

Microbes and Food Preservation



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INTRODUCTION:

The purpose of this collaboration was to:

- design an inquiry-based learning experience that addresses state and district science content standards about food preservation and microbes (7.4),
- provide an opportunity for students to explore the relationships between environmental conditions, microbial actions and food preservation techniques, and
- have students improve scientific inquiry and literacy skills and learn basic classroom microbiology techniques.

METHODS:

Part 1: Exploration: Yeast reproduction. Conditions that promote yeast reproduction to understand relationship between environmental conditions and cellular activity.

Part 2: What is pH? Explore pH and acidity.

Part 3: Exploration: Microbial Action on Peas Students design/conduct investigations to manipulate environmental conditions to promote or inhibit bacterial growth on peas.

Part 4: Exploration: Environmental Sampling Students apply knowledge of environmental conditions and growth to test for microbes.

Part 5: Yogurt-Making. Students make yogurt to apply knowledge of beneficial bacteria, environmental conditions and pH.



Figure 1

Student teams applied various treatments to peas in nutrient broth

LEARNING GOALS:

Students will:

1. Understand and describe conditions necessary for microbial growth.
2. Explain ways to prevent bacterial contamination.
3. Learn and utilize basic classroom microbiology tools and techniques.
4. Identify questions about microbes that can be answered through scientific investigation.
5. Design investigations to explore relationships between environmental conditions and microbe growth.
6. Analyze experimental data, draw conclusions, provide explanations to research questions and identify sources of error.
7. Communicate findings verbally and in written reports.

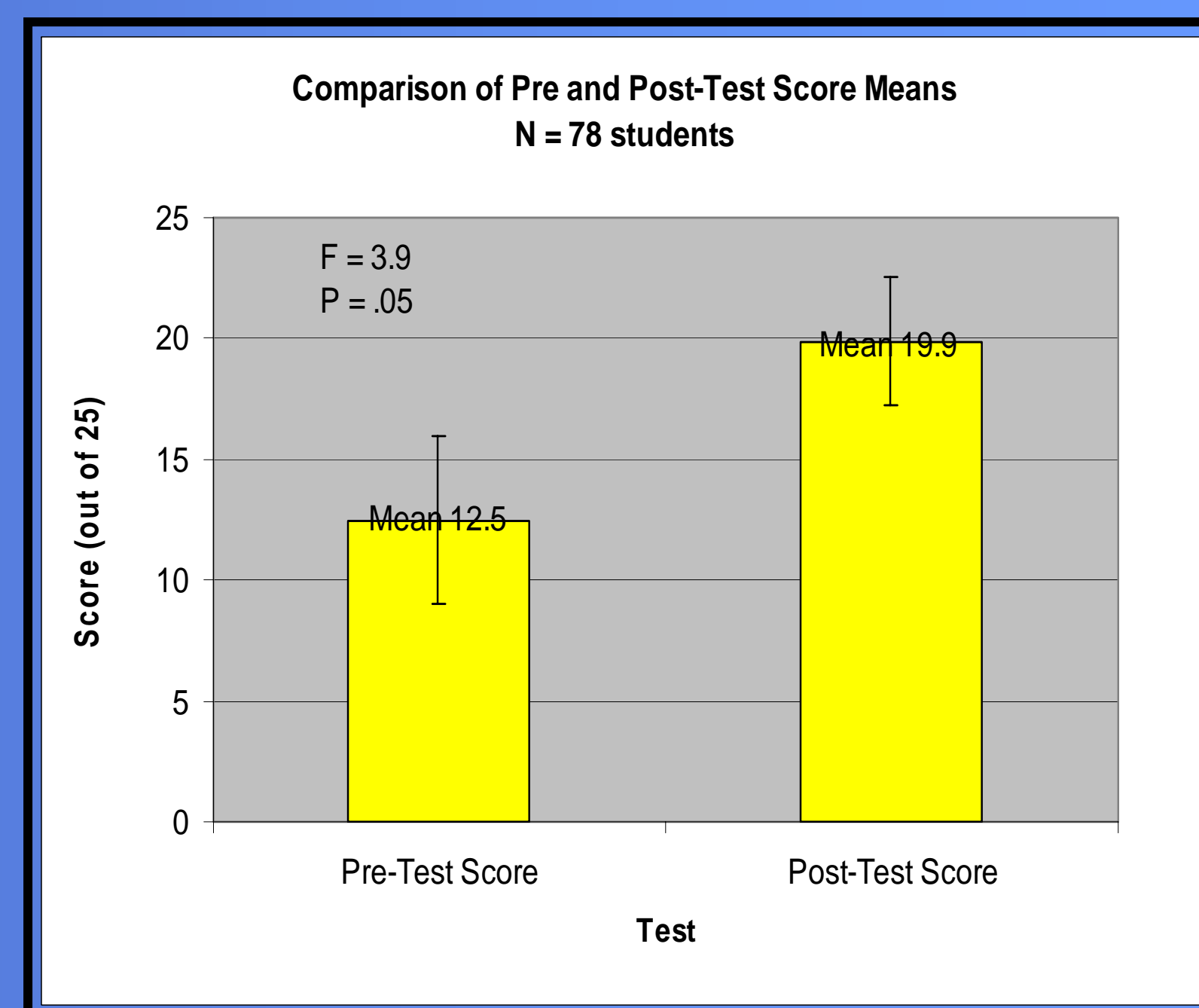


Figure 2

Student Test Score Gains

TABLE 1: LEARNING GAINS	
	Percent Gain
AVERAGE LEARNING GAINS, Overall	60.5
AVERAGE LEARNING GAINS, Scorers below 50%	59.7
AVERAGE LEARNING GAINS, Scorers above 50%	61.4



Figure 3

Students discover environmental conditions influence microbes

DISCUSSION:

The project was an absolute success because collaboration between teacher and researcher enabled students to engage in a dynamic standards-based inquiry lab experience in the classroom.

Quantitative data shows measurable gains in content knowledge. Equally important was the improvement in scientific inquiry and laboratory skills. Students with diverse learning needs demonstrated the ability to create research questions, design inquiries, manipulate variables, collect and analyze data and communicate their findings.

Qualitatively, student interest was extremely high as evidenced by the many students who came to class early and stayed after class to work on their projects. This project generated greater enthusiasm for learning than any unit throughout the year.



Figure 4

Students tested pH of milk, yogurt and other foods

SAMPLE PRE/POST TEST QUESTIONS:

1. What conditions encourage bacteria growth?
 - a. warm, moist environment that is acidic
 - b. warm, moist environment that is not acidic
 - c. cool, dry environment that is acidic
 - d. cool, dry environment that is not acidic
2. Putting food in the refrigerator
 - a. kills bacteria
 - b. makes bacteria less active
 - c. makes bacteria more active
 - d. does not affect bacteria

STUDENT PERFORMANCE:

Students expressed tremendous interest in microbes, food preservation, laboratory experiments and research. All learning goals were met. Student content knowledge and research skills improved. Students independently created lab reports to communicate findings. By the end of the learning unit, students were able to pose research questions and successfully design and conduct experiments with little guidance.



Figure 5

Students were excited to learn about microbial diversity in the environment



Figure 6

Students enjoyed learning that making yogurt can preserve milk

SELECTED REFERENCES

WISTR. http://www.wcsu.edu/biology/wistr_home.html

When Bugs Have You on the Run. <http://www.science.org.au/nova/030/030box02.htm>

Food Safety. <http://foodsafety.wsu.edu/index.htm>

The Bad Bug Book. <http://vm.cfsan.fda.gov/~mow/intro.html>

Microbe World Resources. <http://www.microbeworld.org/resources/>