Promoting student learning of statistical food sampling plans using an online interactive module

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Instructional Challenges in Applied Sciences

- Helping students understand real world applications
- Facilitating experiential learning opportunities
  - Accessibility
  - Time
  - Funding)
- Constructivist approach to teaching
  - Students lack prior experiences necessary for constructing meaning
- Instructional strategies can help overcome barriers, but no universal fix

Project Outline

Goals

Develop process for creating a reusable module that
1) is based on sound learning principles,
2) engages undergraduate students with real-world applications of agricultural and food science subject matter through virtual reality, and
3) incorporates adaptive learning strategies

Objectives

1) Develop interactive online virtual reality module that covers statistical sampling principles
2) Assess module effectiveness
3) Refine module based on Objective 2 results

The Spectrum of Costs for Creating e-Learning

Level 1	Level 2	Level 3
Content, pages, text graphics, "PowerPoint-to-eLearning"	Level 1 plus 25% more interactive exercises	Highly interactive, simulations, game-based, etc.
Average cost: $10K	Average cost: $18K	Average cost: $50K
Average time to create 1 hour of content: 79 hours	Average time to create 1 hour of content: 184 hours	Average time to create 1 hour of content: 490 hours

Chapman, 2010. How long does it take to create learning? Chapman Alliance LLC: www.chapmanalliance.com

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So what do you do when you have limited budget and time?

Our approach:

- Collaboratively draft a design document
- Recruit tech-savvy and motivated undergraduate for design development
- Implement iterative development process

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Successive Approximation Model

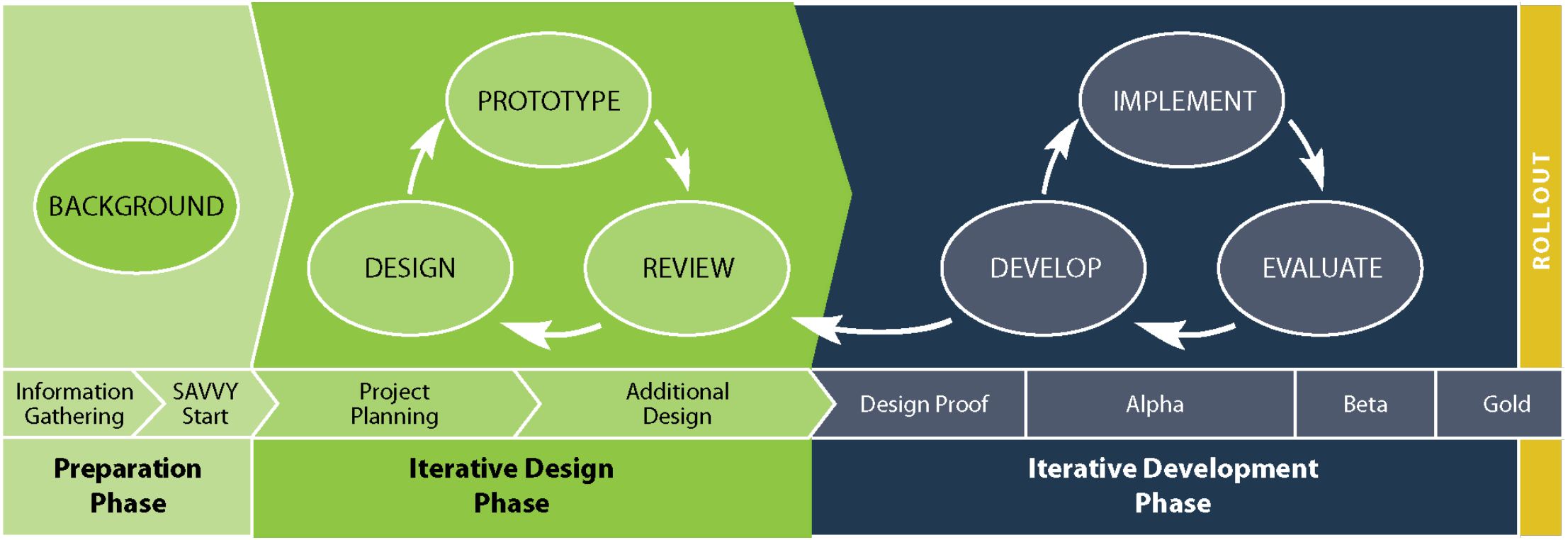

Image from https://www.alleninteractions.com/sam-process

Module Design

- Collaborative design process

- Learning goals
- Storyline
- Translation to storyboard
- Module development
- Alpha testing
- Beta testing

Study Design

Pre-Test

- 10 knowledge questions
- 4-point self-efficacy instrument consisting of 9 questions

Intervention

Post-test

- Pretest questions
- Learning Object Evaluation Scale for Students
  - 4 questions each for levels of learning, engagement and quality of design

Statistical Analysis

N=49 (npre-test=24, npost-test =20

Nonparametric Wilcoxon test

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Change in Knowledge and Self-Efficacy

Construct	Pre-Test Average (n=24)	Post-Test Average (n=20)	P-value
Knowledge	69% (SD = 20%)	66% (SD = 17%)	0.36
Self-Efficacy (5-point scale)	1.9 (SD = 0.66)	2.4 (SD = 0.67)	< 0.001

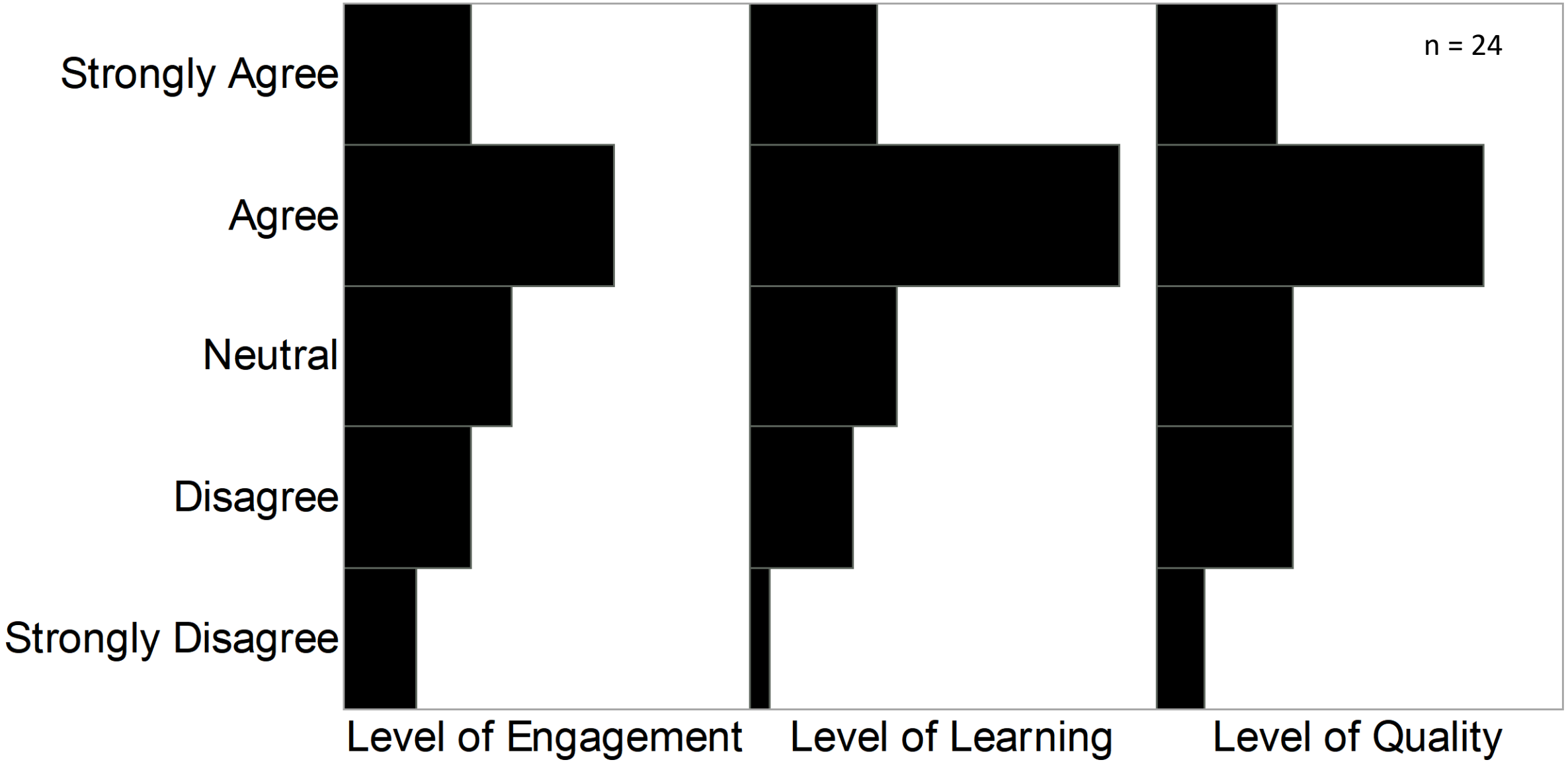
Qualitative Feedback

What did students like?

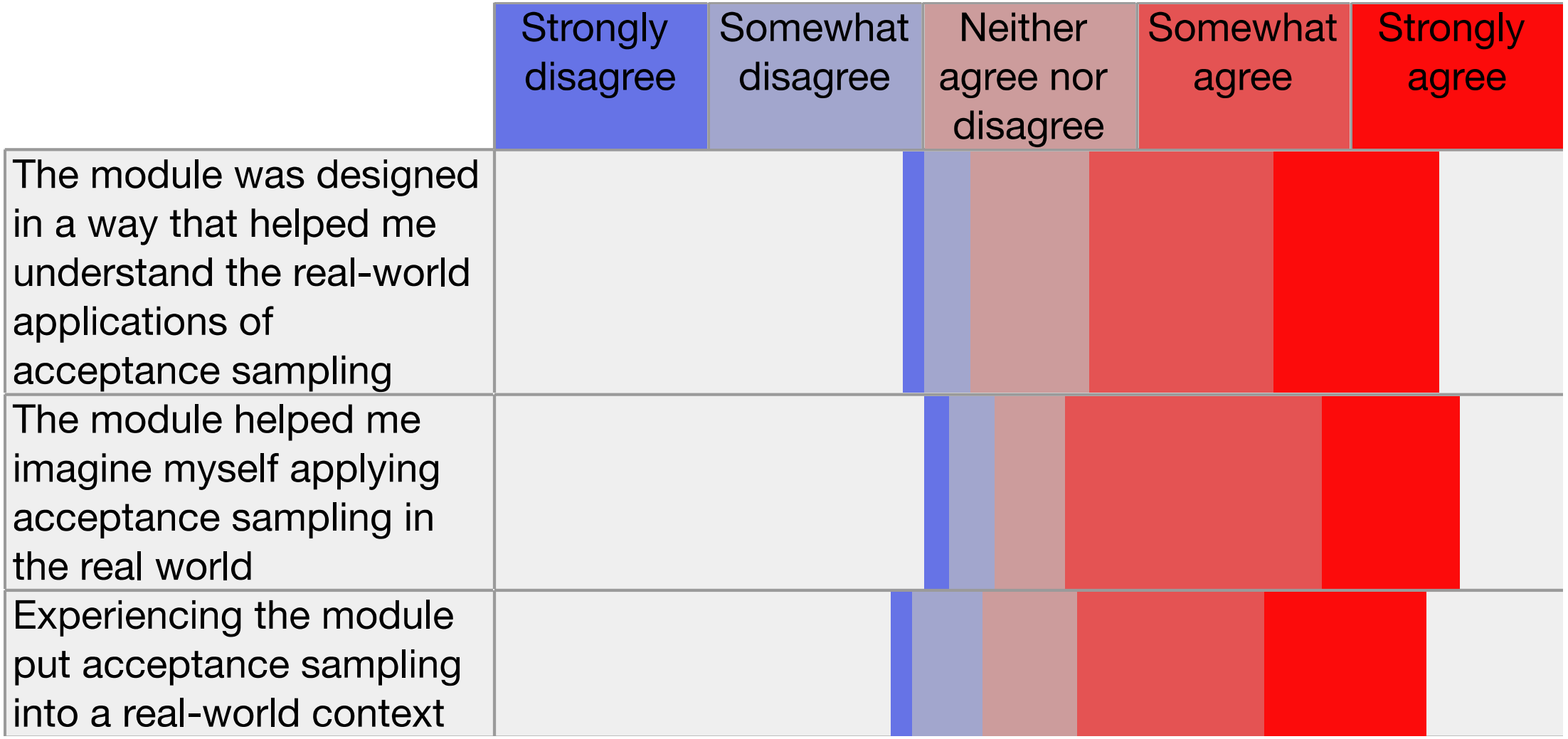
- "I thought the **concepts were interesting to learn about and by putting the "player" in a real-world office environment** was pretty neat and relatable. Overall, I thought it was pretty fun and conducive to learning. It just needed a few kinks worked out."
- "**It was interactive and had visuals and feedback**"

- What did students NOT like?
  - "**The font of the words are too hard to figure**. Should make it bigger and clear."
  - "The setup of the module, hard to follow."

- What recommendations did students have?
  - "**Make the words in the module bigger and clear**."
  - "Maybe add in more videos."


n = 24
Strongly Agree
Agree
Neutral
Disagree
Strongly Disagree
Level of Engagement
Level of Learning
Level of Quality

Awareness of Real-World Applications



Lessons learned

- Module boosted self-efficacy, but not actual learning
- Adaptive learning helps target areas where students struggle

- Expert blind spots
- Iterative testing is necessary!
- Work around limitations of program
- Make sure module is intuitive to use!
  - Functionality
  - Context

Acknowledgements

- Association of Public Land Grant Universities – Innovative Teaching award
- WSU/UI, UofI, NCSU Food Science departments
- Glen Joyner
- University of Illinois Students

Thank you!

Questions?

Four Learning Theories

Behaviorism

Focus on behavior change

Learning principles:

- Direct Instruction
- Programmed Instruction
- Social Learning Theory

Cognitivism

Requires prior knowledge: mind is "black box"

Learning principles:

- Attribution Theory
- Elaboration Theory
- Cognitive Development
- Conditions of Learning

Humanism

Educator is facilitator, not teacher

Learning principle:

- Experiential Learning

Constructivism

Learner constructs information based on prior knowledge

Learning principles:

- Situated Learning
- Problem-Based Learning
- Case-Based Learning
- Social Development Theory
- Cognitive Apprenticeship
- Discovery Learning
- Activity Theory
- Actor-Network Theory

Adapted from Wu et al., 2012. Investigating the learning-theory foundations of game-based learning: a meta-analysis. Journal of Computer Assisted Learning 28: 265-279.

Our Collaborative Approach to Teaching an Undergraduate Course on Quality Control

Core Domains*	Instructional Strategies	Level of Students' Proficiencies
Quality management principles and programs	Discussions, case studies	Medium-High
Basic quality tools	Peer reviewed case studies**	Medium-High
Root cause analysis	Peer reviewed case studies**	Medium-High
Control charts	Peer reviewed case studies**	Medium-High
Hypothesis testing	Peer reviewed case studies**	Medium-High
Acceptance sampling	Peer reviewed case studies**	Low-Medium

*Joyner and Stevenson. 2018. If you don't know, ask! Using expert knowledge to determine what content is needed in an undergraduate food quality management and control course. Journal of Food Science Education 16: 19-27

** Case studies published through the National Center for Case Study Teaching in Science

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