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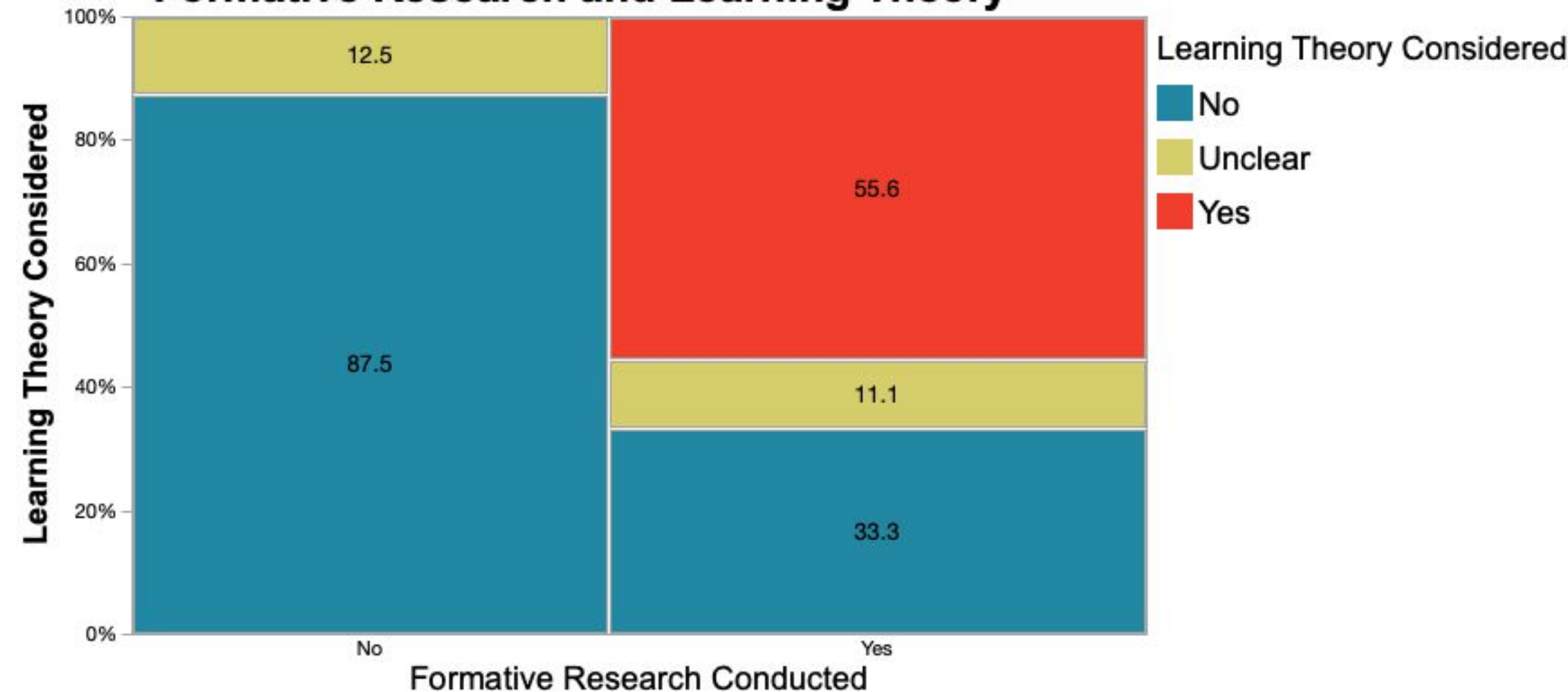
Introduction

The Food Safety Modernization Act (FSMA) of 2011 was the most significant food safety regulatory event in over 70 years. It provided new requirements for comprehensive and science-based preventive controls for the entire food manufacturing industry. As a result of the FSMA, all processors producing ready-to-eat products that are exposed to the environment after a kill step are required to implement an environmental monitoring program. According to the CDC National Outbreak Reporting System, dairy is the 5th leading cause of foodborne outbreaks and the second leading cause of foodborne deaths in the United States. The artisan dairy industry is a particularly high-risk group because they generally have fewer resources compared to larger facilities. Since environmental monitoring is a new requirement, training is needed to teach processors how to develop and implement an effective plan. The goal is to mitigate risk and support food safety behaviors by positively influencing attitudes, norms, personal agency, and intentions, thereby closing knowledge and skill gaps. Online learning meets the needs of this audience because it is often difficult or impossible for artisans to attend face-to-face training due to time and money constraints.

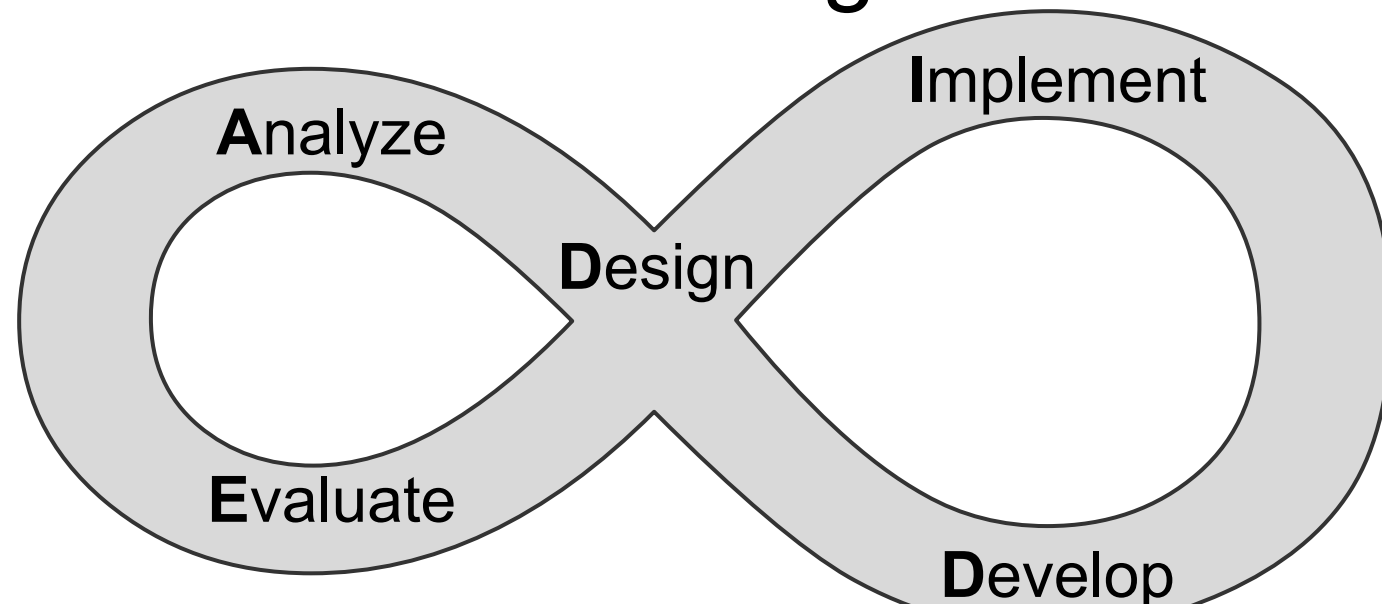
Current Food Safety Training

Of the food safety training for food handlers evaluated in the literature between 2006 and 2017 for knowledge, attitudes, and/or behaviors (n=17), two were media campaigns or other messaging, while the remainder were actual educational training courses. The studies that used media campaigns or other messaging included methods such as posting food safety infosheets (informational posters) around the processing facility, encouraging group discussion and providing food safety films for home viewing. The educational training courses included face-to-face classroom lectures with and without demonstrations, hands-on activities, and/or group discussion.

Reported Food Safety Training Design Considerations: Formative Research and Learning Theory



Instructional Design Process



Needs Analysis: Purpose & Methods

Purpose:

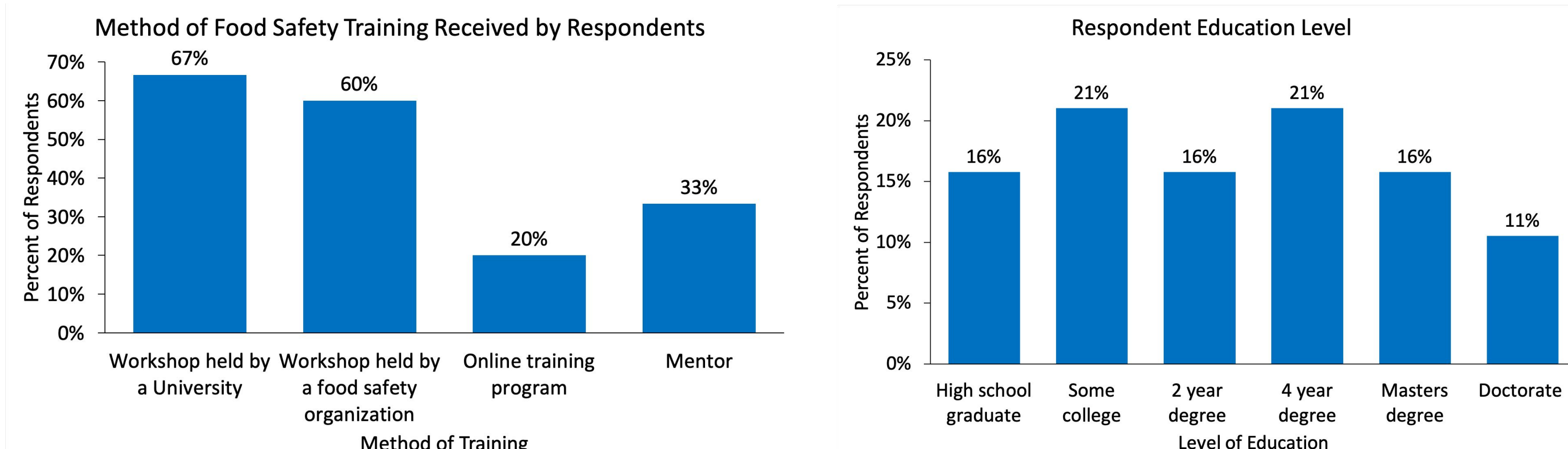
1. Identify the demographics of North Carolina Artisan Dairy Processors.
2. Use the Integrated Behavior Model (IBM) to assess which components of behavior predict the Artisan's decision to perform safe food handling behaviors.

Methods:



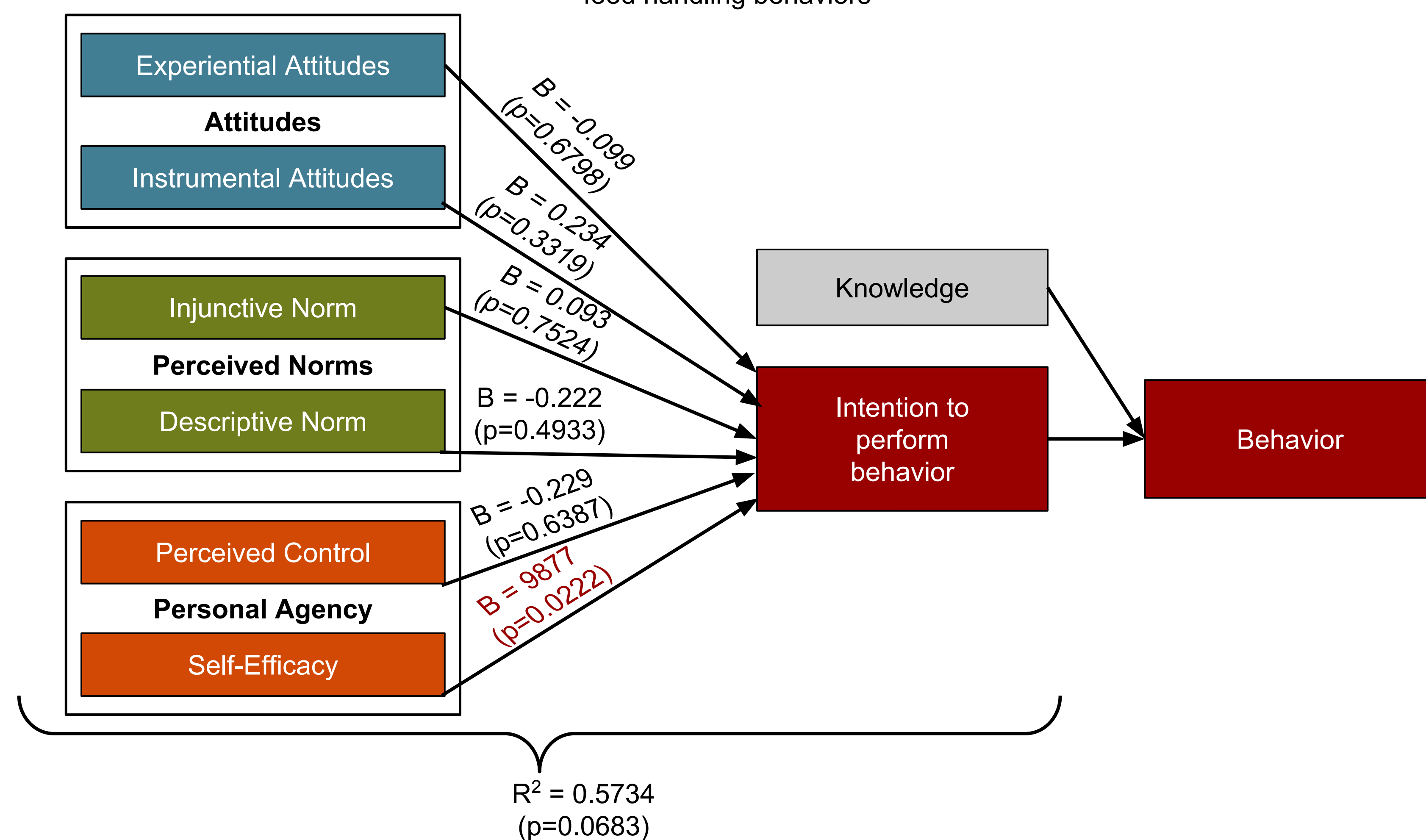
Identified Audience (n=49) Face-to-face Interviews (n=7) Online Survey (n=21)

Needs Analysis: Results



Integrated Behavior Model

Linear Regression predicting respondents average behavior component scores on intentions to perform safe food handling behaviors



Needs Analysis: Key Findings

To best meet the needs of the target audience and have the greatest impact of behavior change, the training should:

- Be readable at an 8th-grade level.
- Provide opportunities for remedial learning.
- Feel socially engaging.
- Provide the user with opportunities to apply knowledge.

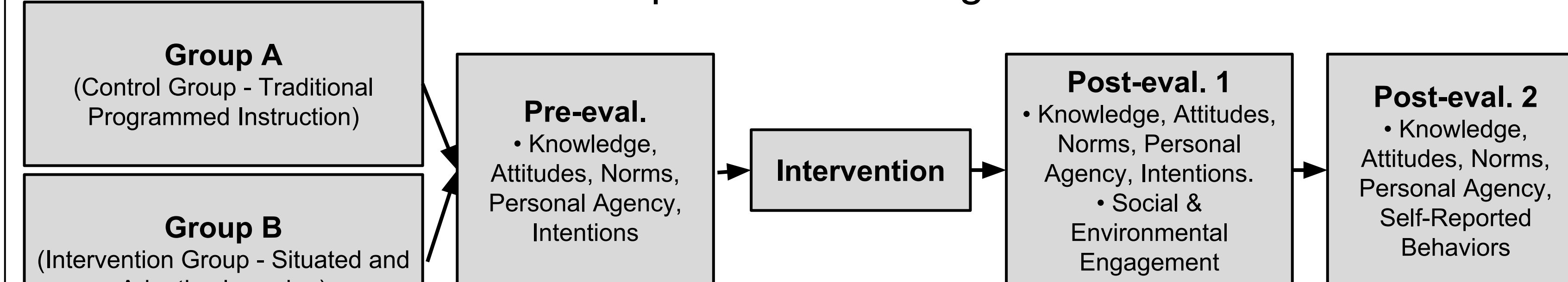
Purpose of Study

The purpose of this study is to **determine if an online training designed using adaptive and situated learning strategies** (i.e. case study, simulation, and virtual reality) **has a significant impact on adult learners' knowledge, attitudes, norms, personal agency, intentions, and behaviors**. Specifically, do artisan dairy manufacturers successfully develop and implement an environmental monitoring program in their facilities after completing this course?

Research Questions

1. How **effective** is the online training course, designed using situated and adaptive learning strategies, in increasing adult learners in the workplaces' **knowledge** of training topics, specifically environmental monitoring in artisan dairy facilities?
2. Were the adult learners able to **effectively apply** the training content at the dairy facility in which they work?

Experimental Design



Adaptive Learning Strategies

1. Provide Remedial Pathways

In the Cheesy Wheel case, the first routine sample that came back positive was in Zone 1, on the cheese form used to form blocks of sharp cheddar cheese.

Use that information to locate the correct cell in the FDA table to determine which corrective actions you should take. Move the pin to the correct table cell below:

PINS	Food Contact Surfaces (Zone 1)	Non-Food Contact Surfaces (Zones 2 - 4)
Routine Sampling Positive #1	<ul style="list-style-type: none"> Intensified cleaning and sanitizing in the area where positive occurred Re-test positive site and perform intensified sampling and testing during next production run (at least 3 hours into production) Conduct comprehensive investigation - root cause analysis 	<ul style="list-style-type: none"> Clean and sanitize area where positive occurred Re-test positive site and Corrective Action during next production cycle
Follow-Up Sampling Positive #2	<ul style="list-style-type: none"> Intensified cleaning and sanitizing for 3 consecutive days (ie: disassembly of equipment) Intensified sampling and testing for 3 consecutive days Hold and test product for 3 consecutive days Hold and test product for 3 consecutive days 	<ul style="list-style-type: none"> Intensified cleaning and sanitizing

That's not quite correct. Take another look at which zone the positive sample was found in, then try again.

That's still incorrect. It looks like you could use a little more information on how to use the FDA table. Click Next for more info.

TRY AGAIN

2. Personalized Feedback

Outbreak Details

I'm actually very familiar with this case. Let me pull up the details on the CDC website so we can look at them together.

What concerns you most about the news article?

- ☐ The same thing could easily happen to my plant
- ☐ I don't have an EMP either
- ☐ People died from contaminated product
- ☐ Lots of product had to be recalled
- ☐ The reputation of the plant was destroyed
- ☐ I have no idea how this could've been prevented

CDC Report Total Creamery

- Samples positive for Listeria were found in 2 lots of finished product (cheese and mozzarella), under the hinge on the light switch cover, the edge around the handles of the hand washing area, and on the handle of a cart fork.
- The CDC used whole genome sequencing to verify that the Listeria found in the facility was the same strain that infected the 30 people.
- The FDA hypothesized that the contamination originated from the light switch and covered by employees cross-contaminating other surfaces and failing to properly clean and sanitize the facility.

Outbreak Effect:

Throughout this course, you've been learning important skills that will help you implement an EMP. Hopefully, cases like this will encourage you to put all you've learned together into an effective EMP so you can protect your facility from suffering total Creamery's sad fate.

NEXT

3. Choose A Pathway

Choose a Case Study

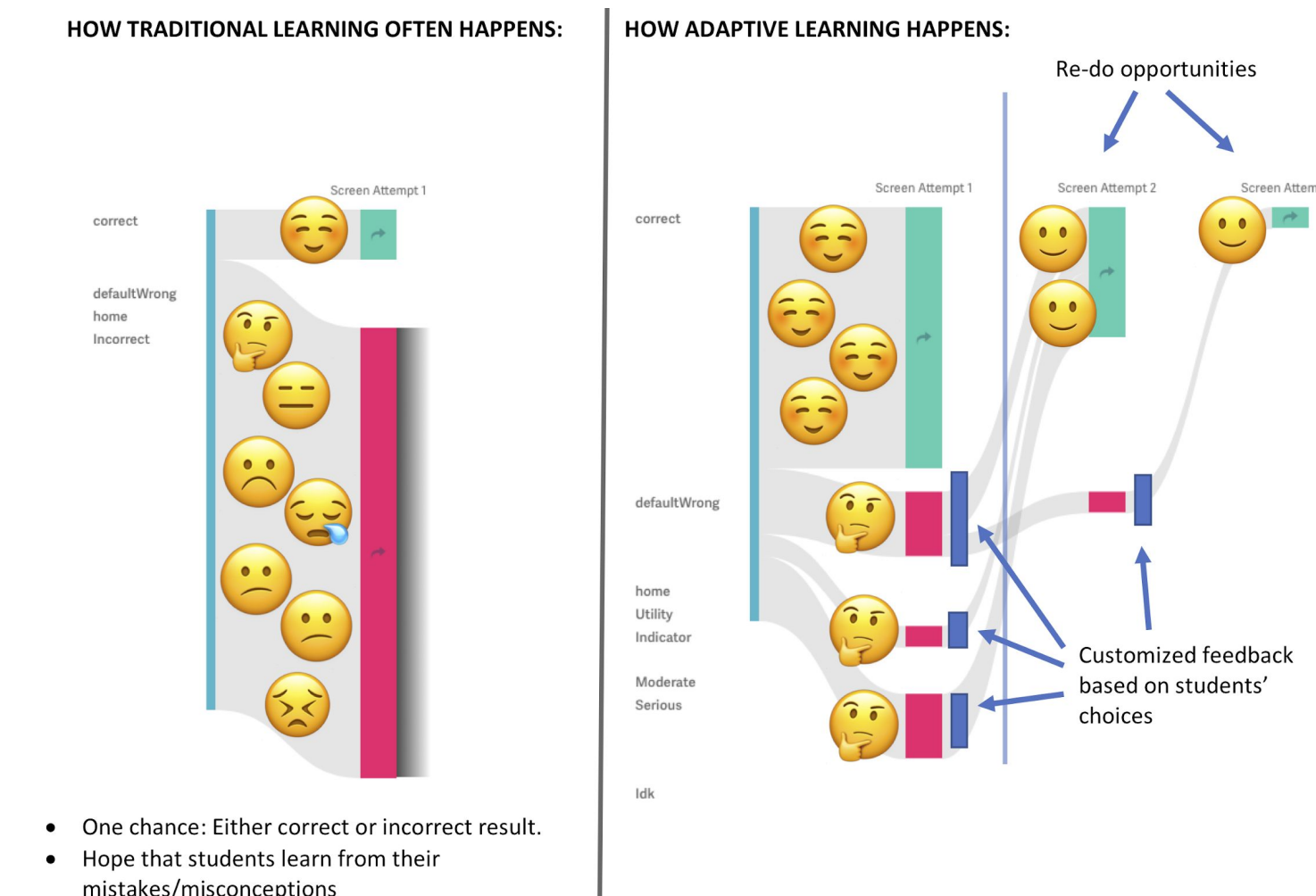
Now that your comfortable identifying corrective actions, its time to learn what to do in the worst case scenario, a positive on a Zone 1 site.

I'm going to give you a case study to work through here in the Dairy Teaching Lab. Would you rather work on the example in the cheese room or ice cream packing area?

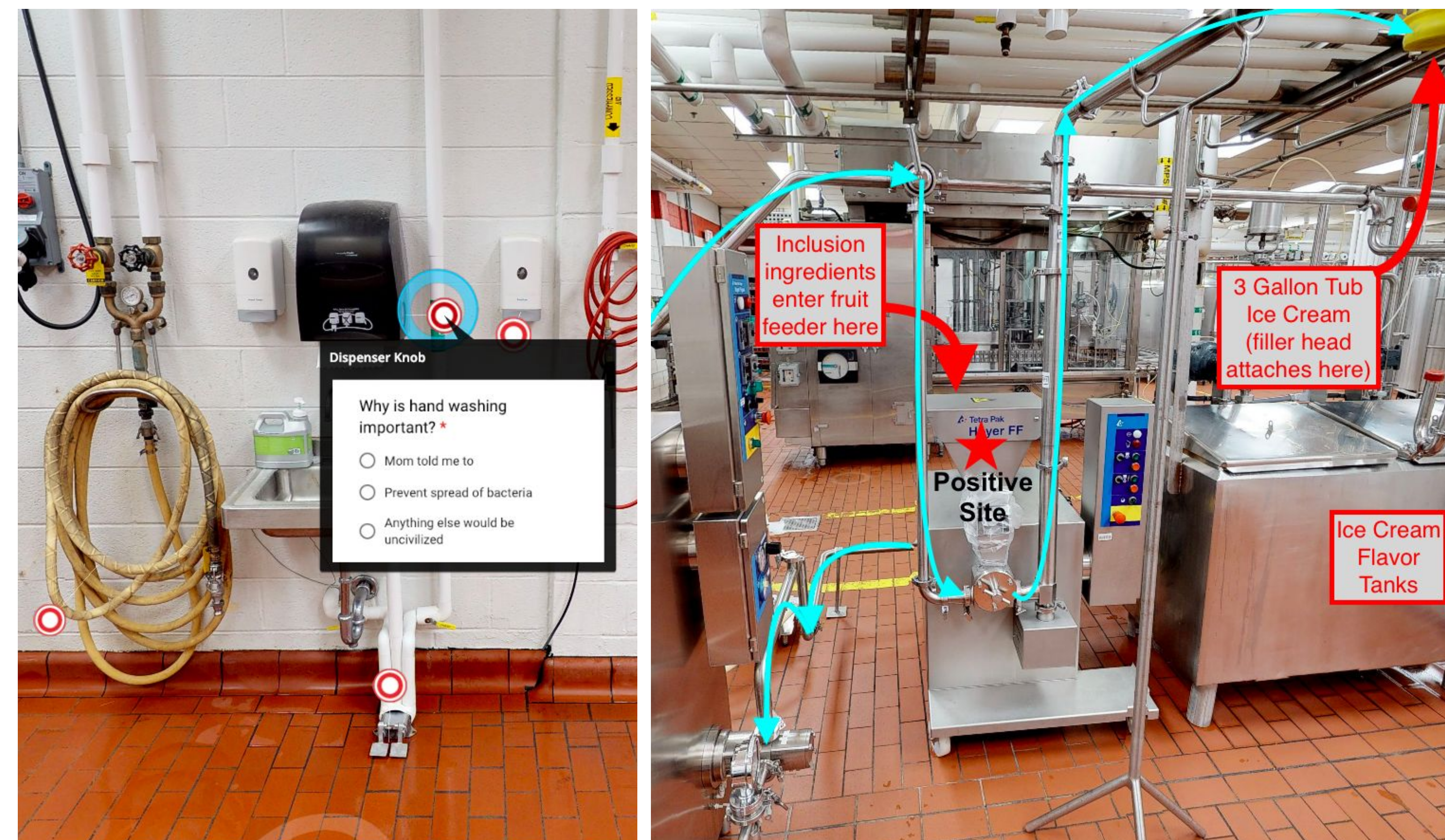
☐ Cheese Room ☐ Ice Cream Packaging Area

Next

4. Help Students Get to Correct Answer



Virtual Situated Learning



Significance

If it is successful, the approach used to design and develop the environmental monitoring training can serve as a model for trainers in *any* industry which requires students to learn complex material in the setting in which the material will be applied. This design approach has the ability to make training more accessible and (potentially more) effective, especially for small businesses, by reducing training costs, providing flexibility, and adapting to the unique needs of individual users. This approach to online training can help users by providing them with the knowledge and skills required to maintain regulatory compliance thereby helping keep our food system safe and helping small businesses stay in business.

Acknowledgements

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