The Nutrition Lab: Bringing Hands-on Food Education to P–12 Students

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Why Start a Nutrition Lab?

The American Association of Family and Consumer Sciences (2019) estimates that only about 5 million students in the United States currently participate in family and consumer science classes. With more than 56 million students enrolled in public and private elementary, middle and high schools in the United States (National Center for Education Statistics [NCES], 2019b), many may never benefit from learning essential life skills typically taught in family and consumer sciences, such as family finance, parenting, consumer awareness, and of course, cookery. In his book *Medium Raw*, the late Anthony Bourdain wrote, “Basic cooking skills are a virtue ... the ability to feed yourself and a few others with proficiency should be taught to every young man and woman as a fundamental skill” (2010, p. 60). Other nations are already on board with this idea. School-age children and adolescents in some parts of the United Kingdom are required to participate in cooking lessons (Department for Education, 2013).

Mr. Bourdain and the United Kingdom may be on to something. There is strong evidence that home cooked meals are more nutritious and less calorie dense than convenience foods, such as restaurant fare, prepackaged meals, and highly processed foods that require minimal preparation (Soliah et al., 2003). Cooking skills, food preparation knowledge, and self-efficacy are all important factors that predict how frequently a person prepares home cooked meals, rather than eating convenience foods (Soliah et al., 2012). Though many students may learn the basics of nutrition in health classes, they may not necessarily learn how to handle and cook real food. Additionally, it cannot be assumed that young people will learn to cook at home. As fewer adults prepare home-cooked meals, children have fewer opportunities to observe and learn cooking skills from their parents or guardians (Byrd-Bredbenner, 2005). If children and adolescents
do not learn basic food preparation skills in America’s classrooms, they may never learn. For the authors of this article, it was this startling truth that inspired the creation of an experiential Nutrition Lab.

The purpose of the Nutrition Lab is to bring basic nutrition and cooking skills to students of all developmental levels, and especially students at high risk for overweight and obesity. This article presents teaching methods and lessons learned from implementation of a nutrition and cooking unit in a health and physical education program at a rural, racially diverse high school. This initiative is based on social cognitive theory, which posits that individuals can and often do learn behavior through observation of social modeling (Glanz et al., 2015).

Steps to Implement a Nutrition Lab Unit

To bring nutrition education to students at high risk for overweight and obesity, the teaching team partnered with a rural high school serving a large population of low-income students living in a designated food desert. Of 766 total students enrolled in the school, 48% were Black, Hispanic, American Indian, or mixed race (NCES, 2019a). The remaining 52% were White. A majority of the students (59.4%) were eligible for free or reduced-price lunch (NCES, 2019a). Many of the students spoke English as a second language. For this learning segment, the intended audience included all ninth-grade students enrolled in the school’s health and physical education (PE) program, for a total of 40 students.

The decision to implement a nutrition intervention at this school was not made at random. Rather, the school’s health and PE teacher contacted the teaching team to request a nutrition intervention at his school, stating in his request that more than half of his students were overweight or obese. Prior to planning the learning segment, the teaching team conducted a key informant interview with the health and PE teacher. The interview focused on commonly observed nutrition behaviors in the school and classroom, students’ pre-existing knowledge about nutrition, and skills that might be most helpful to improve students’ nutrition behaviors. Some sample questions include “What have students already been taught related to nutrition?” and “What do you typically observe your students eating for snacks?” and “Do you see most of your students taking advantage of the breakfast provided through the school district and, if so, what do you typically see them eating for breakfast?”

Based on the key informant interview, the teaching team developed a unit that included the following learning outcomes to address both knowledge and skills:

By the end of the unit, students will be able to:

1. identify serving size, fats, sugars, fiber, total carbohydrates, protein, vitamins, minerals, sodium and total calories per serving when reading a food label.
2. determine whether a food is healthy based on the nutrition label.
3. modify a recipe to make it more nutrient dense.
4. modify a recipe to reduce the calorie content.
5. calculate the nutrition content of a recipe.

6. plan a nutrient-dense meal on a budget of $10.00 or less.
7. prepare a nutrient-dense meal for four people.

For the purposes of this article, the term “nutrient-dense” is used to describe foods that are high in fiber, protein, vitamins and/or minerals and low in calories and added sugar. The teaching team planned a four-lesson learning segment, totaling 5 h 20 min of instructional time. The teaching team co-taught the lessons over a period of 3 weeks, with each lesson lasting 80 min.

The teaching team used a pre-assessment at the start of the unit to determine how much scaffolding may be needed moving forward, and the pre-assessment revealed that students were already familiar with most nutrients and how each is beneficial to health. For the pre-assessment, the teaching team gave each student at least three different pictures of common foods, such as fish, beans, eggs, tortillas, rice, different types of fruits and vegetables, and sweets such as cake. Each student was then asked to classify the food pictures under the correct food group heading (carbohydrates, vegetables, fruits, protein and sweets/fats/oils) on the whiteboard. With only one or two exceptions, students were able to execute this task. When prompted, students were also able to explain the benefits of each food group. For example, students explained that protein is needed to build muscle, carbohydrates are needed for energy, and vegetables provide vitamins and minerals to support immune function and bone health, among other things.

Following the pre-assessment, the teaching team used the remaining 60 min of the first lesson to build basic knowledge and skills, including identification of standard serving sizes (as opposed to typical portions) and how to read food labels. The teaching team modeled how to read food labels by identifying important...
information on an example label (calories, fats, protein, carbohydrates, fiber, sugar, sodium, vitamins and minerals). The class was able to make a unanimous decision about whether the example food item (breakfast toaster pastries) was a healthy choice. Students declared toaster pastries too high in added sugar and too low in fiber. Several students also noted that the ingredient list was very lengthy and included many ingredients they could not pronounce. Following this guided practice, each student was given a different food label cut from actual product packaging. Using the Food Label Detective worksheet (see Appendix A), students used food label clues to determine whether their foods were healthy (meeting learning outcomes 1 and 2).

The teaching team also used household objects to provide students with a visual representation of standard serving sizes for a variety of foods, such as a deck of cards representing a 3 oz. portion of meat, a stack of four dice representing a 1 oz. portion of cheese, and a baseball representing a 1 cup serving of leafy greens. Students also had an opportunity to contrast these standard serving sizes with typical portions. For example, the teaching team asked for several student volunteers to pour onto paper plates the amount of potato chips, trail mix, or cookies that they would usually eat in a single sitting. These portions were then compared to the actual serving size as specified on the nutrition label for each snack food. In every case, student volunteers had served up at least twice as much as the serving size indicated on the label. Using basic multiplication skills, students calculated the actual number of calories, grams of fat, grams of sugar, and milligrams of sodium consumed in the portions they served up for each snack food. One student discovered that in his 10-cookie portion (actual serving size = 2 cookies), he was consuming 750 calories, 100 g of refined carbohydrates and 50 g of sugar (the equivalent of about 11 teaspoons).

In the second lesson, students were assigned to teams of four, each intended to represent a family unit. Each family unit was instructed to find or develop a nutrient-dense recipe to feed the family on a budget of $10.00 or less. The teaching team provided family units with examples of websites where they could find healthy recipes for meals and snacks, as well as a list of nutrition requirements their recipes must meet (see Appendix B). Nutrition requirements were based on school lunch requirements established by the U.S. Department of Agriculture and included limits for sodium, total fat, saturated fat, and total calories. Recipes were also required to contain at least 10 g of protein and at least 5 g of fiber. The teaching team used a sample recipe (black beans and rice, seasoned with butter and salt) to demonstrate how to use...
happyforks.com to analyze nutrition content. Happyforks.com is a website that provides a nutrition calculator. The user can add ingredients to create a recipe and the website then uses a nutrition database to estimate nutrition content per serving. Based on the recipe’s nutrition content, the teaching team then asked students to brainstorm how they could alter the recipe to improve nutrient content, such as substituting spices or fresh herbs for the salt, substituting heart-healthy olive oil for saturated fats like butter, and adding vegetables to increase levels of fiber, vitamins, and minerals.

Next, each family unit used a laptop to find a recipe of their own, analyze the nutrition content, and make modifications to improve nutritional value. By the end of the lesson, family units were required to provide an estimated cost for their recipe, along with their shopping list (learning outcomes 3, 4 and 5). The teaching team provided each family unit with a table for listing their ingredients and estimating the cost of each ingredient.

In lesson 3, family units traveled by school bus to a grocery store where they took a tour of the produce section and learned where to find fresh whole foods in most grocery stores. The tour also included an overview of options for more shelf-stable fruits and vegetables, such as frozen produce, canned vegetables with no added sodium, and canned fruit packed in 100% fruit juice, rather than syrup. Students then had 30 min to find ingredients for their recipes and price check everything on their lists (learning outcome 6). With grant funding, students were able to purchase their ingredients and stash everything in the school’s kitchen lab space until lesson 4, scheduled for 48 h later. In the future, the teaching team would like to add an advocacy component to this lesson by challenging students to introduce their parents or guardians to the shelf-stable produce options covered in class and to encourage their families to try at least three new fruits or vegetables by the end of the week. This extension could improve the likelihood that students will be able to access more fruits and vegetables at home, where they may have limited control over how the pantry is stocked.

Lesson 4 was designed as a culminating event. Students convened in the kitchen lab and ingredients from the grocery store field trip were distributed to each family unit. With only 80 min to prepare and taste test their recipes, family units had to work cooperatively. Half of the family units used counter space to wash and prep vegetables or fruit, while the other family units used the stovetops and ovens to boil, sauté, steam, and bake. Family units sat down together to eat healthy meals they planned and prepared themselves on a budget of only $10.00 (learning outcome 7).

Based on the identified outcomes for the learning segment, the teaching team developed a post-questionnaire to explore students’ perceptions of any changes in confidence to perform the learning outcomes. Students were asked to gauge their level of improvement using 5-point Likert scales. An example question is “After participating in the nutrition lessons, I feel more confident in my ability to read a food label.” Response choices for all items included strongly agree, somewhat agree, not sure, somewhat disagree, and strongly disagree.

Results

This nutrition unit was taught to two separate classes. Class A had 22 students and Class B had 18 students. The two classes were demographically similar. Students in both classes ranged in age from 13 to 15 years, and there were approximately equal proportions of males to females and Caucasian students to non-Caucasian students. Although the classes were co-taught, Class A was led by the more veteran health educator on the teaching team, with 10 years of experience teaching health and PE. Class B was led by a graduate assistant with very limited previous teaching experience. In Class A, 86.4% of students indicated that they somewhat or strongly agreed that their confidence to perform at least 75% of the targeted behaviors had improved as a result of participating in the unit. Of the students in Class B, 66.7% of students indicated that they somewhat or strongly agreed that their confidence to perform at least 75% of the targeted behaviors had improved. Although significantly fewer students in Class B reported improvement in their self-efficacy levels, this demonstrates that even a novice teacher can significantly affect confidence to perform health behaviors. An improvement in two-thirds of the class is a great achievement for a developing educator and may suggest that the use of practical skill development in the lessons can help even a novice to build stronger self-efficacy levels in students.

Implications for Practice

Logistics of providing an authentic experience can be challenging for many educators. Most schools are not fortunate enough to have kitchen space where students can work in tandem to make recipes that require stovetops and ovens. Because the teaching team often implements nutrition and cooking education in other schools and in community settings such as farmers’ markets, public parks, and retirement communities, the Nutrition Lab is supplied with two camp stoves, propane fuel canisters, lightweight stainless steel cookware, a microwave, a blender and a cooler, as well as a variety of mixing bowls, food scales, cutting boards, knives, and common kitchen utensils like spatulas and tongs. In the interest of safety, there are also steel mesh gloves to be worn when using any of the knives. This simple cookware is portable. The teaching team uses large wheeled totes to transport equipment to any site, even those lacking electricity and running water. Sites with no electricity or water supply pose some challenges, but it is still possible to teach children or community members to make simple meals, such as overnight oats, vegetable and hummus wraps, or cucumber tuna boats.

To purchase equipment, food, and other supplies such as disposable gloves and hand sanitizer, the teaching team turned to nutrition and education grants, which can provide funding for those interested in teaching a similar learning segment. Opportunities for funding are included in Appendix C. There may also be opportunities for schools to partner with local nonprofits. For example, the teaching team for this intervention developed a partnership with a local nonprofit organization devoted to making affordable, locally sourced produce more accessible to all. This organization has provided free fresh fruits and vegetables for use in Nutrition Lab programming.

Finally, a needs assessment prior to lesson planning and implementation is a critical step. Identifying the barriers, both real and perceived, that inhibit healthy nutrition habits for a specific target population will enable educators to focus the curriculum on strategies to overcome those barriers. For example, families living in a food desert may struggle to incorporate fresh fruits and vegetables into their meals. For this type of population, it may be essential to teach students how to use more frozen produce, how to find canned fruits and vegetables with no added salt or sugar, or which fruits and vegetables will keep longest, such as winter squash and root vegetables like carrots, turnips, and sweet potatoes. By carefully assessing needs prior to the planning phase, educators can more effectively reduce or eliminate the challenges facing their students.
Conclusion

Self-efficacy, a major construct of social cognitive theory, has been shown to significantly improve a person’s likelihood of performing a health behavior, and previous experience with the behavior helps build stronger self-efficacy (Glanz et al., 2015). By applying this logic to instructional models, it seems likely that health educators can reduce the frequency of obesogenic behaviors in school-age children and adolescents by using meal planning, shopping, and cooking experiences to build self-efficacy levels. Social modeling provided in the Nutrition Lab creates opportunities for observational learning that children may not get at home. Furthermore, time spent actively learning through these experiences builds behavioral skills or abilities needed to successfully perform a behavior (Glanz et al., 2015). Observational learning and behavioral skills are both major constructs from social cognitive theory. Investing just a few weeks in an innovative and authentic nutrition education experience similar to the one described here could have lasting effects on eating behaviors among young people. Eating behaviors developed during childhood or adolescence are often maintained over a lifetime (Montano et al., 2015).

References


Appendix A: Food Label Analysis

Food Label Detective

I ate one of the four packs of Strawberry Pop-Tarts in this box. I want to know how much I just consumed of each of the following....

Calories:________________
Fat:____________________
Carbohydrates:___________
Fiber:___________________
Sugar:__________________
Protein:_________________
Vitamins & Minerals:____________________________________________
_____________________________________________________________

4 grams = 1 teaspoon. How many teaspoons of sugar did I eat? __________
Which does this food contain more of: sugar or fruit? __________________
Do you think Pop-Tarts are a healthy choice? Why or why not?

You’re the Judge!

Using your assigned food label, respond to the following. Be prepared to share!
What do you think this food is?______________________________
How much is one serving of this food?________________________
How many servings are in one package/container?________________
How much of each of the following would be in one serving of your food?
Calories:________________
Fat:____________________
Carbohydrates:___________
Fiber:_________________
Sugar:________________
Protein:_________________
Vitamins & Minerals:________________________________________

The Verdict! Is it healthy and why?


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Appendix C: Grant Opportunities

The Wal-Mart Foundation has a Community Grant Program that offers grants ranging from $250 up to $5,000 for local nonprofit organizations (https://walmart.org/how-we-give/local-community-grants). These small grants are intended to support efforts to improve healthy eating, hunger relief, quality of life, education and environmental sustainability. The U.S. Department of Agriculture offers Food and Nutrition Service grants appropriate for a range of program objectives and target populations. More details are available at https://www.fns.usda.gov/fm/grant-opportunities. The Target Foundation offers school field trip grants worth up to $700 (https://corporate[target.com]/corporate-responsibility/philanthropy/corporate-giving/field-trip-grants). These funds could be used to replicate the grocery store field trip described previously. Additionally, the Robert Woods Johnson Foundation offers opportunities for larger, more competitive grants. One example of their nutrition education–based grants is Building Evidence on Nutrition Supports for Low-Income Families with Young Children. This grant opportunity is intended to support schools and other organizations with an interest in reducing nutrition disparities. Awards range from $50,000 to $500,000.

Appendix B: Nutrition Requirements for the Family Meal (Per Serving)

1. Less than 700 calories.
2. Less than 25 grams of total fat.
3. Less than 8 grams of saturated fat.
4. Less than 800 mg of sodium.
5. Must have at least 10 grams of protein.
6. Must have at least 5 grams of fiber.
7. No trans fats.

Appendix D: Pre-Assessment/Post-Assessment

Attention: Your completion of this questionnaire is completely voluntary. You may choose to stop at any time or refrain from responding to any question you do not wish to answer.

Instructions:
Please fill out this survey as honestly as you can. You do not need to put your name on it.

1. After participating in the nutrition lessons, I feel more confident in my ability to:
   a. Read a food label.
   b. Judge whether a food is healthy or unhealthy based on the food label.
   c. Recognize a standard serving size of most foods.
   d. Find a healthy recipe online.
   e. Analyze nutrition information for any recipe I find.
   f. Change a recipe to make it healthier.
   g. Manage my weight by eating healthier foods.
   h. Find ways to eat more fruits and vegetables.

2. After participating in the nutrition lessons, I feel like I am better at the following skills:
   a. Plan a healthy meal for myself or for my family.
   b. Plan a healthy meal even if I only have $10.00 to spend.
   c. Find healthy ingredients at the grocery store.
   d. Cook simple, healthy recipes on my own.