



Triangle Sensory Test with Oreo Cookies Lesson Plan

Grade levels: 2-10

Lesson adapted by Beth Calder, Mary Ellen Camire, and Susan Brawley.

Reference:

Meilgaard, M., Civille, G.V., and Carr, B.T. 1999. Sensory Evaluation Techniques, 3rd Edition, CRC Press LLC, Boca Raton, FL.

Objectives:

To introduce sensory science to students.

To have students voluntarily participate in a sensory test.

To learn more about hypothesis testing and statistical significance.

Materials:

Low-fat Oreo cookies with normal cream filling (total should equal 1.5 times the number of students)

Original Oreo cookies with normal cream filling (total should be 1.5 times the number of students)

Example: 12 students, need at least 18 Low-fat Oreo cookies

Example: 12 students, need at least 18 regular Oreo cookies

Small white paper plates

Marker

Sensory ballots

Pencils

6-8 oz. Plastic cups (one for each student)

Water

(Note: Be aware that some students may have food allergies or sensitivities.)

Background Information:

Sensory science is a scientific method used to measure, analyze, and interpret human responses to products as perceived through their senses of touch, taste, sight, smell, or sound. Sensory science is often used to improve existing products or to test peoples' views on new products such as the softness of tissues, the crunchiness of an apple variety, or the aroma of air fresheners. It is also used to test the taste and color acceptance of new products such as purple ketchup, or the sound characteristics of products as in the crunch of snack foods. There are many different types of sensory tests. Attribute Difference tests ask: How does a certain quality or trait differ between samples? Affective sensory tests ask: What is the consumer acceptance of a product(s)? Overall Difference tests ask: Does a sensory difference exist between samples? A Triangle test is a type of Difference test to determine if there is a sensory difference between two products. For example, a researcher may want to see if changing one ingredient in a recipe to make a certain food product will affect the taste of the final product. Three coded samples are presented to each panelist, and each panelist is asked to pick out which sample they feel is different from the other two. There are also sensory tests which panelists have to be trained to detect taste thresholds (such as determining the concentration of a flavor which can be identified by the panelist when introduced into a food product) or to have trained panelists describe certain characteristics that researchers are interested in studying.

Sensory tests have to be conducted under controlled conditions to reduce bias (prejudice or influence) on how panelists view the product(s). The sensory room has to be free from distractions (sound, odors) to not influence peoples' decisions of the product. Sensory testing laboratories are able to adjust the lighting, air regulation, and individual booths according to the

needs of each sensory test that is conducted. Samples also have to be presented in a random order and assigned product codes, such as three-digit sample numbers, to keep food products anonymous to further reduce influencing the panelists' decision. The sensory test measures if any differences detected are truly significant by analyzing the sensory data for statistical significance. After statistical analysis, the researchers can make a meaningful interpretation from the results of the sensory data.

Activity:

Introduce the topic of sensory science to familiarize students. Try not to bias students with the introduction. Just mention to students that they will be participating in a Triangle sensory test. Students can voluntarily participate, but should not be forced to participate because all sensory tests that include human subjects must be conducted on a voluntary basis. Explain to students if they participate, sensory panelists have to remain silent during the taste test and cannot share answers with their neighbors. Explain that there will be a discussion after the test to share answers later. Mention to students that they will be given three cookies, and that they should taste the cookies from left to right. They should take a sip of water between each sample. The object of the test is to mark which of the cookies is different from the other two. Only one cookie out of the three should be marked as being different to them. If students have difficulty deciding, mention to them that it is acceptable if they want to go back and forth and re-taste samples to determine the different cookie. They may have to re-taste samples, so explain to students that they may not want to eat the whole cookie all at once, but wait until the test is over before eating the entire cookie samples. If they cannot tell which cookie is different, tell them to guess. Use the provided sensory ballot as a guide if needed. Half the students should receive two low-fat Oreos, with the regular cookie as the different sample, and the other half of the students should receive two regular Oreos and one low-fat Oreo. Pass out sensory ballots, labeled plates with random codes, cookies, and water. Allow the students to begin the sensory test. Enforce the quiet rule during

the sensory test. After the students have finished the test, collect sensory ballots. After the ballots are collected, explain the hypothesis of the sensory test. The stated scientific question is: Can the class detect a difference between low and regular fat (original) Oreo cookies? Hypothesis testing and introducing the scientific method could be used in this lesson. For example,

H_0 : Students of the 3rd grade class cannot tell a difference between low-fat and original Oreo cookies.

H_a : Students of the 3rd grade class can tell a difference between low-fat and original Oreos.

Tally sensory ballots to determine the number of correct and non-correct responses. There is a statistical table (T8, pg. 369 of Meilgaard et al., 1999) that can be used to determine if the total number of correct responses for the total number of students that participated were statistically significant with a set at 0.05 and n =to the total number of participating students. There is a 1 out of 3 chance that the correct (different) cookie will be picked just by chance (guessing). After determining final results, interpret the findings back to the students. The class was able (or not able) to detect a statistically significant difference between low-fat and original Oreo cookies. Statistically significant means that the results fall below a set "confidence" level, which is usually at 95%. The researcher can be 95% confident that there truly was (or was not) a detectable difference among the students in the class. Nabisco (the company that makes Oreo cookies) may find the results interesting that this particular grade level was able to detect (or not detect) a significant difference between the two kinds of cookies. Sensory tests can provide companies with valuable information such as the acceptability of a new cookie. If the sensory test results are promising, the company may find it worthwhile to produce the cookies. If a company produced cookies and then sold them without conducting sensory tests, they could potentially be taking a large risk and lose a lot of money producing a food product that will not sell. Have a class discussion with students and get their input. If they were able to detect a difference, what sort of sen-

sory differences were they able to perceive between the two cookies? Any texture, flavor, or color differences? (In previous sensory tests, students have mentioned that low-fat Oreo cookies have a slight coffee flavor, are slightly lighter in color and crunchier than the original.) Another discussion can be introduced as to what properties fat can add to cookies for example, more flavor or softer textural qualities. A good final question to ask the students is: How well did the food and sensory scientists meet the challenge to make the cookie lower in fat, but try to retain good flavor qualities of the original Oreos?

The following are random code assignments and balanced presentations of cookie samples. Balanced presentations of coded samples (equal number of low-fat and original Oreos are presented to students) are offered in this fashion to help further reduce bias. Sensory ballot examples are included and can be used as guides. The blank sensory ballot provided can be photocopied, and appropriate sample numbers and presentation of samples can be written in ahead of time in the same order as “Balanced Random Code Presentations” guide. Distribute a sensory ballot to each student in random order. Provide students with the appropriate cookie samples on a paper plate with labeled codes that match exactly the code presentation order on their sensory ballot. Students can silently begin the sensory test after receiving samples, water, ballot, and pencil.

Blank sensory ballot:

Triangle Sensory Test on Cookies

Please take a drink of water before tasting cookie samples. Eat cookie samples from left to right, and please take a sip of water between samples. **Place an “X” under the cookie which is different than the others.**

Comments:

Random Sample Codes:

- 767 - Original Oreo cookie sample
- 189 - Original Oreo cookie sample
- 312 - Low fat Oreo cookie sample
- 570 - Low fat Oreo cookie sample

Balanced Random Code Presentations:

O=original Oreo sample

L=Low fat Oreo sample

OLO LOL

OLL LOO

OOL LLO

Or

Student #1 receives sample order: 767,312,189

Student #2 receives sample order: 767,312, 570

Student #3 receives sample order: 767,189,570

Student#4 receives sample order: 312,189,570

Student#5 receives sample order: 312,189,767

Student#6 receives sample order: 570,312,189

Student#7 receives sample order: 189,570,767

Student#8 receives sample order: 189, 570,312

Student#9 receives sample order: 189,767,312

Student#10 receives sample order:570,767,312

Student#11 receives sample order:570,767,189

Student#12 receives sample order:312,570,767

Student#13 receives sample order the same as

Student #1 and order continues on...

Example of sensory ballot for Student #1:

Triangle Sensory Test on Cookies

Please take a drink of water before tasting cookie samples. Eat cookie samples from left to right, and please take a sip of water between samples. **Place an “X” under the cookie which is different than the others.**

767 **312** **189**

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Comments: