

# Experiential Learning in Environmental Control of Animal Production for Minority Students

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# Outline

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1. Introduction of needs
2. Goals and objectives
3. Methods and activities
4. Evaluation results
5. Recommendations and future works

# Introduction-Animal Industry

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- The animal industry is the largest food production and revenue-generating sector of agriculture (**\$346 billion in 2012**).
- Over the past decades, mechanization development and economic pressure have driven commercial animal production into large-scale and industrialized operations for high production efficiency
- The industry needs a competent workforce of professionals with ethnic and gender diversity to be trained with engineering knowledge and emerging technologies for sustainable animal production.



# Introduction-Training Needs for Minority Students

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- America is facing a serious challenge in educating sufficient numbers of women and minorities in STEM disciplines.
- “More minority students must be recruited in order to sustain the agricultural related industries for the future and to help ensure that the U.S. remains competitive in the global economy” (Jones & Larke, 2003).
- Students' participation in hands-on research learning increases their understanding, confidence, and awareness of careers in science disciplines and their anticipation of an advanced degree in STEM (Russell et al. 2007).



# Training Needs for Minority Students

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- Women and minorities learn best in scientific research fields when put into collaborative settings that use a problem-based approach (Dirks & Cunningham, 2006; Karukstis & Elren, 2007; Carter, 2006).
- eCEAP project, a USDA Higher Education Challenge project was proposed to develop experiential leanings on controlled environment animal production for minority students.



# Objectives of the eCEAP project

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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



# Specific Objectives of this study

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The objectives of this study were

- to develop experiential learning workshops and field tours for minority students,
- to help them draw connections between the animal's needs, the role of engineered facilities and technologies to meet these needs, and real world problems and challenges in animal production, and
- to evaluate the effectiveness of the experiential learnings.



# Methods—

## Experiential Learning Workshops

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- The following experiential learnings workshops were offered by a multistate team at North Carolina Agricultural and Technical State University (NCA&T) in the summers of 2015 and 2016 for NCAT students.
  - 1) Environmental control of homes and class-rooms
  - 2) Environmental control of dairy barns
  - 3) Environmental control of poultry houses
  - 4) Environmental control of swine barns
- The participants were Junior, Senior, grad students, and professional staffs.
- The students majored in animal science, biological and agricultural engineering, and veterinary.



# Methods—

## Specific Experiential Learning Activities

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- The workshops provided students:
  - 1) Pre-test on student knowledge of indoor environmental control
  - 2) Lectures on environmental control for human beings, poultry, dairy and swine;
  - 3) Tours of dairy farm, poultry farms (layer and broiler) and green hotel;
  - 4) Measurement of indoor environmental quality in human buildings and animal facilities
  - 5) Student presentation of their leanings
  - 6) Post-tests on student knowledge and skills of indoor environmental control
  - 7) Certificate of the experiential learning



# Pre- and Post-Tests

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- Pre and Post test questions were used to evaluate the learning effectiveness of the students
- Pre-test questionnaire was distributed before each of the workshop
- Students had about 10-15 minutes to answer the questions based on their previous knowledge and experiences.
- The same questionnaire was distributed after the workshops and field tours to be used as Post-test questions for assessment of the student learning.



# Example Pre- or Post-Test on Environmental Control of Dairy Barns

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1. What are dairy cows' and calves' needs for thermal comfort? Do we have the same thermal comfort needs as dairy cows?
2. How do we meet the dairy cows' thermal comfort needs?
3. How do we control the indoor environment of dairy buildings?
4. Do you have any concerns on odor or gas emissions from dairy buildings or manure storages?
5. What is your idea of a comfortable and energy efficient dairy building?
6. How do you like the idea to use solar energy to produce hot water and electricity for dairy operations?



# Lectures on Environmental Control for Human, Poultry, Dairy, and Swine Animals

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1. Human and animal needs for thermal environment and good indoor air quality
2. Heating, ventilation, and air conditioning (HVAC) and air quality engineering technologies to meet the needs
3. Challenges in environmental control for human and animal buildings.
4. State-of-the-art and future trends of environmental control facilities and technologies for sustainable animal production.



# Field Tours

- Observe animal behavior and tell your impressions on animal comfort and well-being
- Find air inlet(s) and exhaust(s) and figure out what ventilation system(s) the barn is using?
- How the farmer is managing animal manure?
- Can you find any green features on the farm?



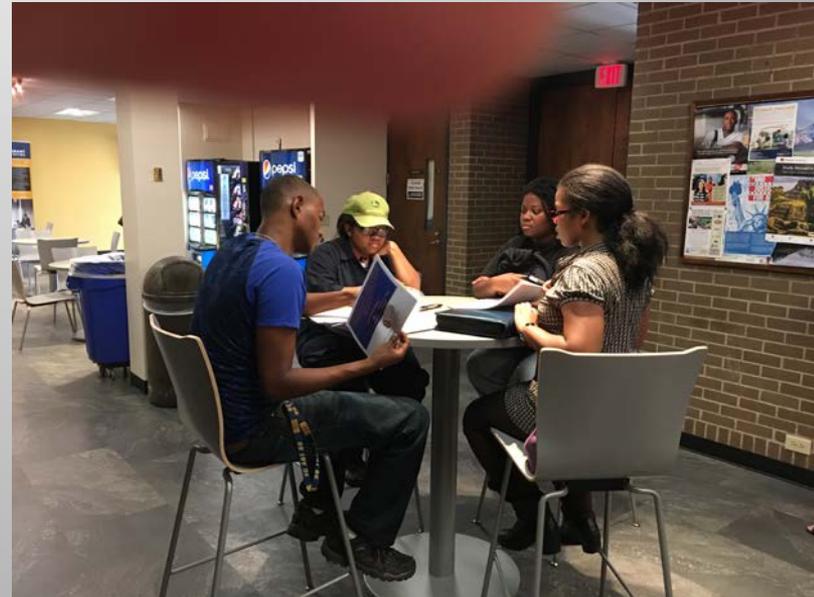
# Measurement of Indoor Environmental Quality

- Portable meters for air temperature, relative humidity, airflow speed, and carbon dioxide concentration were used by the students to check on indoor environmental quality during the field tours
- Measurements were compared with comfort need of the occupants
- Spatial variations in indoor environmental quality were evaluated.



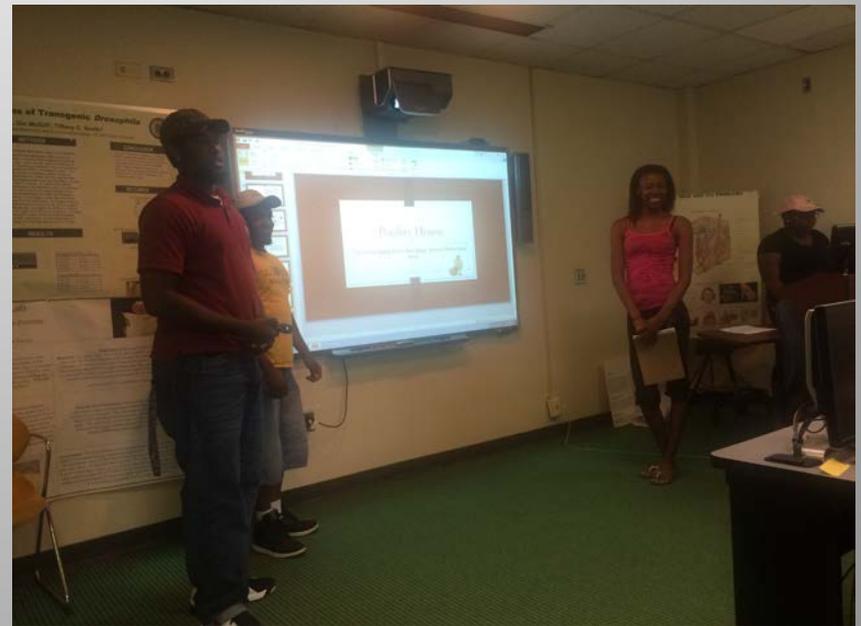
# Student Team Presentations

- Students work as a team of 4-5 peer students to summarize and share their learning.
- Each team choose a topic to present :
  - Environmental control of homes and class-rooms
  - Environmental control of poultry houses
  - Environmental control of dairy barns



# Student Team Presentations

- The students were required to develop an up to 15 minutes presentation on their learnings and shared among the team members.
- They had additional 5 minutes to address questions from the audiences.



# Certificate of the Experiential Learning

- All of the students who finished each of the workshops were issued a certificate of the experiential learning.
- These experiential learning sessions can be potentially incorporated into some existing NCAT courses on animal sciences for extra credit hours.



# Evaluation of the Experiential Learnings

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- Pre and post tests indicated that the minority students had increased their understandings of animal needs for thermal environment, engineering systems used to control indoor environment and air quality, and effects of indoor environmental control on animal health and performance.
- The experiential learning also increased the students' awareness on challenges for sustainable animal production.
- The minority students had drawn connections between the animal's needs, the roles of engineered facilities and technologies, and the sustainable animal production.



# Future Work

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- Further develop the PPT lectures into recorded presentation by peer experts.
- Record the field tours for future leaning activities.
- Team with NCAT faculty to facilitate the workshop and experiential learnings
- Offer the experiential learnings at NCAT in Aug. 2018.
- Disseminate the experiential learnings to other minority institutions



# Thanks and Acknowledgements

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# Questions? Comments?



eLearning on Controlled Environment Animal Production



NC STATE UNIVERSITY

