



## Facilitating Experiential Learning in a Large Introductory Food Science Course

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### ABSTRACT

Experiential learning activities are often viewed as impractical, and potentially unfeasible, instructional tools to employ in a large class. Research has shown, though, that the metacognitive skills that students utilize while participating in experiential learning activities enable students to assess their true level of understanding and mastery for the subject matter. The objective of this study was to evaluate whether students in a large (643 person) Introduction to Food Science and Human Nutrition (FSHN 101) course improved their understanding of dietary intake and food safety after participating in two experiential learning activities developed for these course topics. The first activity, completed during class, asked students to select one day's worth of food from a list of menu choices, calculate the nutritional value of their food choices, and then compare their daily nutritional intake to the dietary reference intakes for their gender, age category and health status. The second activity, completed via the course website, asked students to complete one food safety survey prior to the commencement of the course's food microbiology section to assess the students' personal food safety behaviors and a second survey upon completion of the section to assess students' knowledge of recommended food safety practices. Students were asked to evaluate both the cognitive and affective aspects of the experiential learning activities by completing a reflective questionnaire after participating in each activity. Overall, students' responses revealed that the activities were effective learning tools and that the students liked engaging with the material on a personal application level.

### INTRODUCTION

Experiential learning can be broadly defined as the process by which a learner creates meaning from direct experience. David Kolb's (Kolb and Fry 1975; Kolb 1984) experiential learning model suggests that most adults utilize a four stage cyclical process to learn new information (e.g., about new subject matter). Though Kolb and Fry (1975) suggest that the cyclical learning process can begin at any one of the four stages, the learning process often begins with the "Concrete Experience" stage, followed by the "Reflective Observation" stage, the "Active Conceptualization" stage, and then finally the "Active Experimentation" stage. By including experiential learning activities in the classroom and curriculum, students are able to participate in the stages outlined by Kolb, solidifying their comprehension of the subject matter (Cano, 2005).

Research has shown that the metacognitive skills that students utilize while participating in experiential learning activities enable students to assess their true level of understanding and mastery for the subject matter (NRC, 2000; Brown, 1975; Flavell, 1973). Incorporating experiential learning activities into the classroom has also shown to improve student grades by as much as 8.6% in an introductory food science course, (Reitmeier, 2000), to improve student attitudes towards challenging material in a nursing curriculum (Pugsley and Clayton, 2003), and to help student motivation by putting learning in a real-world context and showing them how the knowledge can apply to their lives (Briers, 2005).

Thus, the objectives of this study were to: 1) create and implement two experiential learning activities in our introductory, large enrollment course, Introduction to Food Science and Human Nutrition (FSHN 101), for dietary intake and food safety course topics and 2) to evaluate their cognitive and affective impact on student learning. The first activity, completed during class, asked students to select one day's worth of food from a list of menu choices, calculate the nutritional value of their food choices, and then compare their daily nutritional intake to the dietary reference intakes for their gender, age category and health status. The second activity, completed via the course website, asked students to complete a food safety survey that assessed the students' personal food safety behaviors prior to the commencement of the course's food microbiology section. After completing both activities, the students were asked to evaluate both the cognitive (did it help students learn) and affective (did they like it) aspects of the experiential learning activities by completing a reflective questionnaire after participating in each activity.

### MATERIALS AND METHODS

FSHN 101 is a large (643 student) lecture course that introduces students to the basic concepts of food science and human nutrition. The course is divided into four sections throughout the semester: nutrition and health; food composition and chemistry; food microbiology and processing; and food laws, quality, and the consumer. Experiential learning activities were created for the first (nutrition and health) and the third (food microbiology and processing) sections. Both experiential learning activities were approved by the University of Illinois, Urbana-Champaign Institutional Review Board (IRB). Students were required to complete the assignment to earn credit, however, participation in the study was voluntary and their grade was not impacted if they chose not to participate in the study.

Table 1. The meal choice worksheet.

BREAKFAST CHOICE 1	LUNCH CHOICE 1	DINNER CHOICE 1	SNACKS CHOICE 1
1C soy milk 1.5C raisin bran clementine tea with 2 tablespoons of honey	1 can low sodium minestrone soup 6oz. cottage cheese with fruit fuji apple water Western omelet (ham, cheese, green peppers, onions)	Tofu stir fry 1C steamed brown rice garden salad (with shredded cheese, croutons, and low-cal dressing) 1C soy milk	6 oz yogurt
CHOICE 2	CHOICE 2	CHOICE 2	CHOICE 2
McDonald's Quarter pounder with cheese 7 pieces of whole wheat toast (with butter and jelly) 8 oz glass of orange juice coffee with 0.25 oz cream and 2 tsp sucrose	McDonald's large fry McDonald's apple pie	3/4 of a frozen supreme tombstone pizza garden salad (with shredded cheese, croutons, and full calorie dressing) 2C 2% milk	king sized snickers
CHOICE 3	CHOICE 3	CHOICE 3	CHOICE 3
1C 1% milk 1.5C frosted flakes 16 oz. apple juice	32 oz. coca-cola Turkey sandwich (2 slices) Wonder bread, 3oz deli turkey, 1 slice swiss cheese, mustard) 6 oz yogurt fuji apple water 1 oz bag of Doritos	4 orzos 8oz penne pasta with 1/4C marinara sauce topped with 6oz of grilled chicken and parmesan cheese steamed vegetable medley 1C 1% milk 2 garlic breadsticks 1C ice cream	2 oz traditional snack mix
CHOICE 4	CHOICE 4	CHOICE 4	CHOICE 4
1 nutri-grain granola bar water	Asian Sesame Chicken salad (dressing included) roll 20 oz diet soda	Frozen lean cuisine dinner garden salad (with shredded cheese, croutons, and low-cal dressing) 20 oz diet soda pudding cup 1 bag of low-fat microwave popcorn	

### Nutrition and health experiential learning activity – dietary intake assessment

In the first experiential learning activity, the students participated in a basic dietary intake assessment activity that occurred during a regularly scheduled 50-minute class period. A worksheet with four different menu selections for breakfast, lunch, dinner, and snack (Table 1) was posted on the course website, and students were instructed to print off the worksheet prior to this class period. At the start of the class, students were asked to select the meal choices that most closely resembled their own daily meal choices (from any of the categories). They were then given a packet information. On the first page, the nutritional information and cost for each breakfast, lunch, dinner, and snack was provided. On the second page, students were first instructed to complete a table which highlighted the kcals, fat (g), carbohydrates (g), protein (g) cholesterol (mg), sodium (mg), fiber (g), and cost of each meal (Table 2). They were then asked to reflect on their notes that covered nutritional adequacy, macronutrient requirements, micronutrients requirements, nutrients digestion and absorption, Dietary Guidelines for Americans, the Food Guide Pyramid, and the food label, and identify what their nutritional needs were for their age, gender, and health status. Once they had identified their nutritional needs from the Dietary Reference Intake Tables and their notes, they began to fill in a second table (Table 3). After completing Table 3, the students were asked to consider their meal choices by completing a reflective questionnaire. The activity was worth ten points and the students were required to be in-class in order to complete the activity and earn the points.

Table 2. Student-completed nutritional information worksheet.

Meal or Snack	kcals	Fat (g)	Carbs (g)	Pro (g)	Chol (mg)	Sod (mg)	Fiber (g)	Cost (\$)
Breakfast								
Lunch								
Dinner								
Snack								
Snack								
Total								
% of Total kcals	NA				NA	NA	NA	NA

Table 3. Student-completed nutritional comparison worksheet.

	kcals	Fat (%) <sup>1</sup>	Carbs (%) <sup>1</sup>	Pro (%) <sup>1</sup>	Pro (g)	Chol (mg)	Sod (mg)	Fiber (g)
Your Totals from above								
Recommended values								
Gender	M	F						
Age group	14-18	19-30	31-50	51-70				
Health Status	Pregnant	Lactating						
% of Total kcals								

### Food microbiology and processing experiential learning activity – food safety

The second experiential learning activity was a two-part activity that primarily occurred outside of the classroom. Prior to the start of the third section, food microbiology and processing, students were asked to complete a food safety survey (Figure 1) that asked them about their own routine food safety behaviors. After the lectures on bacteria, yeast, and mold; food fermentation; biotechnology; and food-borne illnesses were completed, students were asked to complete the second part of the activity. For those students who attended class, a complete explanation of the "correct" answers to the survey was provided during one of the regular class periods in an attempt to educate the students about which behaviors were the right behaviors and why it is important for adhere to those behaviors. For those students not in attendance, a written explanation of the correct answers was posted on the course website. After the students either listened to or read the explanations, they were asked to complete a reflective questionnaire that asked them to consider their behaviors, if and how they differed from the correct behaviors, and how they will change their behaviors in the future. The second part of the activity was also worth five points.

- The temperature of my home refrigerator is closest to:
  - 50 °F
  - 45 °F
  - 40 °F
  - I don't know; I've never measured it.
- Which of the following best describes your average hand washing practices?
  - Rinse hands under running water for a few seconds, but sometimes I don't wash my hands at all.
  - Scrub hands with soap and hot water for at least 20 seconds using a nailbrush when necessary.
  - Rub hands with a waterless sanitizer.
  - Clean hands with warm water and soap for about 6 seconds.
- I usually defrost (or thaw) my frozen products (i.e., meat, poultry and fish) by:
  - setting them on the counter
  - placing them in the refrigerator
  - microwaving them
  - placing them in a pan of water
- If you use a cutting board to cut raw meat, poultry or fish and it is going to be used to prepare another food, such as lettuce for a salad, the board is:
  - reused as is
  - wiped with a damp cloth
  - washed with soap and hot water
  - microwaved
- I clean my kitchen counters and other surfaces that come in contact with food using:
  - water
  - hot water and soap
  - hot water and soap, then bleach solution
  - hot water and soap, then commercial sanitizing agent
- I feel safe eating most foods because the bacteria that cause food borne illness also causes the food to look or taste bad.
  - True
  - False
- Which of the following would you consider not to be a good leftover practice?
  - Partition hot food into small containers before placing in the refrigerator.
  - Put the food immediately into the refrigerator.
  - Reheat the food to 165°F and test it using a metal stem probe thermometer.
  - Cool the food on the counter for several hours before refrigerating.
- Which of the following best describes your fresh fruit or vegetable preparation practice?
  - I thoroughly wash all fresh fruits and vegetables before I consume them.
  - I usually rinse the fresh fruits and vegetables before I consume them.
  - I wash only the unpeeled or unboxed fresh fruits and vegetables before I consume them.
  - I often do not wash fresh fruits and vegetables before I consume them.
- On average, how frequently do you change your kitchen hand towel?
  - every day
  - every other day
  - after 3 to 4 days
  - once a week
- The last time there was cookie dough in my home, the dough was:
  - made with raw eggs, and I sampled some of it
  - made with raw eggs and refrigerated, then I sampled some of it
  - store bought and I sampled some of it
  - not sampled until baked

Figure 1. Food safety behavior survey.

### Food microbiology and processing experiential learning activity – food safety survey

Of the 451 students that participated in the reflection assignment that accompanied the food safety behavior survey, 348 (77%) of them said that it both engaged and assisted them in learning the course material. Actual comments such as “It provided a direct relationship to the material. It provided everyday examples which made the information easier to remember.”, “The information has been reinforced. We learned it on the survey and also in the lecture, so doing the survey really made the information hit home.”, and “It peaked my interest in terms of whether or not I was engaging in food safety measures. Everything discussed in class gave me good guidelines for how to prepare food which engaged me.” were positive comments made by students about the assignment.

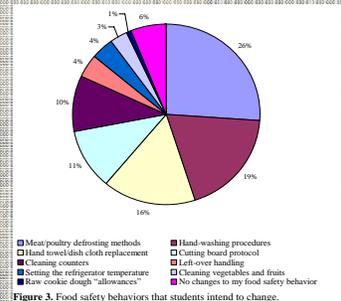


Figure 3. Food safety behaviors that students intend to change.

With regard to the questions “Based on the food safety behavior survey, are there any food safety behaviors you are considering changing? If so, why and what are they?”, nine behavior changes were common among most of the students that completed the assignment (see the legend in Figure 3). Figure 3 provides the graphical breakdown of the student responses, with 94% of the students identifying at least one key food safety behaviors they intend to change. Students have casually recognized their own food safety behavior inadequacies in past semesters, however, by asking them to identify which food safety behavior they intend to change, students were required to specifically reflect on their own behaviors in order to suggest a change. This assignment allowed students to complete each stage of Kolb’s experiential learning process, starting with the “concrete experience” (the survey) and ending with “active experimentation” (their food safety behavior changes indicated in Figure 3).

## CONCLUSIONS

Experimental learning activities can, and definitely should, be utilized in large enrollment, introductory courses. A considerable amount of time and effort must be expended when creating an activity for a large classroom in order for it to be as effective and impactful as possible. For example, care must be taken when deciding upon worksheet appearance and reflective assignment word selection. Ensuring that students have, and understand how to use, any supplemental materials required for the activity is also essential. In addition, this instructional team had the advantage of being able to audition both activities during a concurrent, smaller-enrollment, class. Presenting the activities to a smaller audience and asking for their feedback about the effectiveness of the activity prior to presenting it to the large class enabled the instructional team to eliminate many potential issues that would have frustrated students and impacted their participation.

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## Reflective questionnaires/assessments

The reflective questionnaires for both experiential learning activities were assessed after the semester was completed and the grades for all of the students were submitted. Specific questions were evaluated in each reflection. For the dietary intake activity, 1) “How did this in-class activity help you learn the course material?” and 2) “Did you like participating in this activity? Why or why not?” were categorized and tabulated. For the food safety activity, 1) “Did being asked to reflect on your own personal food safety behavior at the beginning of the food microbiology and processing section (via the pre-quiz you did on Illinois Compass): a. Engage you in learning the course material? If yes, how? If not, why not? b. Assist you in learning the course material? If not, why not?” and 2) “Based on the food safety behavior survey, are there any food safety behaviors you are considering changing? If so, why and what are they?” were categorized and tabulated.

## RESULTS AND DISCUSSION

### Nutrition and health experiential learning activity – dietary intake assessment

Five hundred and sixty-seven students participated in the dietary intake experiential learning activity. Each reflective questionnaire was read and categorized based on the actual student responses. In response to the question “How did this in-class activity help you learn the course material?” student answers fell into one of eight categories (see the legend in Figure 2). Figure 2 provides the graphical breakdown of the responses. In total, 97% of the students acknowledged that this assignment helped them learn at least one aspect of the course material (the remaining 3% did not feel that the assignment help them learn the material). Specifically, 53% of the students stated that this assignment helped them learn how to do the nutritional calculation (36%), use the DRI tables (15%), or read the nutritional labels (2%). Thus, this activity provided the students with another opportunity to ask questions and practice the concepts that are typically the most difficult concepts to grasp each semester. Twenty-five percent asserted that the assignment allowed them to apply the material to his/her own life, exemplifying the second stage (“reflective observation”) of Kolb’s experiential learning model. Fifteen percent noted that the assignment provided them with more opportunity to interact with all of the material covered in the nutrition and health section, either noting that the assignment allowed them practice applying the concepts (12%) or that the assignment provided them with hands on experience (3%). The remaining 4% reflected more on the actual observations he/she could make about their dietary intake, rather than how the assignment helped them learn the course material.

In response to the second reflective questionnaire item “Did you like participating in this activity? Why or why not?” 484 students (85%) reported that they enjoyed participating in the activity. Many students appreciated that they were able to apply the course content to themselves. Select responses from students are shown in Table 4.

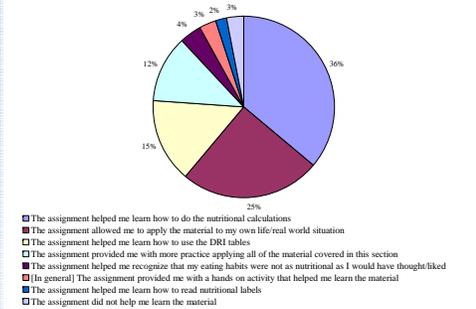


Figure 2. Responses to “How did this [dietary intake] activity help you learn the course material?”

Table 4. Selected comments from students in response to the questions “Did you like participating in this activity? Why or why not?”

“Yes, it was interesting to break up my diet and analyze what I’m actually eating and the nutritional value behind it. It’s something I would usually never think about.”
“Yes, it was fun. I enjoyed calculating and learning more about what I am putting into my body and what that means [nutritionally].”
“Yes, I enjoyed this activity because it was a nice alternative to straight forward lecture. I always feel that I learn better by doing.”
“Yes, it was interactive as opposed to normal lecture.”
“Yes, it was fun and enlightening.”
“I did [like participating in this activity]. It was a fun way to apply course material.”

