Developing a Hands-On Food Science Curriculum with Bilingual Elementary-Aged Hispanic Heritage Students

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Developing a Hands-On Food Science Curriculum with Bilingual Elementary-Aged Hispanic Heritage Students

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Abstract

In the United States alone there are over 48 million cases of foodborne illness, with most of these cases deriving from food cooked in the home (Young 2016). Many themes have been assessed such as confidence, knowledge, habits, taste in food preferences, and societal/social influences (Young 2016). However, when food safety curricula are targeted toward younger populations, including young adults and children, attitudes and behavior change (Mullan 2018 and Young 2016). As there is a lack in home economics education in today’s current curriculum, students and their families may not know food safety behaviors (Finch 2005; Young 2016). It has also been shown that families are influenced by what their kids learn in school and are likely to change their food safety behaviors because of it (Young 2016). As more bilingual kids come into the United States, they are becoming a target population for teaching public health and food safety concepts. The curriculum developed for this project is targeted at 20-22 primarily Spanish-speaking youth of ages ranging from 5-12.

These students participated in hands-on activities, such as using Glo-Germ and sensory evaluation of fruits, vegetables, and candy. As the purpose of Spanish Club is to give students of Hispanic heritage an open space to speak Spanish freely, all lessons were taught in Spanish. When students were asked to read or write, it was determined that many students were not proficient in their Spanish literacy skills. After observing this, further literature was reviewed on reading and writing acquisition skills for bilingual students in order to recommend an interactive, bilingual, food safety curriculum for the growing Hispanic Population in the United States.
Introduction

Background

The Center for Disease Control and Prevention (CDC) estimates that there are 48 million cases of foodborne illness each year in the United States. Of these 48 million cases, 128,000 people are hospitalized, and 3,000 die. These past few years, there has been an increase in foodborne illness. In 2017, the CDC only had to investigate eight different multi-state outbreaks. In 2018, that number tripled to twenty-four different outbreaks. Some of the more notable outbreaks in 2018 were related to ground beef and romaine lettuce. These outbreaks even inspired the social media and meme culture (See Figure 1). As of the April 30, 2019, the CDC has investigated six different multi-state outbreaks. Across all three years, the majority of the outbreaks have been caused by a strain of Salmonella, E. coli or Listeria monocytogenes.

Figure 1: Romaine Lettuce Outbreak Meme

Problem

Although some of these outbreaks are due to inherent problems at the food company, the majority of foodborne illnesses are still contracted from the home. While there has been research on food safety education and intervention with the familial unit (Lum 2013) and research on
cultural populations (Stenger 2014). Not much research has been done on teaching elementary-aged students of cultural backgrounds.

In regards to the three most prevalent microorganisms that cause foodborne outbreaks in the United States, children are even more susceptible to contracting *Listeria monocytogenes*, *Salmonella*, and *E. coli*. Approximately one-third of all foodborne illness is attributed to elementary-aged students (Lum 2013), and the rates of *Listeria* are even higher amongst Hispanics than any other ethnic group (Stenger 2014).

**Common Hispanic Cultural Perceptions and Beliefs About Food**

Hispanics have a cultural belief of the “hot and cold” theory (Stenger 2014). The hot and cold theory is on the notion of balance, and that you have to treat a “cold” ailment with a “hot” treatment. Another cultural practice that many Hispanics are accustomed to is going the market every single day to prepare food, adding to the notion that food in their respective countries is “ fresher” (Stenger 2014).

**Purpose**

I was first introduced to Inskip Elementary through the Spanish Service-Learning Certificate Program. Before being involved in the after-school programming, I would volunteer at the school to serve as an interpreter for Hispanic parents that did not know English. Additionally, I would translate the newsletters sent to us by the teachers. Once I began working in the classroom, I was there to help Spanish-speaking students who were not performing to state standards, increase their English acquisition. These students worked in the English Language Learners (ELL) Club, 2-3 times a week. However, the administration reserved Fridays for Spanish Club. Spanish Club was established to allow students of Hispanic Heritage a free space where they could speak Spanish freely. At Spanish Club, everything was required to be in
Spanish so the students of Hispanic heritage would not lose their knowledge of the language. Due to class scheduling, the only time I could volunteer at Inskip was on Fridays which led me to develop the interactive Hispanic heritage food safety curriculum.

**Methods**

Over the course of nine weeks, nine different lessons were taught to a group of 20-23 bilingual elementary-aged students. The lessons were built sequentially to start with a basic conceptual understanding of how bacteria spread to what food safety behaviors are needed when testing raw fruits and vegetables. Additionally, lessons were also placed close to major holidays where the students may run into situations where they need to know proper food safety behaviors. For example, the *At Picnic Park* curriculum was taught the weekend before Labor Day so the students would know proper food safety behaviors before they went to large picnics and cookouts. These lessons were approximately one hour long and covered topics such as food safety and food science. Lessons were designed to intentionally connect to students’ Hispanic culture or general public health.

The first lesson used GloGerm to help students visualize how bacteria spread. Three students were given the powder to simulate someone sneezing or coughing into their hand without washing them. All students were then asked to shake hands with other students in the room. Afterwards, we evaluated each students’ hands under the black-light to see how many “germs” were transferred. This activity went relatively well. The students enjoyed it, because it was interactive, engaging, and fun, especially because they felt like they were playing. Once they determined who the “infected.” ones were it was like they were playing tag to avoid being “infected.” One thing I would change though is the type of GloGerm I used. I used the powder
GloGerm and it made a HUGE mess. If I were to redo it over again, I would use the GloGerm lotion and maybe have more kids be “infected.”

Figure 2: Hands under black-light after using GloGerm

The next lesson used GloGerm to teach proper handwashing. Each student went to the bathroom and wash their hands the way they normally would. Afterwards, we saw their hands under the blacklight and evaluated the areas where germs normally reside. Later, we showed them the target areas and the proper way to wash your hands, for twenty seconds with soap and warm water. The students were then given the GloGerm an additional time to determine if their handwashing improved after learning the proper method. When they learned how to wash their hands properly, we observed under the blacklight that the majority of the students learned the the areas that they were most likely to miss. When I asked them to draw a diagram a week later, highlighting the areas they would miss, they colored where their fingernails would be and in between their fingers, indicating that they retained the information as to where they would be most likely to miss when washing their hands.
The next two weeks, we used fightbac.org’s *At Picnic Park* curriculum. The first part taught proper food safety behaviors to have at a cookout. The following lesson taught proper storage procedures of foods served at a picnic. With this lesson, I split the students into groups of five, with the fifth grader leading the group. The fifth grader was responsible for teaching the students the curriculum from what they read in Spanish and then tasked with helping them complete a worksheet. *At Picnic Park* curriculum was a good segway to the next lesson on perishable vs nonperishable foods. The students were given different foods and were asked where they should store them, the fridge, the freezer, or on the shelves.
The next several lessons focused on the sensory evaluation of the lessons. First, the students were given Kool-Aid of differing flavors and colors. The first half of the experiment the students had normal flavored Kool-Aid and were asked to describe the color and the flavor. Afterwards, the students were given the same flavors, just dyed different colors. For example, the watermelon flavor Kool-Aid was dyed blue. The students were then asked to describe what flavor each new color was (See appendix).

Figure 5: Multiple flavors of Kool-Aid that were dyed to add in the sensory experiment

The next sensory lesson was on fruits. The students were split into four groups and were asked to rotate between four different fruits: apples, oranges, strawberries, and bananas. Each student was then asked to determine the difference between each fruit. Example descriptors included if one was more fragrant than the other, the different textures between fruits, the crispiness when you eat the fruit, and the visual appearance of the fruits. The next sensory lesson was on vegetables and the differences between cooked and raw vegetables, making this lesson more texture focused. The students were asked to compare the differences on raw versus cooked,
broccoli, spinach, eggplant, and radishes. The final sensory lesson focused on the differences between junk food. The first part covered the differences in texture between, kettle cooked, wavy, and regular chips. The second part covered the differences in hard candies such as butterscotch, peppermints, and cinnamon disks to evaluate the differences in pungency and aroma (See appendix).

Figure 6: Apples, oranges, strawberries, and bananas. All of these fruits were chosen due to their fragrant nature, unique texture, and sounds made when eating

Figure 7: Chips cooked in different styles of the same flavor to evaluate texture.
During the curriculum, a very important day came up for Mexicans and Guatemalans (which is the demographic of most of the students): Día de los muertos. On this day we delved more into the culture of the students to show how food is a part of their culture. We also asked how they celebrated Día de los muertos in the United States, and other important aspects of this day in their culture.
Once the curriculum was completed, the experience was compared to peer-reviewed literature on teaching Spanish-speaking students. Additionally, since it was observed numerous times that the students were not proficient in reading and writing in Spanish, literature on bilingual reading acquisition was reviewed and compared to the curriculum.

**Expected Outcomes**

From previous literature, we expect that there will be a behavior change in the home environment, and that the students will understand the food safety and food science concepts taught to them. However, we do not expect a behavior change in the students washing their hands properly every single time they need to wash their hands. This is because many studies have shown that while people may have the proper knowledge on a food safe behavior, they may not put it into practice due to convenience or other external factors (Lum 2013; Young 2016).
Additionally, we expect the students to have a greater interest in science due to the engaging nature of these activities. The beauty of food science is that it is an applied science. Generally, college-aged students understand how basic concepts from biology and chemistry such as fermentation, titration, and oxidation are utilized in the “real world” allowing deeper understanding of these concepts. We expect a similar understanding of sensory science with these activities. Furthermore, since the students were having fun with these activities, we expect that the students were learning without realizing that they did.

**Observations**

When Spanish Club was first established at Inskip Elementary School, it was established as a place for students of Hispanic descent to speak Spanish freely. One of the rules in Spanish club was “No English. *Puro español,*” meaning that I had to teach all lessons in Spanish. However, as my supervising teacher and I were teaching the kids, we discovered that many do not know how to read and write in Spanish, which then led us to teach them the fundamentals of Spanish. When the students were in groups, we did ask the older ones to assist the younger ones with filling out the worksheet and help them spell the words in Spanish. However, the older students would “help” the younger students by just doing the entire worksheet for them.

Once we moved into the sensory lessons, we needed the students to describe textures, tastes, smells, sounds, and appearances. This led to better vocabulary acquisition in both English and Spanish as sometimes the students had a better word or phrase to describe the food in Spanish, while at other times they only knew the English word and we had to teach them the Spanish word.

Another thing I observed while volunteering at Inskip Elementary school is that the Hispanic families would actively participate in events for their kids. They knew about the events
through newsletters that each grade level would send home. Parents also spoke with me and told me that they enjoyed reading those newsletters because when they would review the spelling words for the week with their children, they could increase their English knowledge.

Additionally, students would tell me what they told their parents about Spanish club and all the fun they would have. Some student’s parents would quiz them about what they learned in Spanish club, potentially attributing to behavior changes in the home.

While I was teaching the curriculum, I took one week off for UT’s fall break. Once I returned, all the kids were asking me where I went, and they kept telling me how glad they were to see me, because when I was teaching, they did not have to learn anything. They claimed when I taught, they were allowed to have fun and play games. This led to the assumption that the students were learning without knowing that they were. The students did not believe that many of the sensory activities could be counted as “science.” When they realized that fun activities are science, they all told me that they had a greater interest in science.

**Recommendations**

The overall goal with food safety education is to build proper food safe behaviors so we can ideally reduce the number of foodborne illnesses. While I do believe it is still appropriate to teach a similar curriculum to elementary-aged students of Hispanic Heritage, there are a few recommendations I have to improve on the curriculum.

1. Split students up in 2-3 groups by grade level
   a. If two groups:
      i. K-2
      ii. 3-5
b. If three groups:
   i. K-1
   j. 2-3
   k. 4-5

2. Increase the time of the lessons by fifteen minutes so students can further discuss what they have observed in the experiments

3. Require the students, especially the younger ones, to have a Spanish-English book on Food Safety Terms

4. Add more lessons on how food relates to culture

5. Use more technological based instruction such as virtual reality and augmented reality

1. **Splitting the Students up into groups by grade level**

   This recommendation is due to the primary observation that the majority of the students were not proficient in reading/writing in Spanish. The groups were chosen because of the differences in reading and writing levels at each subsequent age group.

   If the students were split up in two groups, we could help the younger kids focus on spelling, pronunciation, and allow them to have more age appropriate readings and activities for them. The same goes for the older students. The older students were the ones who were the most proficient at reading and writing in Spanish. Giving the older students more challenging and exciting experiments and readings.

   However, if the students were able to be split up into three groups, kindergarteners and first graders could be exposed to new vocabulary. While the second and third graders could focus on the phonetics between the two languages helping them discriminate the differences in sound.
Finally, the fourth and fifth graders could focus on composition and mechanics of Spanish (Spies 2016). Further breakdown allows the students to be challenged for their skill level appropriately.

In addition, younger students need additional help due to the inherent delay in language acquisition and the interference between the two phonological, lexical, and grammatical systems (Ardila 2017). Furthermore, it is beneficial to teach the students to read in Spanish because prior studies have shown that students who read in Spanish read faster due to the orthography (Ardila 2017). Although there may be a delay in reading initially, it is no longer observed after a few years of school (Ardila 2017). This indicates that splitting the students up by different age groups would assist in improving their literacy skills in both Spanish and English.

One of the caveats to this is that cohesion amongst the group would be broken. This is a fair statement, because when you see these students interact and play with each other outside on the playground, they stick with each other even though they are of different age groups. The fifth grade girls love taking care of the younger girls, and the third grade boys will chase the fifth graders around. While them all being together in the club assists with cohesion, if the goal of the club’s supervising teacher is to increase student’s Spanish reading and writing proficiency, they must be separated by age and grade.

2. Increase the lessons by fifteen minutes

While I was working, there were many times where I could not fit my entire lesson into the hour allotted. If the lessons were increased by fifteen minutes, I believe the students would have gotten more out of the discussion about what they learned. Many found the sensory activities fun because they enjoyed trying all of the new foods. This activity also seemed to improve both Spanish and English vocabulary. However, when the students were done rotating through the groups, they really did not have enough time to exchange any ideas and observations.
they made during the activity. If the lessons were increased by fifteen minutes, they could see what they missed in their observations and consider other ideas of their students.

3. Have a booklet of vocabulary to build-on

Throughout this entire experience, what surprised me and my supervising teacher is that many of the students were not proficient in reading and writing in Spanish. One way to improve both their English and Spanish vocabulary is for them to create a booklet of words that they would carry throughout the curriculum. This booklet would be designed similarly to a Spanish-English dictionary, where one side would have the world in English and the other in Spanish. A simple tool like this would help the students become more familiar on proper spelling of words in both languages. Additionally, if a student did not know a word in Spanish but knew it in English, he/she could ask one of us, put it in his/her book, utilize the book as a resource in the future, and vice versa. Furthermore, this could help students recognize cognates in both English and Spanish (Nagy 1993). Focusing on cognates improves language fluency in both languages. Additionally, a study done has shown that knowing the primary language vocabulary enhanced the reading comprehension of the secondary language (Spies 2016). Meaning that this will benefit the students in their educational endeavors.

4. Have more lessons on how food relates to culture

The day I taught Día de los Muertos was the calmest I had gotten the students to be throughout the entire experience. A reason why I think that they were so much calmer than normal is because this holiday is extremely important to their culture. While I only planned for them to color wooden skulls, I prompted questions about how they celebrated it, or if their mothers cooked anything special for the occasion. Each told me how they celebrated or how they were fearful of celebrating due to being discriminated to in the past. This lesson was eye-opening
and made me realize that these kids needed to be empowered and be proud of their Hispanic heritage. I think another fun lesson that could be incorporated is having cooking classes. This would be an ideal way to apply all the food safety measures they have learned while allowing them to be proud of their heritage and all the different types of food they make. Furthermore, cooking classes could allow the instructor to focus on specific food safety behaviors that must be practiced when preparing specific ethnic foods.

Figure 10: Pan de muerto, a traditional type of bread served during Día de los muertos.

5. Using interactive types of technology

One of the growing research areas in food safety education is using augmented and virtual reality. Food safety is generally not a very exciting topic to learn about and needs to be interactive because it is important for consumer health. However, technology helps us mitigate this problem through gamification. When using the interactive technology, a game is usually inherent in the instructional design. The game starts to present a challenge for the participant, because they want to “win” said game (Stevenson 2018). Incorporating this to a technologically savvy population will be extremely beneficial in learning and retention of food safety concepts. Additionally, some of the material, especially for augmented reality exists through FightBac! lessons, making it easier to incorporate this into the curriculum. Furthermore, prior food safety
education studies stress the importance of using mixed-media methods that are catered to your audiences (Lum 2013; Machado 2018, Young 2016).

Figure 11: FightBac! At Picnic Park’s Curriculum Game; Perfect Picnic

In addition, technology can be utilized to reach parents as well. Reaching out to parents about proper food safety behaviors through newsletters and podcasts have been shown to be effective and promote behavior changes (Stenger 2013). However, the challenge that will arise with using electronic media is for those who do not have access. An alternative would be sending paper copies in both Spanish and English home with the students. At Inskip, this would probably be effective as the parents do read the newsletters and enjoy increasing their English vocabulary through the newsletters. Podcasts may be a challenging way to distribute education materials to the families. Although it would be useful in the car, providing access in both English and Spanish would be the greatest barrier.

**Conclusions and Future Directions**

We have determined that it is important to educate the general public about food safety due to the recent increase of foodborne outbreaks. However, it is important to teach food safety in an effective and engaging way to build habit strength in order to reduce the number of noncompliance. One of the most effective ways is to target the youth, because the youth are
susceptible to building habit strength. If they are taught proper food safety behaviors at a young age, they will practice the proper behavior over time, slowly but surely building habit strength. Additionally, it is shown that students can foster a behavior change as parents are more likely to change a behavior if it affects the health of their child (Young 2016). Finally, food safety must be taught in an engaging, and culturally-relevant way to be effective. If people of ethnic populations cannot understand why they need to practice these food safe behaviors, the number of foodborne outbreaks will not decrease.

A major challenge with teaching cultural populations is establishing trust (Stenger 2014). Due to having a previously established relationship with these students, I did not run into this problem. However, integrating a food safety curriculum into an after-school program or developing an interdisciplinary food safety curriculum similar to the Hands-On model (Richards 2008) for elementary-aged students would easily assist in establishing trust. Families almost instantly trust schools (Young 2016), therefore, teaching a food safety curriculum through a school would be the most effective and optimal way to teach to elementary-aged ethnic populations.

Specifically with this curriculum, further evaluation would need to be done through focus groups or surveys to see if the students retained the information and enjoyed the lessons. Additionally, it would be interesting to see if the language the curriculum is taught in affects the retention of material in bilingual students. Finally, it would be beneficial to see if a stronger behavior change will occur if a bilingual student is taught in the language, he/she is more comfortable reading/writing in.

Another direction that can be pursued is teaching Hispanic grandmothers food safety. In Latinx tradition, grandmothers hold a high status and are a source of knowledge. Additionally,
they have a strong influence on the family dynamics (Stenger 2014). Grandmothers are also the ones who pass down the culture to their families. If they pass down a bad food safety behavior, they cycle will continue and will not improve compliance. Developing a curriculum for Latinx grandmothers to teach to their children and their grandchildren could be a way to instill behavior changes with Hispanic families.

Finally, more research needs to be done on bilingual education, but in regard to Spanish reading acquisition or the loss of it once students are in the schools. There has been phenomenal research done in the 1990s on bilingual education, but only in regards to improving English reading and comprehension. One study has shown that the majority of second-generation immigrants of Hispanic heritage that went through the American education system have a greater proficiency in English compared to their native language of Spanish (Ardila 2019).
Acknowledgements

First and foremost, I want to thank my ever so patient mentor and advisor, Dr. Jennifer Richards. Thank you for pushing me through this process (especially writing, because I hate writing) and keeping me on track. I know I am not the easiest to work with, and we ran into multiple crises during this entire project. I am extremely grateful for your mentorship and guidance throughout this process.

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Additionally, thank you to my two honors research mentors Dr. Kristina Cantin and Dr. Kimberly Gwinn. I honestly do not know where I would be without you. Ever since my freshman year, this senior thesis intimidated me (and it still does), but you both showed me that it is doable.

Finally, thank you to all my students at Inskip Elementary School. All of you were a blast to teach (even though you all were super rowdy). Without you guys, I would not have been able to do this project. You all are fantastic and have some of the brightest futures ahead of you.
References


cdc.gov/foodsafety


Appendix

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A-3: Fruit Worksheet
A-4: Vegetable Worksheet
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**Dulces**

<table>
<thead>
<tr>
<th>Dulce de azúcar y mantequilla</th>
<th>Canela</th>
<th>Menta</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Sabor:</strong> (¿Dulce? ¿Aromático?)</td>
<td><strong>Sabor:</strong> (¿Dulce? ¿Aromático?)</td>
<td><strong>Sabor:</strong> (¿Dulce? ¿Aromático?)</td>
</tr>
<tr>
<td>Oler:</td>
<td>Oler:</td>
<td>Oler:</td>
</tr>
<tr>
<td>Ver:</td>
<td>Ver:</td>
<td>Ver:</td>
</tr>
</tbody>
</table>

Evaluar los tres. ¿Cuál es más aromático? ¿Lo más dulce?

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______________________________________________________________________________
______________________________________________________________________________

**Papitas Fritas**

<table>
<thead>
<tr>
<th>Ondulado</th>
<th>Cocinada en una caldera</th>
<th>Normal</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Ver:</strong></td>
<td><strong>Ver:</strong></td>
<td><strong>Ver:</strong></td>
</tr>
<tr>
<td><strong>Sonido (Cuando comes):</strong></td>
<td><strong>Sonido (Cuando comes):</strong></td>
<td><strong>Sonido (Cuando comes):</strong></td>
</tr>
<tr>
<td><strong>Sabor:</strong></td>
<td><strong>Sabor:</strong></td>
<td><strong>Sabor:</strong></td>
</tr>
<tr>
<td><strong>Oler:</strong></td>
<td><strong>Oler:</strong></td>
<td><strong>Oler:</strong></td>
</tr>
</tbody>
</table>

¿Hay una diferencia en la textura cuando comes una papita específica? Explique.

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