The Taste of Yellow

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Overview of Lesson

In this activity, students participate in an experiment to determine if color affects taste. Students are divided into two groups, one of which will rate the taste of regular lemonade while the other rates the taste of lemonade that has been dyed another color. After rating the drinks students will construct pie charts of the results and compare them to determine if the color of the drink had an impact on the perceived taste. Teachers should confirm the conditions whereby the school's food safety policies will permit distributing food to students.

GAISE Components

This investigation follows the four components of statistical problem solving put forth in the *Guidelines for Assessment and Instruction in Statistics Education (GAISE) Report*. The four components are: formulate a question, design and implement a plan to collect data, analyze the data by measures and graphs, and interpret the results in the context of the original question. This is a GAISE Level A activity.

Common Core State Standards for Mathematical Practice

4. Model with mathematics.
5. Use appropriate tools strategically.

Common Core State Standards Grade Level Content (Grades 3 through 5)

3. MD. Represent and interpret data.

NCTM Principles and Standards for School Mathematics
Data Analysis and Probability Standard for Grades 3-5

Formulate questions that can be addressed with data and collect, organize, and display relevant data to answer them:

- design investigations to address a question and consider how data-collection methods affect the nature of the data set;
- collect data using observations, surveys, and experiments;
- represent data using tables and graphs such as line plots, bar graphs, and line graphs;

Select and use appropriate statistical methods to analyze data

- compare different representations of the same data and evaluate how well each representation shows important aspects of the data.

Prerequisites

Students will have experience collecting data and constructing basic graphs (dotplot, bar graph, picture graph) of categorical data.

Learning Targets
Students will correctly determine an appropriate graph to display categorical data and will interpret the data given specific criteria.

Time Required
One class period.

Materials Required
- Yellow lemonade (enough for each student to have a taste in a small cup).
- Food coloring for coloring half of the batch of lemonade.
- Small paper cups.

Prepare the two batches of lemonade before the activity. Use food coloring to dye one of the batches an unappealing color.

Instructional Lesson Plan

The GAISE Statistical Problem-Solving Procedure

I. Formulate a Question
Begin the lesson by formulating a hypothetical situation: The class has been asked to compare two drinks and indicate which one the students prefer. Explain that students will be divided into two groups, one of which will rate the taste of one of the drinks while the other rates the taste of the other drink. The class will decide how they should be divided into two groups.

Possible questions might include:
1. Should the groups be the same size?
2. How do we decide who is assigned to each group?
3. What rating system should we use?
4. Should students taste and rate both drinks?
5. Should students be aware of how others have rated the drinks?

II. Design and Implement a Plan to Collect the Data
Explain to the class that they will conduct an experiment to determine which drink tastes better. Guide the students in setting up an investigation to determine which students will be in each group and what rating system will be used. Suggest a simple rating system such as "Disgusting," "Satisfactory," and "Excellent." Once the students have been divided into two groups and the rating system has been determined, serve the prepared drinks to the two groups and ask them to rate the taste. Explain that the unappealing drink is safe to drink - take a sip to demonstrate this without indicating whether or not you like it.

After everyone has tasted and rated their drink, collect and record the class data. One way to collect the data might be to give students a slip of paper to record their rating along with which group they were in. If time permits, data collection could be made easier by preparing rating sheets with check boxes next to each of the possible responses so that all students have to do is place a check mark by their response. As each student tastes their drink they should be reminded to not verbalize whether or not they like it in order to not bias the responses of their classmates.

One way to record the results would be to prepare a tally sheet on a blackboard where students can take turns recording their own responses. Alternatively, a group of students could be given the responsibility of collecting the rating sheets or slips of paper and complete the tally for the class.

III. Analyze the Data
Create a table of the results using the rating categories and construct pie charts for the two groups. Make sure that students use appropriate titles for their charts and that they include labels or a key for the categories.

IV. Interpret the Results
Facilitate a discussion about which drink the class thinks tastes better. Ask how the pie charts differ and which drink appears to taste better. Reveal that the drinks are both lemonade and ask if the students are surprised by the results. What are some possible explanations for any differences? What other factors might affect the results?

Ask the students to explain why the study had to be done this way. That is, in order to find out if appearance somehow affects taste why did the students have to believe there were two different drinks? Why was it important to use the same drink with two different colors? What are the implications of these results for the marketing of foods and drinks?

Assessment

Jeremy's class produced the following results for the taste test of the two drinks:

Yellow Drink			Ugly Drink		
Disgusting	Satisfactory	Excellent	Disgusting	Satisfactory	Excellent
2	30	48	18	27	30

Use the approaches below to compare the results of the taste test:

(a) How many students tasted the Yellow Drink? How many tasted the Ugly Drink?

_____ tasted the Yellow Drink   _____ tasted the Ugly Drink

(b) Calculate the percentage of each group that rated the drinks as Disgusting, Satisfactory and Excellent.

Yellow Drink			Ugly Drink		
Disgusting	Satisfactory	Excellent	Disgusting	Satisfactory	Excellent

(c) Produce a pie chart for each group.

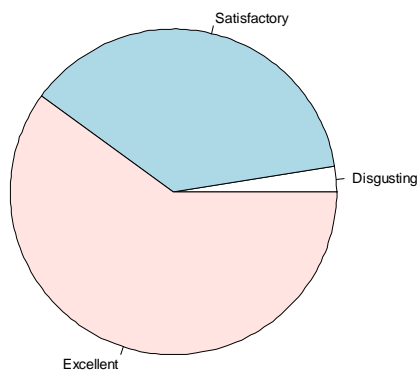(d) Compare the results for the two groups.

Answers

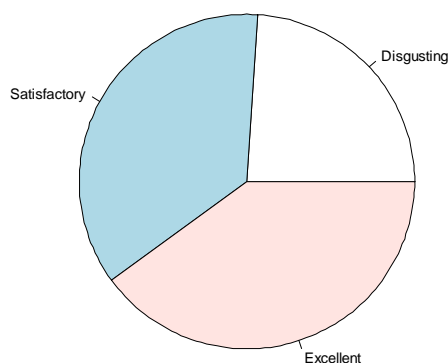(a) __80__ tasted the Yellow Drink   __75__ tasted the Ugly Drink

(b)

Yellow Drink			Ugly Drink		
Disgusting	Satisfactory	Excellent	Disgusting	Satisfactory	Excellent
2.5%	37.5%	60%	24%	36%	40%

(c)

Pie Chart of Taste Test Results for the Yellow Drink

Pie Chart of Taste Test Results for the Ugly Drink

(d) 97.5% of the students who tasted the Yellow Drink rated it as "Excellent" or "Satisfactory" compared to 76% of the students who tasted the Ugly Drink.

Possible Extensions

1. Instead of producing pie charts students can be asked to produce bar charts. Students could be asked to compare the bar charts with the pie charts and to describe the differences in how these graphs present the data.

2. Instead of comparing the taste test results by groups determined by drinks, comparisons can be made according to the test taste result. That is, students can be asked to determine, for example, what proportion of those who rated their drink as "Excellent" were given the Yellow Drink and what proportion were given the Ugly Drink.

References

Adapted from an activity created by Paul J. Fields, Ph.D. for the *American Statistical Association Meeting Within a Meeting Program for Middle School Teachers* (2008).

The Taste of Yellow Activity Sheet

1. How can we evaluate the taste of a drink?

2. Indicate which drink you tasted: _____ Yellow Drink _____ Ugly Drink

What is your taste rating? ____ Disgusting ____ Satisfactory ____ Excellent

3. Record the responses for the class:

Name	Drink	Rating	Name	Drink	Rating

4. Complete the table below showing the frequency of each rating.

Yellow Drink			Ugly Drink		
Disgusting	Satisfactory	Excellent	Disgusting	Satisfactory	Excellent

5. Construct a pie chart of the results for each drink:

6. Compare the results. Does the color appear to impact the taste of the drink? Why or why not?