Technology-enhanced faculty development in controlled environment animal production

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Outline

1. Background
2. Goals
3. Methods
4. Results
5. Recommendations and Future work

The Challenges in CEAP

Table 3. Listing of seven discipline-specific themes, the subtopics that constituted them, and their frequency of occurrence.

Themes and Subtopics	Frequency
Instrumentation, measurement, controls, and microelectronics	**75%**
Instrumentation and controls	74%
Measurements of natural systems (forests, watersheds)	3%
Microcontrollers	2%
Basic engineering applied to agricultural and/or biological systems	**61%**
Applications of mass and energy balances in agricultural and biological systems	44%
Engineering analysis of biological systems	24%
Biological processing	**56%**
Process engineering (unit operations)	32%
Biological reactors (kinetics)	23%
Biological treatment engineering	9%
Microbial biotechnology or microbiological engineering	7%
Biochemical engineering	1%
Engineering properties of biological materials	**51%**
Engineering properties of biological materials (no subtopics identified)	51%
Soil and water engineering	**49%**
Natural resource engineering	36%
Hydrology	9%
Irrigation or irrigation and drainage	10%
Environmental hydraulics	9%
Power and machinery engineering	**33%**
Machine systems	19%
Machine design	10%
Energy and power	14%
Engine power	2%
Structures	**20%**
Structures	17%
Environmental modification/control	7%
Sustainable buildings	3%

- **Only 7% of ABE programs offer an environmental control course**

Kaleita, A. and R. Raman. 2012. A rose by any other name: An analysis of agricultural and biological engineering undergraduate curricula. *Transactions of the ASABE* 55(6): 2371-2378.

- **eCEAP:**
- **A multi-year, multi-disciplinary, and multi-institutional collaboration developing new eLearning methods for education in Controlled Environment Animal Production**

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Objectives of the eCEAP project

1. develop new eLearning modules related to controlled environment animal production
2. establish an online platform for educational material exchange and delivery
3. write a digital textbook
4. develop and conduct faculty training on the eLearning modules and delivery methods
5. develop and offer experiential-learning workshops and internships for underrepresented minority students

This paper

Goals

- Develop on-line faculty development webinars on course design to facilitate multi-disciplinary, multi-institutional collaboration on curriculum development
- Enable faculty to collaboratively develop eCEAP teaching modules that can be easily used in agricultural engineering, animal sciences, and veterinary medicine

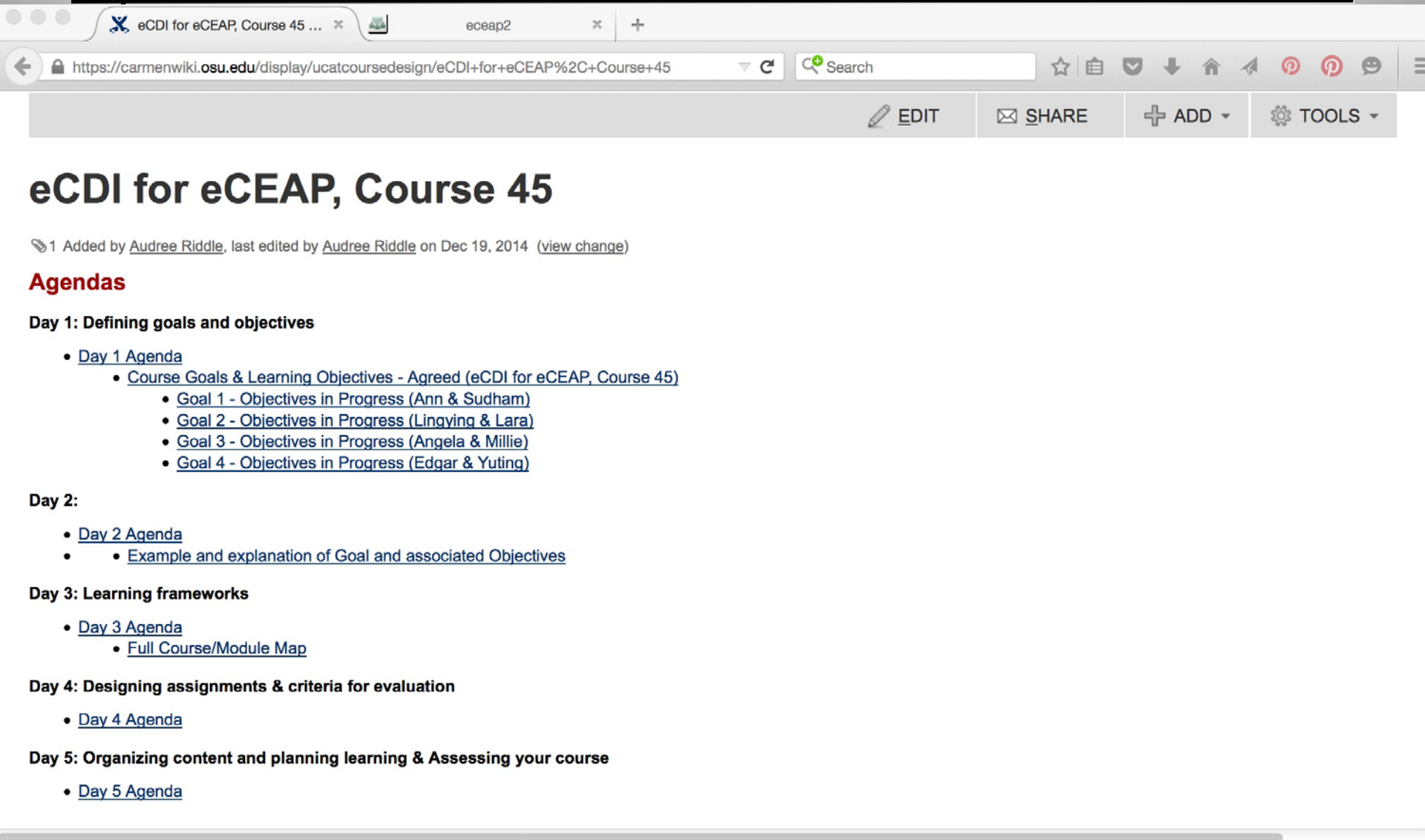
Methods

- During the first year of the project, the team participated in a **series of collaborative on-line faculty professional development training webinars** on course design

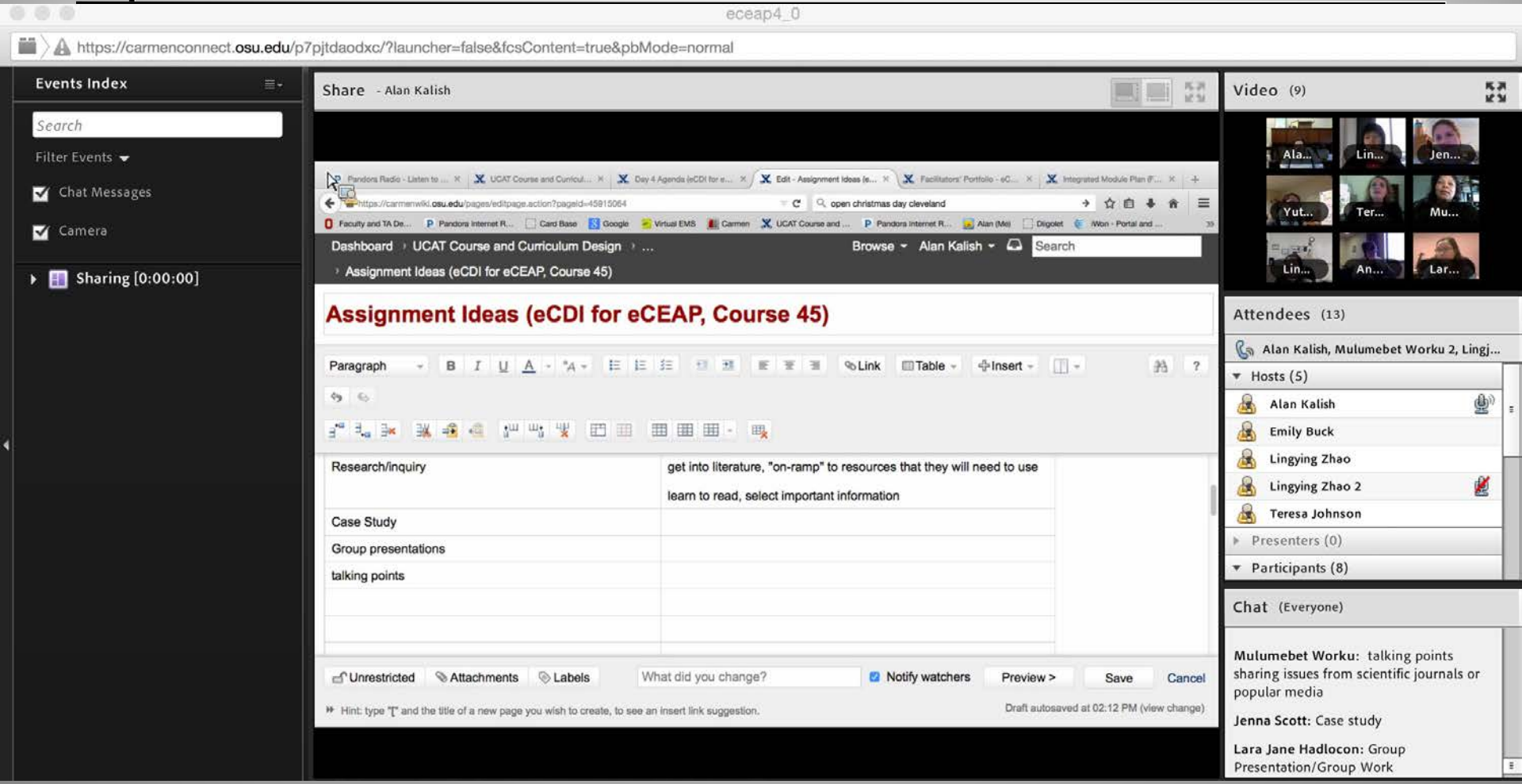
Webinar topics and activities

- Backwards design model (Wiggins, G. and J. McTigue. 2005. *Understanding by Design*, Assn. for Supervision & Curriculum Development.)
- Course goals
- Learning objectives (specific measurable verbs)
- Assessments
  - Self-tests for immediate feedback to student
  - Assignments for intermediate feedback to student and teacher
  - Summative exams to assign grades
- Teaching module content development
- Teaching method selection
- Overall evaluation of the whole course

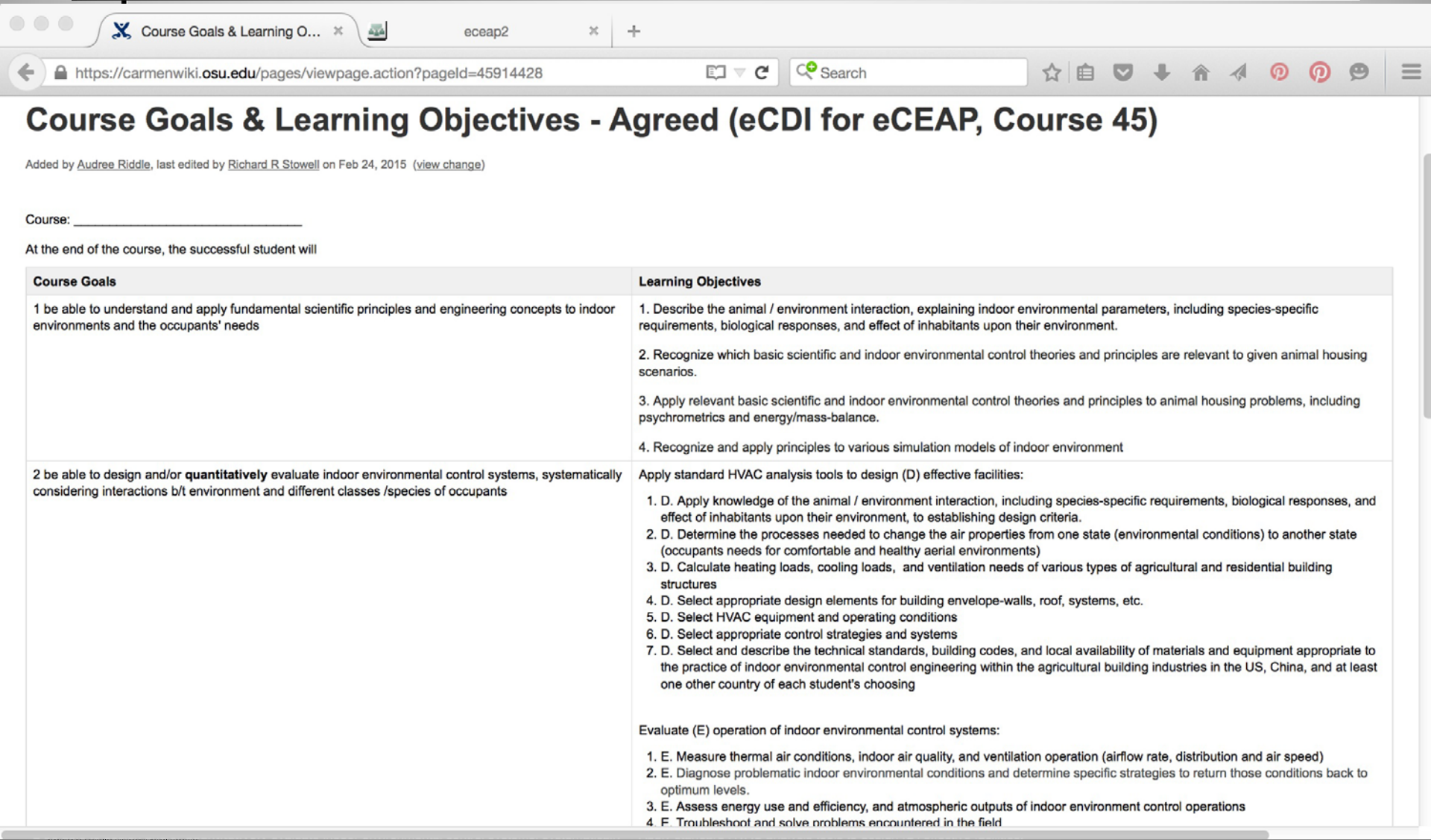
Wiki website to facilitate collaboration



On-line Video Conferencing Tool



Mapping course goals 1&2 to learning objectives



Course Goals & Learning Objectives - Agreed (eCDI for eCEAP, Course 45)

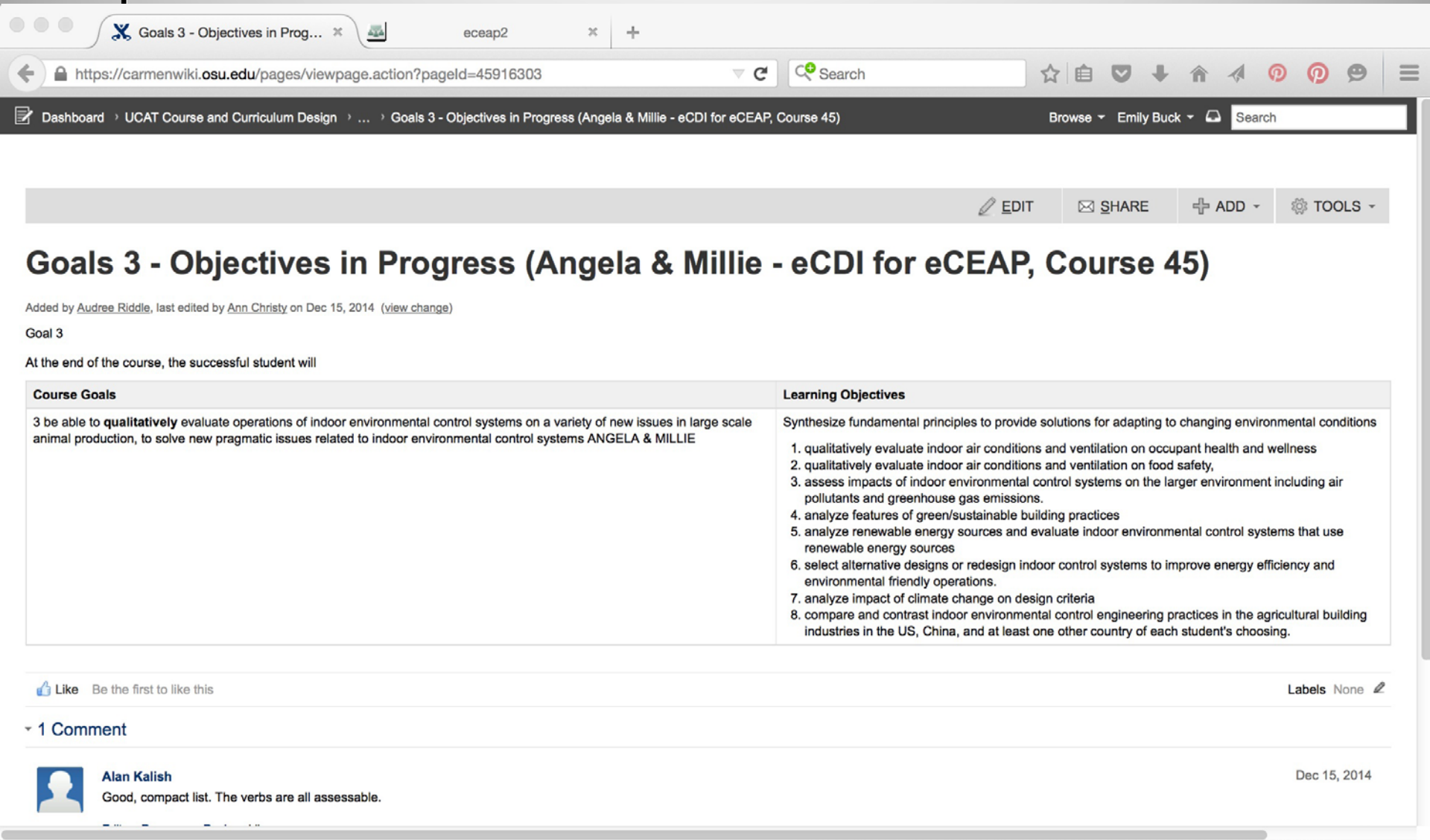
Added by Audree Riddle, last edited by Richard R Stowell on Feb 24, 2015 (view change)

Course: _____

At the end of the course, the successful student will

Course Goals	Learning Objectives
1 be able to understand and apply fundamental scientific principles and engineering concepts to indoor environments and the occupants' needs	1. Describe the animal / environment interaction, explaining indoor environmental parameters, including species-specific requirements, biological responses, and effect of inhabitants upon their environment. 2. Recognize which basic scientific and indoor environmental control theories and principles are relevant to given animal housing scenarios. 3. Apply relevant basic scientific and indoor environmental control theories and principles to animal housing problems, including psychrometrics and energy/mass-balance. 4. Recognize and apply principles to various simulation models of indoor environment
2 be able to design and/or **quantitatively** evaluate indoor environmental control systems, systematically considering interactions b/t environment and different classes /species of occupants	Apply standard HVAC analysis tools to design (D) effective facilities: 1. D. Apply knowledge of the animal / environment interaction, including species-specific requirements, biological responses, and effect of inhabitants upon their environment, to establishing design criteria. 2. D. Determine the processes needed to change the air properties from one state (environmental conditions) to another state (occupants needs for comfortable and healthy aerial environments) 3. D. Calculate heating loads, cooling loads, and ventilation needs of various types of agricultural and residential building structures 4. D. Select appropriate design elements for building envelope-walls, roof, systems, etc. 5. D. Select HVAC equipment and operating conditions 6. D. Select appropriate control strategies and systems 7. D. Select and describe the technical standards, building codes, and local availability of materials and equipment appropriate to the practice of indoor environmental control engineering within the agricultural building industries in the US, China, and at least one other country of each student's choosing Evaluate (E) operation of indoor environmental control systems: 1. E. Measure thermal air conditions, indoor air quality, and ventilation operation (airflow rate, distribution and air speed) 2. E. Diagnose problematic indoor environmental conditions and determine specific strategies to return those conditions back to optimum levels. 3. E. Assess energy use and efficiency, and atmospheric outputs of indoor environment control operations 4. E. Troubleshoot and solve problems encountered in the field

Mapping course goal 3 to learning objectives



Module topics selection

Survey of faculty & industry informed selection of 20 teaching module topics

FUNDAMENTALS (Year 1):

1. Introduction of CEAP
2. Introduction of HVAC environmental control
3. Psychometric processes
4. Insulation design and moisture management
5. Ventilation design, product, and systems

6 Energy and mass balance analysis of animal

7. Heating design, products, and management
8. Cooling load calculation
9. Sensing and control of HVAC

Module topics selection

Advanced TOPICS (Year 2):

10. Adaption to **climate change** through HVAC control
11. Control of air quality and emissions for reduced climate change and **environmental impacts**
12. **Energy efficiency** analysis, conservation designs and on-farm **renewable energy** systems
13. **Food safety** and animal health implications on environmental control
14. Environmental control for sound **animal welfare**
15. **Infectious disease** control for **bio-security** of controlled environment animal production
16. **Economic analysis** of new environmental control technologies and systems

Module topics selection

SPECIES-SPECIFIC MODULES (Year 3):

17. Poultry layer
18. Poultry broiler
19. Swine
20. Dairy and beef cattle

These 20 modules were mapped to course objectives

Mapping the Modules to the Course Objectives

Course Objective	M. 1	M. 2	M.3	M.4	M.5	M.6	M.7	M.8	M.9	M.10	M.11	M.12	M.13	M.14	M.15	M.16	M.17	M.18	M.19	M.20
1.1 Describe the animal / environment interaction, explaining indoor environmental parameters, including species-specific requirements, biological responses, and effect of inhabitants upon their environment	adc, Zhao	xw									Li		Li	Li	Li		Zhao	Li	xw RN	RS, mw RN
1.2 Recognize which basic scientific and indoor environmental control theories and principles are relevant to given animal housing scenarios	adc, Zhao	xw	adc	Li	adc	xw					Li	xw	Li	Li	Li		Zhao	Li	xw	RS
1.3 Apply relevant basic scientific and indoor environmental control theories and principles to animal housing problems, including psychrometrics and energy/mass-balance		xw	adc, Zhao	Li	adc	xw	RS	RS		RS	Li						Zhao	Li		RS
1.4 Recognize and apply principles to various simulation models of indoor environment						xw	RS	RS		RS	Li						Zhao			
2.1.D Apply knowledge of the animal / environment interaction, including species-specific requirements, biological responses, and effect of inhabitants upon their environment, to establishing design criteria	adc	xw	adc	Li	adc		RS	RS			Li		Li	Li	Li		Zhao	Li	xw RN	RS, mw, RN
2.2.D Determine the processes needed to change the air properties from one state (environmental conditions) to another state (occupants needs for comfortable and healthy aerial environments)			adc, Zhao		adc		RS	RS			Li							Li	RN	mw, RS, RN
2.3.D Calculate heating loads, cooling loads, and ventilation needs of various types of agricultural and residential building structures				Li	adc, Zhao		RS	RS			Li						Zhao	Li		
2.4.D Select appropriate design elements for building envelope-walls, roof, systems, etc.				Li			RS	RS		RS							Zhao	Li		RS
2.5.D Select HVAC equipment and operating conditions					adc, Zhao		RS	RS									Zhao	Li		
2.6.D Select appropriate control strategies and systems					Zhao		RS	RS	Zhao		Li		Li				Zhao	Li		

- Helps identify gaps and overlaps
- Facilitates planning intentional repetition

Results

- Increased faculty skills in course development and evaluation
- Consensus maps of course goals, learning objectives, modules, and assessment plans
- Strengthened relationships between collaborating faculty
- Increased effectiveness in course development by a large team across multiple time zones

Recommendations

- Partner with university's Center for Teaching and Learning professionals to train faculty
- Use common shared online platform / web technology
- Use periodic face-to-face meetings for content development and module evaluation

Future work

- Continue professional collaborations
- Update project team as new online teaching technologies emerge
- Exchange our experiences in offering the eCEAP modules and evaluating the results

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Questions? Comments?

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