EDCI 5724
Kate Allen
Heather Sapp

Measuring Temperature and the Production of CO2 in Yeast (5-E Model)

Purpose/rationale: The purpose of this lesson is for students to predict and observe the outcome of experimental designs by following the 5-E Model. By incorporating graphing skills into this lab based exercise, students will explore the meaning/significance of independent and dependent variables. Students will also become familiar with the processes of the scientific method in relationship with Probe-ware technology.

SOLs:

LS.1 The student will plan and conduct investigations in which

a) data are organized into tables showing repeated trials and means;
b) variables are defined;
c) metric units (SI - International System of Units) are used;
d) models are constructed to illustrate and explain phenomena;
e) sources of experimental error are identified;
f) dependent variables, independent variables, and constants are identified;
g) variables are controlled to test hypotheses and trials are repeated;
h) continuous line graphs are constructed, interpreted, and used to make predictions;
i) interpretations from the same set of data are evaluated and defended; and
j) an understanding of the nature of science is developed and reinforced.

Materials and Resources:

1-L beaker (for water bath)
Test tubes
Test-tube rack
Metal/wooden stirring rods
Yeast
Test-tube brushes
Stop watch
Celsius thermometer
Scoopula or small spoon
Balloons
125 mL water
Graph paper/worksheets
Erlenmeyer flasks (125)
Sugar
Flour
Graduated cylinder
Filter paper funnels
Power Macintosh or Windows PC
Logger*Pro*
Vernier computer interface
Vernier Temperature Sensor

Resources:

Holt Science & Technology Life Sciences, Graphing Data Lab, pg. 688-9.

Holt Science & Technology Life Sciences, The Best-Bread Dilemma, pg. 692-3.

Biology with Computers by Scott Holman and David Masterman, Sugar Fermentation in Yeast, pg. 12B-1 thru 12B-3T.

Safety: Safety goggles and safety aprons should be worn in case splattering occurs due to the build-up of pressure in the test tubes. Also alcohol is a by-product of fermentation so student should not inhale strongly after pulling the stoppers out of the test tubes. Students should also show care around the computer to avoid water spilling on the key boards.

Procedures: (Takes place within two 45 minute class periods)

Engage (Day 1)

1. The teacher will engage the students in learning about how to draw and label graphs. The teacher will choose students for each of the listed positions: recorder of data, sit-up kid, counter of sit-ups, and student with stop watch. The student that is chosen to do sit-ups will be timed every 20 seconds for 2 minutes on how many sit-ups he/she can do in that chosen amount of time. The data will be recorded on each student's worksheet along with the teacher doing the same graph up on the board. The teacher will help the students label the independent and dependent variables as well as label the axis and give a title to the graph. The students will be able to follow along with the teacher making individual graphs at their desks while the teacher makes one large graph up on the board/overhead. (25 Minutes)

Explore (Day 1)

2. Students will explore Lab-Pro software. The teacher will set up yeast, sugar, flour, and water in an Erlenmeyer flask and place a balloon on top in order to catch the CO2 and demonstrate to the students how CO2 is a bi-product of yeast fermentation. Students should hypothesize what they believe to will happen to the balloon.
(20 Minutes)

Explore (Day 2)

3. Students will use Lab-Pro software to measure the rise or fall in temperature during yeast respiration. Teachers will walk around and help students set up the computers in order to measure the temperature properly and make sure that

students are wearing their goggles. Students will record the data on their worksheets.
(20 Minutes)

Explain (Day 2)

4. Students will hypothesize what they predict a graph to look like for the CO2 production from the yeast respiration. Students will fill out a graph labeling the axis, variables, and title. The students will answer questions on their worksheet on why they believe the graph will look the way that they predicted. Students will also answer questions as to whether or not their hypothesis was true with the balloon.
(10 Minutes)

Elaborate (Day 2)

5. Once the students have completed the graph, the teacher and the students will discuss and review the results the students recorded on their graphs to ensure that the students understand how to graph and the meanings of the parts of the graphs.
(15 Minutes)

Evaluate (Day 2)

6. Students will provide the following evidence for understanding graphing and the scientific method (refer to back page attachment).

<u>Day 1- Explore Experiment</u>

A. Fill a beaker with 125 mL of H2O. Using a thermometer make sure that the H2O does not rise above 32 degrees Celsius.

B. Add one teaspoon of yeast into an Erlenmeyer flask, one teaspoon of sugar to the flask, add 10 mL of warm water to the flask, and one teaspoon of flour to the flask and stir well.

C. Have students place a balloon over the top of the Erlenmeyer flask and set aside until the next class period so that students will be able to see the production of CO2 present within the filled balloon.

<u>Day 2- Explore Experiment</u>

A. Fill a beaker with 125 mL of H2O and place the beaker on a hot plate. Using a thermometer make sure that the H2O does not rise above 32 degrees Celsius.

B. Add ½ teaspoon of yeast to a test tube. Add a small scoop of sugar to the test tube, add 10 mL of warm water to the test tube, and a small scoop of flour to the test tube and stir well.

C. Observe carefully and look for bubbles. Have students place the temperature probe into their test tubes and hit the "Collect" data button on the computer.

D. Once students have collected the data and drawn the graph, have students wipe off temperature probe and wash out test tubes.