

## Teaching Microbiology by Celebrating Traditional Foods and Cultures from Morocco and Perú<sup>†</sup>

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According to a report published by the Center for Community College Student Engagement and others, global learning is considered one of the high-impact practices used to increase student engagement and motivation to learn. Engagement and motivation have also been linked to increased learning gains and improvement in the overall learning experience. Furthermore, global learning helps students explore other people's cultures and worldviews, which is an important skill for students to gain in order to compete and adapt to solve the problems of our global society. Here, I discuss two class activities that faculty can adopt to implement global learning in their courses, with the purpose of engaging and motivating students to learn microbiology while celebrating some traditions from Morocco and Perú. Students researched traditional fermented foods and drinks from Perú and Morocco. Then, they answered guided questions to help them link the food items to microbiological concepts learned in class. For example: normal flora and fermentation were learned as students researched the process of making a Peruvian drink called "chicha de jora," which is made from chewed corn that becomes fermented as it mixes with oral bacteria from saliva. While engaging in global learning, students learned some microbiology concepts; they passed the knowledge on to the campus community with poster presentations held during International Education Week. Based on students' feedback and participation, I can conclude that teaching microbiology using global learning was engaging, promoted student learning, and motivated students to learn.

De acuerdo con un reportaje publicado por el *Center for Community College Student Engagement*, 2013 y otros, *Aprendizaje Global* está considerado como una de las Prácticas de Alto Impacto utilizadas para aumentar la participación y la motivación de los estudiantes en aprender. La participación y motivación de los estudiantes se correlaciona con un aumento en el aprendizaje y con una mejora en la experiencia de aprendizaje. Por medio del *Aprendizaje Global* los estudiantes exploran culturas y visiones del mundo, lo cual les ayuda a competir, adaptarse y resolver problemas en nuestra sociedad global. Aquí, discuto dos actividades curriculares que utilizan *Aprendizaje Global*, con el propósito de aumentar la participación y motivación de los estudiantes en aprender microbiología, mientras celebran tradiciones de Moroco y Perú. Los estudiantes investigaron bebidas y alimentos fermentados de Perú y Moroco. Luego, respondieron preguntas que les ayudaron a vincular el alimento con conceptos microbiológicos. Por ejemplo: los estudiantes aprendieron sobre flora normal y fermentación al estudiar el proceso de preparación de la bebida peruana "chicha de jora", hecha de maíz, el cual se fermenta con bacterias de la saliva, al ser masticado. Al participar en *Aprendizaje Global*, los estudiantes aprendieron microbiología y compartieron el conocimiento con la comunidad mediante exhibiciones de póster durante la Semana Internacional de la Educación. Basándome en los comentarios y la participación de los estudiantes, puedo concluir que enseñar microbiología utilizando *Aprendizaje Global* promovió participación y aprendizaje en los estudiantes y los motivó a aprender.

### INTRODUCTION

Based on a report published by the Center for Community College Student Engagement and others (1–5), global

learning is considered one of the high-impact practices that engages students and increases their motivation to learn while exploring other people's cultures and worldviews (2). This practice has been found to improve students' learning gains, retention rates, and overall learning experience (1–5). Others have also argued that "transdisciplinarity" in education can be a beneficial tool to teach microbiology (6). Here, anthropology is one of the disciplines interacting with microbiology. To implement global learning, two class activities centered on fermented foods from Perú and Morocco are described in this article (1, Appendices I and 2). Students learned about normal flora and fermentation

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as they read how Peruvians chewed on corn to mix it with saliva containing oral bacteria that fermented the corn. The instructor provided references and guided questions regarding Moroccan foods and the Peruvian drink to ensure class objectives were met (7–8, Appendices 1 and 2). In these assignments, students applied microbiology concepts such as hygiene, disinfection, food-borne pathogens, fermentation and oral bacteria while connecting them to the countries' processes of fermenting that food or drink. These assignments can be used for students from ninth grade to college.

## PROCEDURE

During the first week of class, the professor provided students with instructions, references, and guided questions, which can be found in the supplemental materials, (Appendices 1 and 2). Half of the class worked on the Peruvian assignment and half on the Moroccan assignment. During the first phase of the projects, students were graded for individual work to ensure everyone contributed. The instructor selected the International Education Week Festival as the venue for the final projects' posters presentations. A college symposium or the classroom can also be used to present final projects.

Throughout the semester, when the professor discussed topics such as microbial fermentation, normal flora, and pasteurization, the assignments were used to apply the concepts. The professor explained, for example, "Peruvian Incas would chew on corn and then spit it in a container to allow normal flora of the mouth to ferment the corn over time, then they boiled it to "pasteurize" it, and they filtered it using hay. These examples showed students how to "apply" microbial concepts and "understand" their use, which are higher levels of learning according to Bloom's taxonomy of learning (9).

The materials needed were minimal: library resources and office supplies to create poster boards (Appendices 1 and 2).

### Assignment I: Moroccan fermented foods

Each student selected one food from a list of Moroccan foods (7). After doing individual research and completing the assigned questions, students came together for the final project presentation. The handout provided instructions to create a poster board or slide presentation (posters work best for a festival or symposium) (Appendix 1). Some assigned questions were: 1) What food technology or preservation methods are used to prepare the foods described (e.g., osmotic, pressure, fermentation, salting). 2) Identify the microbes associated with this food preparation, and mention microbiological risks or hazards associated with it. Students listed social and cultural benefits of these food items. For example, many of the foods presented here are used during family or religious celebrations (Appendix 1).

### Assignment II: Peruvian drink

Here we focused on an old way of making a corn-based drink called "*chicha de jora*," which involves chewing the corn and spitting it into a bowl where it is left to be fermented by the normal flora of the mouth (8, Discovery Channel, <https://www.youtube.com/watch?v=Fcf8WUB33hg&feature=youtu.be>). After several days, the drink is boiled and filtered. Students answered questions that guided them to discover that the bacteria responsible for fermentation came from the mouth of the people who chewed the corn. They discussed the safety concerns of this practice and possible diseases associated with it. After discussing the questions, students began to value how ancient Incas, who had no microbiology education, used disinfection techniques like boiling and filtration. The handout also emphasized the roles and benefits of this drink in Peruvian culture (Appendix 2).

## SAFETY ISSUES

There are no safety issues associated with this activity.

## CONCLUSION

Initially, both of these assignments were taken with some level of skepticism. Once the purpose and the association with the lesson became clear, students seemed to appreciate the assignment much more. Student feedback indicates that they began to appreciate how other cultures and ancient traditions contributed to the discipline of microbiology, and they expressed an improved ability to apply microbiology concepts. Some of them discovered Food Microbiologist as a career that they had never heard of before. Although the professor did not formally assess the impact and effectiveness of the Global Learning strategy for this article, faculty who wish to could design a survey, quiz, or reflective essay that students complete before and after the project to assess students' own perceptions of their learning. In addition, the instructor can compare two classes, one that undertakes the global learning project and one that does not, to test whether the strategy increased student learning gains, engagement, and motivation. Faculty can also adopt the Global Learning Value Rubric to evaluate their course's assignment (10). One way to measure engagement is by tracking class attendance and participation, as described elsewhere (1).

Students with ties to Morocco or Perú exhibited a higher level of engagement, possibly due to a greater feeling of personal identification with the assignments. Regardless of their ethnicity, students seemed to enjoy the discoveries they made and even wore the traditional clothing during the festival (Fig. 1), demonstrating that global learning can enhance students' engagement and motivation to learn. It is important to keep an open mind when discussing aspects of the countries' practices and to avoid attributing value judgments so as not to fall into ethnocentric discussions

that belittle other countries. For example, to avoid ethnocentrism, students used the article referenced to identify contributions of these Moroccan researchers to science and microbiology (7). Any country or microbiology topic can be selected. However, the instructor should provide the references and questions (Appendices 1 and 2). If students are not guided to find positive aspects, they tend to emphasize the undesirable aspects of other countries' practices, which can hinder their ability to embrace other cultures. This activity is interdisciplinary and helped students apply microbiology by learning about other countries' fermented foods. The poster presentations during the international festival (Fig. 2) meant that even non-microbiology students on the campus learned about microbiology.



FIGURE 1. Students showcasing their projects during International Education Week, HCC, Plant City Campus, Morocco poster, Nov. 2, 2015 (Assignment #1).

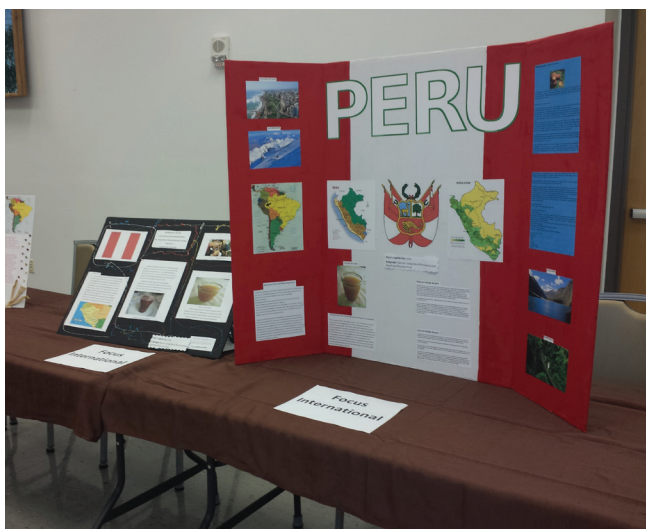


FIGURE 2. Student projects showcased during International Education Week, HCC, Plant City Campus, Perú poster, Nov. 2, 2016 (Assignment #2).

## SUPPLEMENTAL MATERIALS

Appendix 1: Assignment #1 – Instructions and references for students (Moroccan fermented foods)

Appendix 2: Assignment #2 – Instructions and references for students (Peruvian fermented drink – *chicha de jora*)

Appendix 3: Table 1

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