discuss the pros and cons of each visualization:

- Start with Data
- Data Visualization Improvement #1
- Data Visualization Improvement #2
- Data Visualization Improvement #3
- Data Visualization Final Version
- Key Takeaways to Improve Data Visualizations

Start with Data

High school students were asked to rate their level of satisfaction with four facilities at the school. A total of 213 students responded out of 1,050 students in the high school. Figure 1 shows the data table the administrator created from the survey data.

Figure 1. Data Table

Are there school facilities that students like better than others?

	satisfied	not satisfied	no opinion
cafeteria	65	22	13
quad	13	85	3
library	90	6	4
gym	52	25	23

The data table includes the four facilities mentioned in the survey—cafeteria, quad, library, and gym—as well as how many students were satisfied, not satisfied, or had no opinion about each facility. The purpose of the data visualization is to share the information from the survey clearly and succinctly so that the committee can discuss the findings and generate additional ideas. Although the information in the data table is accurate, the administrator wonders if displaying the data in a different way could make the information more easily understood by the diverse interests of the committee.

Pause and Consider: *Is there a better way to display these data so they are more easily understood?*

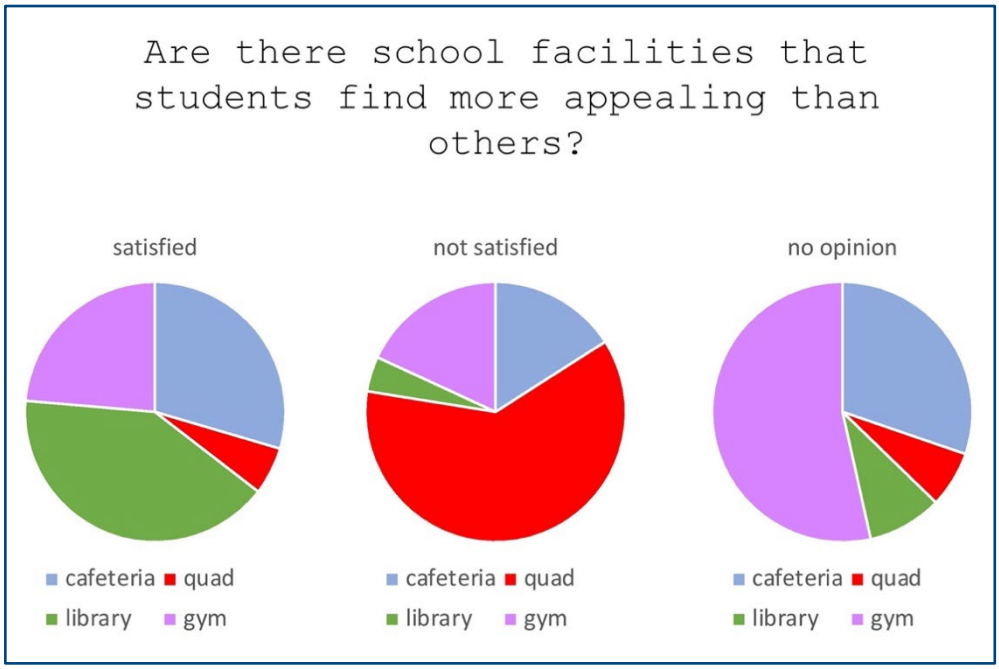
Considerations

This data table may not be the best way to share the data generated from the survey. While the data table contains all the data the committee members need, its current form does not allow for a quick comparison of the responses, which may lead to confusion and inefficient conversation in the committee.

Data Visualization Improvement #1

In an effort to improve the data visualization, the administrator represents the data from the data table as three pie charts, shown in Figure 2, which depict the breakdown of students that are satisfied, not satisfied, or have no opinion of each facility.

Figure 2. Pie Charts



Pause and Consider: *What is improved in these new data visualizations? Is there anything that should be reconsidered?*

Considerations

Pie charts (or circle graphs) are one way to visualize data for an audience. These pie charts each contain information about how satisfied students are with the four facilities at the school. However, because each pie chart shares a different dimension of satisfied, not satisfied, and no opinion, it is difficult to compare the information across these charts.

- **Choose Colors Carefully**

  In addition, while color is a common method for differentiating information, some members of your intended audience may not be able to easily discern the differences in color if they have a color vision impairment. The colors chosen here may be difficult to distinguish, with the light purple and light blue having similar values, and the red and green being among the most common problematic color combinations.

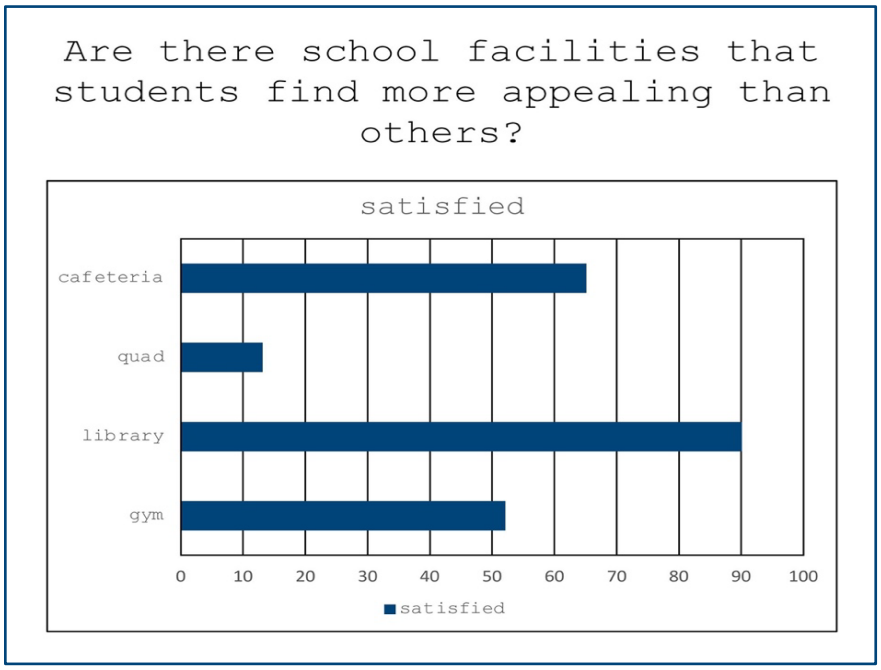
- **Grayscale**
  Consider how these charts will appear if they are printed in grayscale. These colors will be difficult to distinguish between the different sections of the charts if they are shown in grayscale, even for audience members without color vision impairments.

Data Visualization Improvement #2

The administrator determines that there is too much information to easily compare the student responses, so she decides that a new data visualization is needed. She chooses a bar chart, shown in Figure 3, because she believes it is likely that all the committee members are familiar with this type of chart.

She opts for a simplified approach and chooses to use one color so that the audience will focus on the different sizes of the bars. She also chooses to include only the data that communicate positive student satisfaction with each facility.

Figure 3. Bar Chart



Pause and Consider: *How is this new data visualization an improvement over the pie charts?*

Considerations

This type of data visualization is an improvement for its clarity and alignment to purpose for several reasons.

- **Match the Data Visualization to Your Purpose**

  A bar chart is well-suited to the purpose of comparing data. In this case, the various sizes of the bars represent differences in the responses from the student survey, but it is unclear if the values along the x-axis represent the number or percentage of responses. By contrast, pie charts are hard to compare, making it difficult for your audience to understand differences and similarities in the data.

- **Consider Your Audience**

The administrator is wise to consider the experience that committee members may or may not have analyzing different types of charts. Selecting a commonly used chart can help improve comprehension for the committee.

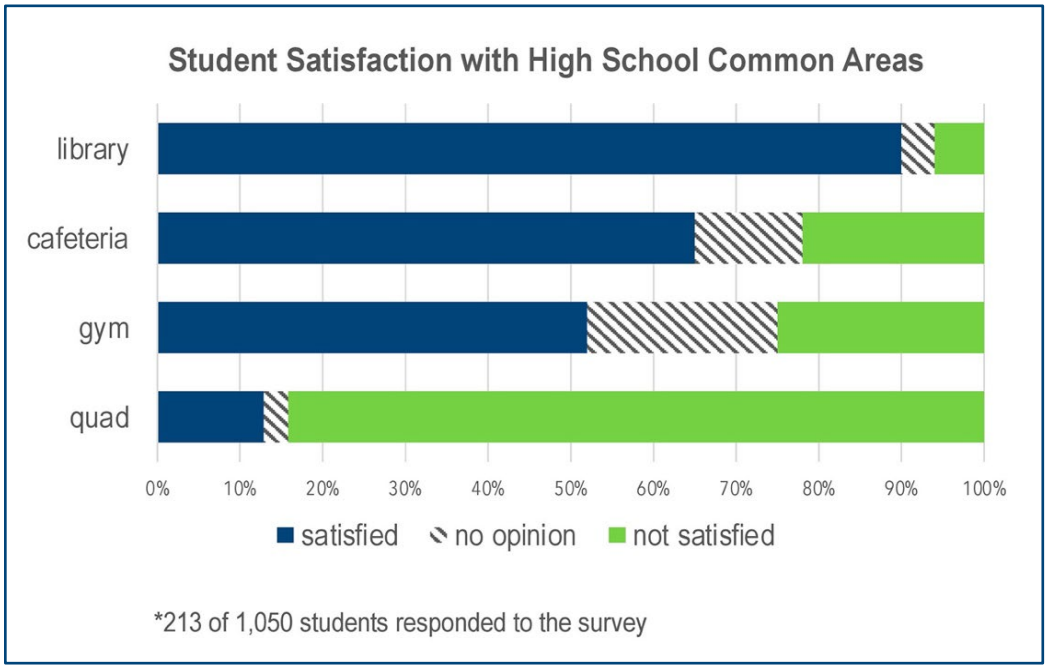
- **Focus on What Matters**

  The single color makes it easier for the audience to notice and compare the size of the bars, which represent the students who report being satisfied with each facility, and is what the committee needs to be focusing their attention on. Yet, there is important information missing from this data visualization that the committee needs, including a fairer representation of student voice.

Data Visualization Improvement #3

The administrator's improved data visualization is represented by the stacked bar chart shown in Figure 4. This new version of a standard bar chart contains key improvements that should help the administrator convey the information from the student survey more clearly and succinctly in order to initiate discussion in the committee.

Figure 4. Stacked Bar Chart



Pause and Consider: *What key improvements do you notice in the third iteration of the data visualization?*

Considerations

Specific changes to this bar chart improve its accuracy and clarity for a diverse audience.

- **Include Appropriate Data**

  An important difference between the standard bar chart in Figure 3 and this stacked bar chart is the opportunity to share all the data generated from the survey in a way that is easy to process. This new data visualization includes all the voices of students who participated in the survey, not just those who responded as satisfied with a particular facility, and it better represents the survey format in which students were asked to choose a level of satisfaction from the three options. Finding ways to share information from all the students is one way to ensure equity in the data sharing process because ultimately, all student perspectives have value and can offer important insights.

- **Be Thoughtful About How Data are Organized**

  The data included in the chart have been organized with intention, with the facility that students find most satisfying (the library) at the top of the chart, and the facility that students find least satisfying (the quad) at the bottom. Arranging the data from greatest to least satisfied makes it easier for the audience to notice the differences in student responses.

- **Remove Unnecessary Information**

  Subtle changes to the format of the chart help reduce clutter. In this case, the border around the chart has been removed because its presence did not add value, and the vertical grid lines from 0 to 100 percent have been lightened from black to gray in favor of helping the data in the bars to stand out.

- **Use Text Strategically**

  The text used in the chart has been improved in several ways including a title that more clearly represents the information in the chart. The new title, “Student Satisfaction with High School Common Areas,” focuses audience attention on student satisfaction levels. Key text additions include improvements that help users interpret and understand what the data mean. The numbers 0 to 100 on the chart now include the percent symbol to make clear that these are the percentage of responses rather than

the actual number of student responses. Additionally, text underneath the chart conveys the total number of students that responded to the survey, 213 students total out of a possible 1,050 students—which represents approximately 20% of the student body at the high school. The text format has been considered. It has been enlarged and changed to a condensed font to better fit in the allowable space.

- **Choose Language with Intention**

  The language used in this data visualization has been carefully reviewed for its purpose, clarity, specificity, and inclusivity. It is important that the language be sensitive to both the survey participants and the audience. Data visualizations should be translated into the languages that are representative of community interest holders. Alternative text and notes describing the data visualization should be used in digital formats to aid audience members who rely on screen readers to access the information.

- **Check for Understanding Before Sharing Broadly**

  Prior to sharing the data visualization with the committee, the administrator should share it with members of different audiences to understand what is being communicated clearly, what could be being misinterpreted, and whether there are additional equity considerations that should be addressed.

Data Visualization Final Version

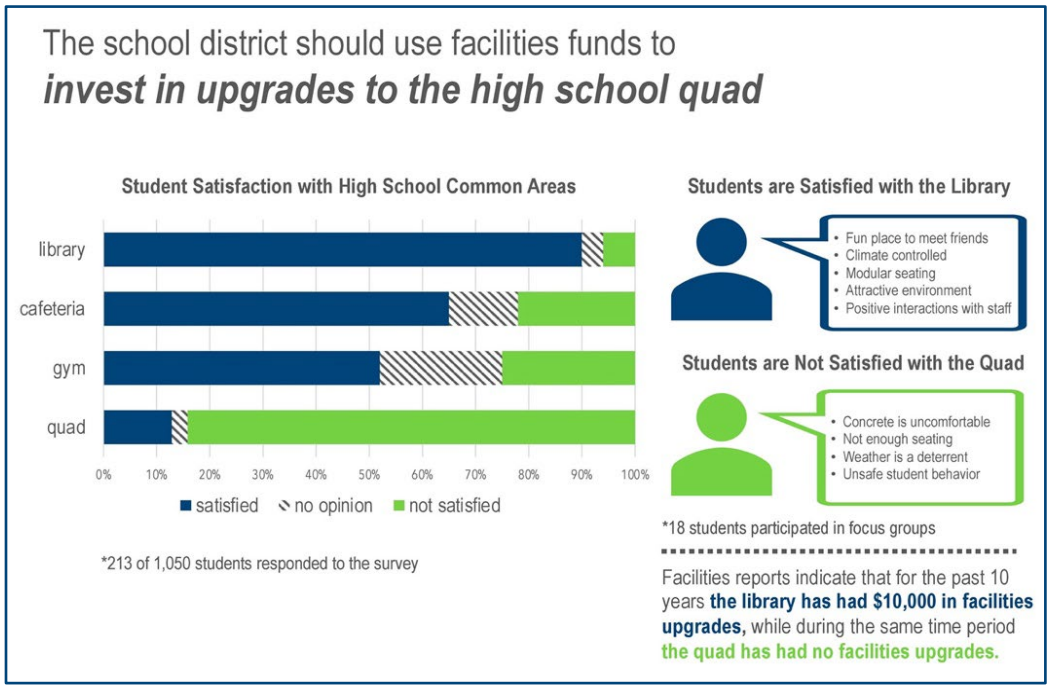
The administrator shared her stacked bar chart, which was well-received by the committee. They had a productive discussion about the data that were gathered and what the information could mean for facilities improvements at the high school.

During the discussion, committee members realized that they were generating many new questions based on their analysis of the data visualization. For example, they wondered why the library was so popular, why so many students had no opinion about their satisfaction with the gym, and what problems exist in the quad of which staff and parents are not aware.

Their curiosity prompted the committee to decide that additional information about *why* students were satisfied, not satisfied, or had no opinion with each facility would be beneficial. The administrator mentioned that she could conduct some focus groups to gather this information.

After meeting with 18 students in three focus groups, the administrator designed the data visualization, shown in Figure 5.

Figure 5. Storytelling Data Visualization



Here she represents two main student perspectives. The blue student and speech bubble represent the students who are satisfied with the library. The students from the focus groups indicated that they are satisfied with the library because it is a fun place to meet up with friends, it has comfortable heating and air conditioning, the flexible seating means they can choose how they gather and socialize, it has an attractive style, and the students enjoy interacting with library staff.

The green student and speech bubble represent the students who are not satisfied with the quad. The students from the focus groups indicated that they are dissatisfied with the quad because the quad is mostly concrete that is uncomfortable, there are only a few benches and steps where students can sit, it is often cold and wet in the winter and it is too hot and sunny in the fall and spring making it a difficult place to spend time, and students sometimes feel unsafe because of the behavior of their peers.

During the committee meeting, the administrator also shares that her review of facilities reports from the past ten years indicates that the library has had ten thousand dollars in facilities upgrades, while the quad has had no upgrades. Armed with this additional information, the committee agrees that the quad needs to be improved and the members draft a recommendation for the school board.

Pause and Consider: *How have the administrator's final changes to the data visualization made the committee's message clearer and more compelling?*

Considerations

The final version of the data visualization includes more information and context than the original data table, resulting in a clearer message and recommendation for a specific audience.

- **Use Data to Tell a Story**

  The administrator assembled the final data visualization from left to right including the stacked bar chart, the focus group speech bubbles, and the text that describes the information from the facilities reports. She added a title that creates an explicit call-to-action for the school board, "The school district should use facilities funds to invest in upgrades to the high school quad." This collection of data visualizations now not only communicates information, but also tells a story that will be easily understood by the school board and the greater community, and clearly demonstrates the need for facilities upgrades to the quad that the committee is recommending.

Key Takeaways to Improve Data Visualizations

- Choose colors carefully
- Match the type of data visualization to your purpose
- Consider your audience
- Focus on what matters
- Include appropriate data
- Be thoughtful about how data are organized
- Remove unnecessary information
- Use text strategically
- Choose language with intention
- Check for understanding before sharing broadly
- Use data to tell a story

References

Evergreen, S. (2023). Evergreen Data: Intentional Reporting & Data Visualization. https://stephanieevergreen.com

Storytelling with Data. (2023). https://www.storytellingwithdata.com