Overview

In 2017-2018 we assessed one Program Outcome, Controlling Microbes in Food. This outcome was assessed across three courses that span our curriculum. The first course used in the assessment was NDFS 3110 (Food, Technology and Health) which is an introduction to food science that students take in the fall of their sophomore year. Next, NDFS 5110 (Food Microbiology) is taken in the spring of the junior year, and NFDS 5920 (Food Product Development) is taken in the fall of their senior year. Over the course of our curriculum, students should develop an increase in both general knowledge on food safety as well as the ability to evaluate food production and distribution processes for controlling microbes. The courses and cognitive domains and depth of coverage are listed below. The cognitive domains are taken from Bloom's Taxonomy and the depth is the level at which this domain is covered in each class. For example; I-1 indicates that the cognitive domain of 1 is Introduced (I-1). The first (1) cognitive domain is for Knowledge or recall, and information presented in this way is typically assessed via tools like multiple choice exams. For NDFS 5110 and 5920, D indicates the cognitive domain was evaluated in depth, and 4 signifies 'analysis' and 5 is 'synthesis.' Consequently, assessment in these courses involve evaluating student performance on assignments where controlling microbes in foods is analyzed (NDFS 5110). For NDFS 5920, students should be able to develop a plan for controlling microbes, and thus the cognitive domain is 'synthesis.'

2017-2018	Control of microbes in food	NDFS 3110	NDFS 5110	NDFS 5920
		I-1	D-4	D-5

Results

In NDFS 3110, several aspects of controlling microbes are covered, albeit at an introductory level. Assessment of student learning in this class is by exam. Questions related to water activity, pH, and heat treatment, that involve controlling microbes, were taken from the exams and the correct scores determined. Our expectations were that student would get >80% correct.

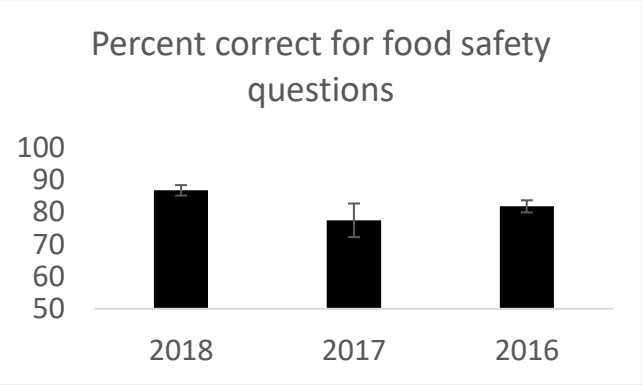

Figure 1: Percentage of correct scores for multiple choice questions on Exam 2 in NDFS 3110.

The percentage of correct answers are shown from the second exam in NDFS 3110 in Figure 1. Depending on the exact year, there were approximately 10 questions in this exam that focused on controlling microbes. In 2018, ~86% were answered correctly, while that number was 77% in 2017, and 81% in 2016.

NDFS 5110 (Food Microbiology) is typically taken in the spring of the junior year, and is the main food safety course in our curriculum. In this course, students are given instruction in basic isolation and enumeration techniques for microbes. These learning outcomes are assessed via quizzes and exams. However, to assess student capability in controlling microbes in food, students were evaluated on fact sheets they prepared. In these fact sheets, students must convey to the general public what steps are necessary to prepare foods that are safe from pathogens. These fact sheets were assessed at the synthesis level (level IV) of Bloom's taxonomy, as the students are required to understand the nature of the food, and the types of microbes that can grow in it. In addition, they must be aware of what steps are necessary to insure the food is rendered safe, depending on what the microbe of concern might be. The fact sheets from this course were evaluated using a 3-point rubric. Our program goal is for the average to be >2.5.

Table 1: Rubric used to evaluate fact sheets from NDFS 5110.

#	Topic	Advanced 3	Intermediate 2	Introductory 1	Average score over 3 years
1	Understand relationship between pH or temperature and food safety	Advanced, complete knowledge	Some knowledge, but not in depth	Minimal knowledge	2.65
2	Understand Critical Control Points in food processing (CCP)	Advanced, complete knowledge	Some knowledge, but not in depth	Minimal knowledge	2.85
3	Understanding pathogens associated with individual food types	Advanced, complete knowledge	Some knowledge, but not in depth	Minimal knowledge	2.60
4	Understand food processing processes for individual food types	Advanced, complete knowledge	Some knowledge, but not in depth	Minimal knowledge	2.65

In general, all students understood the relationship between pH and microbial pathogens and methods to process foods based on the food pH level. The variability is associated with individual students, many of whom who scored a unit of "2" did so for each question, therefore the overall quality of the fact sheet was low, but there was no one category that was lower than others. Therefore, the students have a high intermediate knowledge of the role of pH and thermal processing and food safety.

Controlling Microbes in Food was also assessed in the capstone project in NDFS 5920, Food Product Development. Food Science students complete a capstone project, specifically, develop a food product and create a report, poster and power point presentation that covers the marketing, nutrition facts, health claims, ingredient cost,

overall product cost, and processing with emphasis on food safety. The safety and quality of the reports over the past 3 years were evaluated using the rubric below. The spreadsheet has the detailed data and the average data on the competency of each topic area is given above in the rubric in the last column.

The variability in the data is likely due to a combination of class size and knowledge. But, in general, knowledge areas 3, 4 and 6 scored lower over the years. The instructor noted students have an understanding of control points, but cannot differentiate between a Critical Control Point (CCP) and a Control Point (CP). Additionally, many students know how to prepare a HACCP Plan with a table, yet others only have intermediate knowledge.

Table 2: Rubric used to evaluate Food Product Development projects from NDFS 5920 (Food Product Development).

#	Topic	Advanced 3	Intermediate 2	Introductory 1	Average score over 3 years
1	Understand relationship between water activity and food safety	Advanced, complete knowledge	Some knowledge, but not in depth	Minimal knowledge	2.94
2	Understand relationship between water activity and food shelf life	Advanced, complete knowledge	Some knowledge, but not in depth	Minimal knowledge	2.89
3	Understand Critical Control Points in food processing (CCP)	Advanced, complete knowledge	Some knowledge, but not in depth	Minimal knowledge	2.5
4	Understanding Control Points in food processing (CP)	Advanced, complete knowledge	Some knowledge, but not in depth	Minimal knowledge	2.31
5	Understanding pathogens associated with individual food types	Advanced, complete knowledge	Some knowledge, but not in depth	Minimal knowledge	2.93
6	Understand HACCP Plan				2.56
7	Understand food processing processes for individual food types	Advanced, complete knowledge	Some knowledge, but not in depth	Minimal knowledge	3.0

Plan of action

We developed our current assessment plan to conform to guidelines published by the Institute of Food Technologists (www.IFT.org). In our assessment, we focus both on course learning objectives and program outcomes. In our current assessment plan, we have worked to use a variety of assessment tools across courses in our curriculum. Students receive instruction in individual courses, and over the course of the curriculum

students develop an understanding of program outcomes, like Controlling Microbes in Food.

Our data indicates that students are able to effectively recall information related to microbes in food, as assessed via exam in a lower division course (NDFS 3110). Assessment of the fact sheets prepared in NDFS 5110 indicates that our students have gained an intermediate knowledge of controlling microbes by their junior year, yet there is a lack of depth to this knowledge. For NDFS 5920, we found that students were somewhat weaker in their understanding of Critical Control Points (CCP), Control Points (CP) and HAACP. In our January faculty meeting, we will identify the areas where these topics are covered, and determine if additional instruction or assignments are warranted.