Chapter 11

Investigation Into Fermentation: A Journey Into Cultural Relevance and Mindful Eating

Kris Krautkremer
Kingsport City Schools, USA

Cerrone Renee Foster
East Tennessee State University, USA

ABSTRACT

This integrated lesson focuses on fermentation, its role in cellular respiration, and practical uses of fermentation for food preservation and nutrient bioavailability. The authors created authentic student experiences through fermentation of yogurt, kefir, kimchi, sauerkraut, pickles, and kombucha. Teachers used the science literacy practices while students engaged with a professional paper throughout the learning cycle in the Biology course. ELA reading practices were implemented to engage students in reading scientific papers and development of a final written assignment. Business owners and other experts brought real-world and hands-on experience in making these products as well as ties to personal culture. The authors applied the 5E lesson plan format, which prompts students to analyze their thinking through a cycle of hands-on and minds-on activities. This lesson addresses Tennessee State Standards for Science and English Language Arts (ELA) for students from both Biology and ELA courses (11th and 12th grades).

INTRODUCTION

University of Pennsylvania Graduate School of Education faculty member and educational blogger A. J. Juliani states:

We want students to be successful, so we scaffold and build support systems for them to find success. But, where is the line? How can we support student success, celebrate them as they make mistakes along the way, and make time for them to learn during the process of creating, instead of just following a process to create?

Providing students with authentic learning experiences has been advocated by the National Science Foundation for over 20 years and forms the foundation in *A Framework for K-12 Science Education* (National Research Council, 2012). Nordell (2009) calls this “learning how to learn.” He found that students, especially in science, do not transition to college with self-assessment and metacognition skills. These deficits restrict their ability to assess and modify their learning strategies. Students need to create, fail, assess, modify, recreate, and possibly fail again. However, how do students find the stamina to pursue this way of “learning how to learn?” This chapter provides an approach to increase student motivation through culturally relevant pedagogy, where the lessons allow students to appreciate their own culture while engaging in other beliefs and cultural practices. Dee and Penner (2017) found students had higher attendance, higher overall grades, and earned more credits as a result of culturally relevant pedagogy. Duckworth and Gross (2014) refer to this perseverance and stamina as “grit” and posit that teachers can help students develop the ability to stick to a task and finish successfully through supported iterative failure/progression with intervening self-assessment. Students develop grit through relevant work. This chapter integrates student exploration and cultural relevance to explore fermentation using foods. The authors focus on cultural connections and science practices, especially modeling. The following standards and practices were used in all lessons in the unit.

1. Next Generation Science Standards.
2. Science Literacy Standards for ELA.
3. 5E instruction model.
4. Assessment rubrics as indicated.

**HOW DO I DO IT?**

The authors created authentic student experiences through fermentation of yogurt, kefir, kimchi, sauerkraut, pickles, and kombucha. Implementation of scaffolded and specific reading practices engage students in reading the scientific paper *Health Benefits of Fermented Foods: Microbiota and beyond* (Marco et al., 2017). Business owners and other experts brought real-world and hands-on experience in making these products, as well as ties to personal culture. The authors applied the 5E lesson plan format (Bybee, 2015), which prompts students to analyze their thinking through a cycle of hands-on and minds-on activities. Beginning with the Engage stage, students activate their prior knowledge about anaerobic respiration and fermentation and move directly into hands-on interactions with foods during the Explore stage. The following stage, Explain, challenges students to articulate their experiences with fermentation from Engage and Explore, while also highlighting relevant scientific/literary principles. During the Elaborate stage, students apply their understanding to solve a problem by engaging in Socratic Seminar. The final stage, Evaluate, can be embedded within the learning cycle and/or an assessment at the end of the unit to assess student understanding of the content. Two options for assessment are:

1. Accountable Talk®.
2. Summative assessment.

In this lesson, students from both upper-level Biology and upper-level ELA courses (11th and 12th grades) worked together. Most often, students worked with content-level teachers and were not pulled...