Food Science Program Self-Assessment

Student Evaluations

The IDEA evaluation of our food science courses is shown below. Each faculty member is encouraged to list at least three IDEA objectives on their syllabus, and these are the then scored by the students towards the end of the semester. The 2023 IDEA ratings for all Food Science Courses are listed below in Table 1.

Table 1: Summary of IDEA scores for food science courses taught in 2023-2024

Spring 2024	Instructor	Progress on Objectives	Excellent Teacher	Excellent Course
Food Processing	Bastarrachea	Lower	Much Lower	Lower
Sensory Science	Pico	Much Lower	Much Lower	Much Lower
Food Analysis	Martarneh	Similar	Similar	Similar
Food Microbiology	Oberg	Similar	Lower	Lower
Dairy Processing	Sharma	Lower	Much Lower	Much Lower
Fall 2023				
Chocolate Science	Martini	Similar	Similar	Similar
Sanitation and Safety	Reidhead	Similar	Lower	Lower
Food Chemistry	Matarneh	Similar	Similar	Lower
Meat Technology	Martarneh	Higher	Higher	Similar
Food Engineering	Bastarrachea	Lower	Much Lower	Much Lower
Food Laws	Savello	Much Lower	Much Lower	Much Lower

Compared to previous years, student evaluations in our courses have dropped. Last year, the evaluation scores for *Progress on Objectives* were 91% similar or higher. This year it is 36%. For *Excellent Teacher*, the evaluation scores also dropped from 91% to 36%. For *Excellent Course*, the scores dropped from 91% to 27%. According to our department head, Heidi Wengreen, there was a drop in all department course evaluations this year, but ours dropped more than the others.

As detailed below, for our instruction assessment, we use objective analyses of student learning for our assessment, and instructors have typically used IDEA evaluation numbers and comments to assess their teaching for promotion and tenure committees. Beyond that, instructors may use the evaluations and comments to improve their teaching, but we have not discussed these evaluations as a program. However, based on these data, we will address this drop in student assessment in our first faculty meeting of the new year. Individual faculty will be encouraged to assess student comments in their evaluations and we will devise a plan to improve student assessment of our teaching.

Program Approval and Assessment for the Institute of Food Technologists

The Food Science BS program at Utah State University is an approved program by the *Institute of Food Technologists* (www.IFT.org). Globally, IFT sets guidelines for the background courses and curriculum to be covered in an approved food science program. USU received a new five-year approval by IFT in the Fall of 2019 which was based on a) *the appropriateness and expertise of the faculty*, b) *appropriate infrastructure including research and teaching laboratories*, and c) *a five-year assessment plan*. The food science program began to submit assessment reports to IFT in the fall of 2022. In this assessment

scheme, the overall curriculum of food science is broken down into 11 major areas, called **Standards**, which have associated **Essential Learning Outcomes (ELOs)** For the first 4 years, we will assess three ELOs across two Standards per year. In the fifth year, we will assess two ELOs across two Standards.

The ELOs were written and approved by the Higher Education Review Board (HERB) at IFT to facilitate assessment of learning objectives critical to the development of a capable food scientist. More specifically, the verbs used in the ELOs describe a learning outcome and suggest a cognitive domain level at which the ELO can be assessed. IFT has also advised approved programs to go beyond subjective student course evaluations and grades in assessing student learning and provided some examples of Learning Assessment Techniques (LATs). In 2021 and 2022 the food science faculty met to discuss implementing novel LATs for student evaluation. All food science programs are given flexibility in implementing the LATs and the first review of their appropriateness by the Higher Education Review Board (HERB) was conducted in the fall of 2022. As the IFT assessments are due in October of each year, the assessment we sent to them in October of 2022 reflected assessments collected in the fall of 2022 and spring of 2023. This assessment was approved in December of 2023.

Results

The results are shown below. In 2022/2023 we assessed two standards (Data and Statistical Analysis and Food Chemistry) and for each, there were three ELOs. Next, for each ELO, we used two different LATs. The results are presented in a table. The Standard, ELO, LATs, implementation, findings, and anticipated corrective actions are presented sequentially.

Standard	Food Engineering and Processing
ELO assessed	Define principles of food engineering (mass and heat transfer, fluid flow, thermodynamics)
Course ELO was assessed in	Food Engineering
Period ELO was assessed	Fall 2023
Name of LAT 1	Case Study
Description of LAT 1	Students were asked to define the types of liquid foods based on their rheological behavior.
Description of how LAT 1 was implemented with students	In a laboratory session, rheological data was obtained for different types of foods with a concentric cylinder rheometer. Students

	were also asked to calculate their apparent viscosities at different levels of shear rate.
Description of the tool(s) used for LAT 1 analysis	Student performance was graded using normal 100% grade distribution.
Key Findings for LAT 1	The average score was 95.8 ± 2.9; all the class got a score of 90 – 100.
Description of how student performance for LAT 1 related to expectations for Standard 5 ELO 1	Students tend to perform better in laboratory activities than in exams, possibly due to the opportunity laboratory sessions give to put into practice the concepts covered in class. Based on this finding, case studies that involve laboratory activities and/or take-home activities that simulate laboratory real research situations will be assigned with more frequency.

Name of LAT 2	Consider This
Description of LAT 2	Energy and heat transfer problem
Description of how LAT 2 was implemented with students	In a laboratory session, students were asked to calculate the energy requirements (as well as the energy losses) in a hot-air drying experiment, to performing the corresponding heat and mass balances using the thermal properties of the food samples (fresh fruits) and the thermodynamic properties of the ambient input and output air based on the water psychrometric chart. Students apply the concepts of dehydration, for them to realize how some real scenarios may differ from the theory (for instance, the fact that energy losses take place in a real scenario, while in textbooks' examples energy losses are assumed to be negligible).

Description of the tool(s) used for LAT 2 analysis	Student performance was graded using normal 100% grade distribution.
Key Findings for LAT 2	The average score was 83.0 ± 15.7; 40% of the class got a score of 90 – 100, 40% of the class got a score of 80 – 90, and 20% got a score of 60 – 70.
Description of how student performance for LAT 2 related to expectations for Standard 5 ELO 1	Students tend to perform better in laboratory activities than in exams, possibly due to the opportunity laboratory sessions give to put into practice the concepts covered in class. Based on this finding, case studies that involve laboratory activities and/or take-home activities that simulate laboratory real research situations will continue to be assigned with more frequency.
Standard	Food Engineering and Processing
ELO assessed	Explain the source and variability of raw food materials and their impact of food processing operations
Course ELO was assessed in	Food Engineering
Period ELO was assessed	Fall 2023
Name of LAT 1	Case study
Description of LAT 1	Use of empirical data to determine reaction kinetics
Description of how LAT 1 was implemented with students	Students were assigned a take-home activity in teams of 2 – 3 people in which they were given real data of the change in some physicochemical property during storage at different temperatures. Each team was assigned a different product, covering a variety of products (such as minimally processed and/or fresh produce, fermented products, or shelf-stable products). The written report and the corresponding oral presentation had to include the prediction of shelf-life based on the order of reaction

	obtained, and under a simulated scenario of temperature abuse, for them to determine how that temperature abuse affected the shelf-life.
Description of the tool(s) used for LAT 1analysis	Student performance was graded using normal 100% grade distribution.
Key Findings for LAT 1	The average score was 92.6 ± 3.5; 92% of the class got a score of 90 – 100, and 18% got a score of 80 – 90.
Description of how student performance for LAT 1 related to expectations for Standard 5 ELO 2	Students were able to learn from the different teams how the extent of processing affects shelf-life (raw foods versus highly processed), and how different processing techniques affect shelf-life. With these activities, students not only learn how to use empirical methods to predict shelf-life, but also how raw and minimally processed foods can exhibit high or low variability in their physicochemical properties, and how processing can minimize such variabilities. They also learn how different types of foods may require different types of processing techniques to obtain a specific final result. These types of activities will continue to be assigned since students are able to interpret real data and explain it based on the concepts learned in class.

Name of LAT 2	Paper or Project Prospectus
Description of LAT 2	Take-home question group assignment regarding
Description of how LAT 2 was implemented with students	Students were assigned a take-home activity in teams of 4 – 5 people in which they were asked to propose the production processes of different products (such as osmotically dried fruits, frozen fruits, pasteurized egg, or spray-dried egg), and explain to the rest of the class in a presentation the corresponding mass and energy balances, with all the appropriate justifications based on their

	research and bibliography. This activity also included a written report.
Description of the tool(s) used for LAT 2 analysis	Student performance was graded using normal 100% grade distribution.
Key Findings for LAT 2	The average score was 93.8 ± 7.4; 56% of the class got a score of 90 – 100, and 44% got a score of 80 – 90.
Description of how student performance for LAT 2 related to expectations for Standard 5 ELO 2	With these activities, students not only learn how to use empirical methods to predict shelf-life, but also how raw and minimally processed foods can exhibit high or low variability in their physicochemical properties, and how processing can minimize such variabilities. They also learn how different types of foods may require different types of processing techniques to obtain a specific final result. These types of activities will continue to be assigned since students are able to interpret real data and explain it based on the concepts learned in class.

Standard	Food Engineering and Processing
ELO assessed	Use unit operations to produce a given food product in a laboratory or pilot plant
Course ELO was assessed in	Food Engineering
Period ELO was assessed	Fall 2023
Name of LAT 1	Case Study
Description of LAT 1	Determination of mass and energy balance in freeze drying unit operation
Description of how LAT 1 was implemented with students	In a laboratory session, students were asked to freeze-dry fresh fruits. This process involves two main steps: freezing and sublimation. Students were asked to calculate the mass and heat balances for

	each operation, and the overall energy efficiency based on the power consumption of the freeze-dryer used.
Description of the tool(s) used for LAT 1 analysis	Student performance was graded using normal 100% grade distribution.
Key Findings for LAT 1	The average score was 96.0 ± 6.5; 80% of the class got a score of 90 – 100 and 20% got a score of 80 – 90.
Description of how student performance for LAT 1 related to expectations for Standard 5 ELO 3	These activities also confirm that students can perform better in laboratory activities than in exams or quizzes, due to the possibility of applying course materials to a real situation. Based on this finding, case studies that involve laboratory activities and/or take-home activities that simulate laboratory real research situations will continue to be assigned with more frequency.
Name of LAT 2	Unit operations analysis
Description of LAT 2	Students had to calculate yield for several unit operations in the Aggie Chocolate Factory.
Description of how LAT 2 was implemented with students	NDFS 1010 is an introductory food science class that concerns chocolate making. In addition, there are six laboratory sessions held in the Aggie Chocolate Factory. In two labs, unit operations are used to convert cocoa beans into chocolate. Student sort beans and calculate the percent good and bad beans. In addition, students use a winnower machine to remove the shells from the cocoa beans and then calculated the percent yield of cocoa nibs. Last, in a separate lab, students work with the TA to press the cocoa liquor to produce cocoa powder and cocoa butter.

Description of the tool(s) used for LAT 2 analysis	In the lab introduction, the TAs described unit operations and showed the students the calculations used to determine yield. Next, students collected data in the individual lab sections. There are several laboratory sessions for this class, and students were provided data from each lab section. Last, students were given industry parameters for each yield calculation and were asked to compare the yield data to typical values.
Key Findings for LAT 2	Students perform the calculation with the aid of the TAs, so they typically get the answers correct.
Description of how student performance for LAT 2 related to expectations for Standard 5 ELO 3	This is an introductory class, and the students receive a lot of guidance from the TAs. We expect >90% will do the calculations correctly, and that is typically the case.
What could you do differently next year to further improve student performance on this standard?	We also have a dairy processing plant and a dairy processing class for upper level students. We have discussed moving this assessment to that class.
Standard	Food Microbiology
ELO assessed	Identify relevant beneficial, pathogenic and spoilage microorganisms in foods and the conditions under which they grow
Course ELO was assessed in	NDFS 6110, Food Microbiology
Period ELO was assessed	Spring 2024
Name of LAT 1	Oral Presentation
Description of LAT 1	Students choose a relevant foodborne pathogen to present to the class covering topics listed on the grading rubric.
Description of how LAT 1 was implemented with students	Students are given a list of relevant food borne pathogens and each student selects one organism to prepare and present an oral

	presentation to the class. Each presentation must include the following information: • Briefly discuss a current outbreak (Emphasize human importance of this illness) • Basic biology of the microorganism (Information for better understanding) • U.S. (and Utah if possible) foodborne incidence of the disease • Most common foodborne sources (Information for better understanding) • Control measures (How can the listener help prevent illnesses?) • Conclusions (Reinforce major points) Each student is given 18 mins for their presentation and 5 mins for questions/discussion.
Description of the tool(s) used for LAT 1analysis	A grading rubric is used to assess each students presentation based on the content covered (105 points total) and the students presentation of the material (35 points total). This grading includes constructive feedback on things the student did well and areas that could be improved on. It is expected that students would achieve greater than 80% (84 points) on the content covered portion of the assignment.
Key Findings for LAT 1	All students in the course received a score greater than 80% on the content covered portion of the presentations.
Description of how student performance for LAT 1 related to expectations for Standard 6 ELO 1	This assignment allows the students to use the knowledge gained over the course to identify relevant information on a pathogenic organism and effectively present that information to a group of people. This involved each student researching the topic and identifying the relevant information on their chosen pathogenic organism. The score given show that the students were effective in identifying the required information and presenting it to an audience.
Name of LAT 2	Homework analysis and writing answers to questions.

Description of LAT 2	FoodNet foodborne disease worksheet
Description of how LAT 2 was implemented with students	Students are provided a worksheet with open-ended questions about the CDC's FoodNet foodborne diseases active surveillance network. The students are then allowed to access the CDC's online FoodNet resource to identify the required information. Information that students are required to identify include: • The purpose of FoodNet. • Which states participate. • What information is gathered. • Yearly statistics for select foodborne infections. • The students theory on why certain infections are increasing.
Description of the tool(s) used for LAT 2 analysis	A grading rubric is used to assess the students ability to identify the correct information from the CDC's FoodNet website, with one point given for each correct answer. The students are also given feedback on their theory of why certain infections are increasing in the US. The grading rubric is updated yearly to reflect new statistics provided by the CDC. It is expected that students should be able to identify required information from the CDC's FoodNet website and score above 80% (8 out of 10 points).
Key Findings for LAT 2	Each member of the class received >80% showing that the students are effective at identifying critical information provided by regulatory agencies.
Description of how student performance for LAT 2 related to expectations for Standard 6 ELO 1	This activity allows the student to access online food safety resources and identify the relevant information from these sites. The number of students that received a score above the expected shows that this is an effective activity and will continue to be used.

Standard	Food Microbiology
ELO assessed	Describe the conditions under which relevant pathogens are commonly destroyed or controlled in foods
Course ELO was assessed in	NDFS 5110/5111 Food Microbiology/ Food Microbiology Lab
Period ELO was assessed	Spring 2024
Name of LAT 1	Case Study
Description of LAT 1	Mock Challenge Study
Description of how LAT 1 was implemented with students	Students are given a lab assignment to design a mock challenge study to test is the use of a wash step to decrease potentially pathogenic *E. coli* on freshly harvested spinach. The entire lab group collaborate on the methods design for the test, then break-out into smaller groups to test each variable using lab safe *E. coli* strains. Each student then analyses the data and writes a 2-page executive report that includes a graph of the data, the pros and cons of each wash solution, and a recommendation on what wash is used based on the data and the cost of implementation.
Description of the tool(s) used for LAT 1analysis	A rubric is used to grade the students reports based on the following criteria: • Report is under 2 pages. • Report includes a figure of the test data and the calculated error rates. • Report includes discussion about data presented. • Report makes recommendations on implementation of a wash step based on data and cost. • Report can be understood by a non-microbiologist. Each grading area is assigned point value, and the student is given constructive feedback on the report. This project is the final lab in the course

	and based on prior lab assignments and student experience, it is expected that students receive 75% (75 points).
Key Findings for LAT 1	In the 2024 course, 7 out of 8 students received scores above 75%. An areas that student consistently received less points were in the data presentation.
Description of how student performance for LAT 1 related to expectations for Standard 6 ELO 2	This lab assignment is the capstone project for the students in the Food Microbiology Lab course. The students' scores on experimental design, data collection and interpretation show that this assignment is effective in assessing the skills developed during the course. To address the lower scores on data presentation, a section on proper presentation of microbial plate count data will be added.
Name of LAT 2	Objective test items
Description of LAT 2	An assignment is given at the end of the module covering the environmental factors effecting microbial growth.
Description of how LAT 2 was implemented with students	LAT 2 was used in the form of an assignment that each student needed to complete at the end of the learning module on high temperature processing. The assignment was in the form of a quiz that included multiple choice, true/false, and matching questions. The students were not allowed notes for the assignment, but could repeat the assignment until they received full points (20 points). Students were not allowed to move onto the next module until they had received 18 points on the assignment.
Description of the tool(s) used for LAT 2 analysis	A grading key was used to assess the students responses and the number of attempts per student was measured.
Key Findings for LAT 2	In 2024, all students received at least 18 points on the assignment, with 5 of 7 students receiving

	max points (20 points) with an average of 3 attempts per student.
Description of how student performance for LAT 2 related to expectations for Standard 6 ELO 2	The number of students that received the expected score, and the number of students that received max points show that the students are able to understand the material presented and recall the information when needed.
Standard	Food Microbiology
ELO assessed	Discuss the role and significance of adaptation and environmental factors (e.g. water activity, pH, temperature) on growth response and inactivation of microorganisms in various environments
Course ELO was assessed in	NDFS 5110/5111 Food Microbiology/ Food Microbiology Lab
Period ELO was assessed	Spring 2024
Name of LAT 1	Data collection and analysis
Description of LAT 1	Lab exercise on evaluating how incubation temperature and sodium chloride levels affect cabbage fermentation.
Description of how LAT 1 was implemented with students	Lab instructions were given to students including the protocol for setting up the cabbage fermentation. Students were divided into 3 groups with each group testing a temperature and sodium chloride level for fermentation. The cabbage was allowed to ferment at for 4 weeks with students collected samples weekly that were tested for titratable acidity and lactic acid bacteria plate counts. Because the fermentation needs to be done under anaerobic conditions, the students also visually inspected their fermentation vessels for mold growth. After all the data was collected, the students were required to

	generate a lab report that included percent acid over time by converting the titratable acidity to lactic acid percentage in the sample, and lactic acid bacteria numbers over time, by performing a $\log_{10}$ transformation on the plate count data. Students shared data for each incubation temperature and salt level.
Description of the tool(s) used for LAT 1analysis	A grading rubric was used on the lab report that included the following areas. • An introduction that included information on the fermentation being performed • Methods that were performed • Data presentation including separate figures of the % acid and plate count data. • Results and discussion that draws a conclusion based on the data. Each section was assigned a points value and constructive feedback was provided. It is expected that students receive 75% (75 points).
Key Findings for LAT 1	In the 2024 course, 7 out of 8 students received scores above 75%. During grading and subsequent follow up, it was determined that the student did not complete the report due to their course load.
Description of how student performance for LAT 1 related to expectations for Standard 6 ELO 3	Student performance based on scores received shows that this lab exercise is effective in assessing the students understanding of methods used to test a microbes survival under certain environmental conditions or control treatments.
Name of LAT 2	Open-ended questions
Description of LAT 2	Quiz administered after the course module covering the parameters that affect microbial growth in food.
Description of how LAT 2 was implemented with students	LAT 2 was used in the form of a quiz that each student needed to complete at the end of the learning module on the parameters that affect

	microbial growth in food . The quiz included fill in the blank and open-ended questions. The students were not allowed notes for the quiz which was worth 25 points. Students were not allowed take the section exam until they had completed the quiz. Because this quiz is administered at the end of the module it is expected that students will score 80% (20 points).
Description of the tool(s) used for LAT 2 analysis	Quizzes were graded according to a grading key/rubric. Open-ended student responses were given feedback that could be reviewed by the student so that they have an opportunity to review the material before the exam. It is expected that student be able to score greater than 80% on the quiz.
Key Findings for LAT 2	In 2024, all students in the course received >80% on the quiz.
Description of how student performance for LAT 2 related to expectations for Standard 6 ELO 3	Considering that all student in the course were able to score above the expected level, this evaluation is effective in gauging the students understanding of the material.
What could you do differently next year to further improve student performance on this standard?	The student responses to the open-ended questions are used to evaluate information presented in each module and allows the content presentation to be fine-tuned to increase student understanding.