Teaching and Learning in the Animal Sciences

A National Conference to Challenge Old Assumptions and Break New Ground for the 21st Century

June 19-22, 2012

The Lowell Center, University of Wisconsin-Madison

Contents

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Program Schedule

All events are in Lowell Inn and Conference Center unless otherwise noted

Tuesday, June 19th: Evening

3:00 PM Hotel check in (Upper Lounge)

4:00 - 8:00 Conference check in; poster set up (Lobby)
Dinner and evening on your own. Walking distance, you'll enjoy the UW-Madison Memorial Union Terrace, State Street (pedestrian mall) and the State Capitol.

Wednesday, June 20th: Morning

7:00 - 8:30 Breakfast (Dining Room)
Registration (New Lounge, Lower level); poster set-up (Upper Lounge)

8:30 - 9:00 Welcome Remarks (Room B1)
8:30 - 8:35 - Welcome from the Organizing Committee - *Jean Bertrand, University of Georgia*
8:35 - 8:50 - Welcome from University of Wisconsin-Madison, CALS - *Dean Kathryn VandenBosch*
8:50 - 9:00 - Remarks - *John Campbell, Professor Emeritus, University of Missouri, University of Illinois, Oklahoma State University*

Session I: The Changing Landscape of Undergraduate Education — The Curricula and the Instructors
Moderator: Larry Miller, Consultant

9:00 - 9:40 Invited presentation - *Ronnie Green, University of Nebraska* (Room B1)
9:40 - 9:50 Questions and answers
9:50 - 10:00 Orientation to breakout discussion groups & beverages/snacks
10:00 - 11:00 Curricula and instructor-related challenges and opportunities
(choose one; limited to 25 participants per room)
- Breakout 1: Instructor's roles (educating citizen vs. training for industry job) - *Michael Orth* (Room B1-A)
- Breakout 2: International faculty & internationalization of the curriculum - *Charles Stoltenow* (Room 118)
- Breakout 3: Teaching vs. research: Independent, inclusive or exclusive of each other? *Larry Berger* (Lower Lounge)
- Breakout 4: Excellence in teaching: trial & error vs. scholarship - *Scott Radcliffe* (Dining Room)

11:00 - 11:10 Return to plenary session (Room B1)
11:10 - 12:00 Reports from each breakout discussion group (10-12 min. per group)

Lunch & Review of Posters
12:00 - 12:45 Lunch (Dining Room)
12:45 - 1:30 Informal networking (Dining Room); Review of posters (Upper Lounge)

Wednesday, June 20th: Afternoon

Session II: The Changing Landscape of Undergraduate Education — The Students
Moderator: Hasan Khatib, University of Wisconsin

1:30 - 2:10 Invited presentation - *Ken Esbenshade, North Carolina State University* (Room B1)
2:10 - 2:20 Questions and answers

2:20 - 2:30 Orientation to breakout discussion groups
2:30 - 3:30 Student-related challenges and opportunities (choose one; limited to 25 participants per room)
- Breakout 1: Importance of motivation and student learning styles
Marshall Stern (Room B1-A)
- Breakout 2: Individual vs. team learning (student learning communities)
Aduli Malau (Room 118)
- Breakout 3: Digital divide (accessing & using information for decision-making)
Ashley Driver (Lower Lounge)
- Breakout 4: Educational needs of increasingly diverse student populations
Millie Worku (Dining Room)

3:30 - 3:40 Beverages and snacks - return to plenary session (Room B1)
3:40 - 4:30 Reports from each breakout discussion group (10-12 min. per group)
4:30 - 5:30 Poster presentations (Upper Lounge)

Dinner and evening on your own.

Thursday, June 21st: Morning

7:30 - 9:00 Breakfast and informal networking (Dining Room)

Session III: Creating an Effective Teaching and Learning Environment.
Moderator: Jean Bertrand, University of Georgia

9:00 - 9:40 Invited presentation - *Dr. Frank Robinson, University of Alberta* (Room B1)
9:40 - 9:50 Questions and answers
9:50 - 10:00 Orientation to breakout discussion groups & beverages/snacks
10:00 - 11:00 Improving the student's learning experience (Choose one; limited to 25 participants per room)
- Breakout 1: Teaching and learning critical thinking skills - *Dean Pringle* (Room B1A)
- Breakout 2: Beyond lecture (practicum, laboratories, computer labs., etc.)
Keith Bertrand (Room 118)
- Breakout 3: Beyond lecture (internships, study abroad, faculty-led field programs, etc.)
Mark Russell (Lower Lounge)
- Breakout 4: Information technology (in-class, out-of-class, on-line multistate initiatives, etc.) - *Jodi Sterle* (Dining Room)

11:00 - 11:10 Return to plenary session (Room B1)
11:10 - 12:00 Reports from each breakout discussion group (10-12 min. per group)

12:00-12:45 Lunch
12:45-1:30 Survey (voluntary)

Thursday, June 21st: Afternoon

Session IV: Fostering Scholarship and a New Teaching and Learning "Culture."
Moderator: Dave Thomas, University of Wisconsin

1:30 - 2:10 Invited Presentation - *Nancy Irlbeck, Colorado State University* (Room B1)
2:10 - 2:20 Questions and answers
2:20 - 2:30 Orientation to breakout discussion groups
2:30 - 3:30 Improving the instructor's effectiveness (Choose one; limited to 25 participants per room)
- Breakout 1: Desired learning outcomes of animal sciences BS degree
Michael Gonda (Room B1-A)
- Breakout 2: Teaching and learning communities (peer-review, co-teaching, etc.)

Miriam Weber Nielsen (Room 118)
- Breakout 3: Enhancing good teaching practices (CATs, students' feedback, survey, etc.,) - *Amin Fadl* (Lower Lounge)
- Breakout 4: Documenting changes (portfolios, reflections, memoirs, survey data, focus group, etc.) - *Brian Bolt* (Dining Room)

3:30 - 3:40 Beverages and snacks - return to plenary session (Room B1)
3:40 - 4:30 Reports from each breakout discussion group (10-12 min. per group)
4:30 - 6:00 Choose one:
- Book chapter discussion: "How Learning Works" - *Michel Wattiaux* (Room 118)
- Student-produced on-line multi-media - *Frank Robinson* (Room B1)
- WiCEL (Wis. Collaboratory for Enhanced Learning) Classroom - *John Booske & Suzanne Smith* (off site, meet in Upper Lounge)
- Writing Workshop: Using writing activities to help students learn in STEM courses *Brad Hughes* (off site, meet in Upper Lounge)

Dinner and evening on your own.

Friday, June 22nd: Morning

7:30 - 8:30 Breakfast (Dining Room)
8:30 - 9:00 Conference evaluation

Session V: Providing Incentives, Recognizing and Promoting Effective Teaching Among Current and Future Instructors.
Moderator: David Buchanan, North Dakota State University

9:00 - 9:40 Invited presentation - *Michel Wattiaux, University of Wisconsin* (Room B1)
9:40 - 9:50 Questions and answers
9:50 - 10:00 Orientation to breakout discussion groups & beverages/snacks

10:00 - 11:00 Effecting Changes (Choose one, limited to 25 participants per room)
- Breakout 1: Intrinsic versus extrinsic motivation and rewards *Olga Bolden-Tiller* (Room B1-A)
- Breakout 2: Teaching excellence or scholarship in relation to promotion and tenure *Laura Hernandez* (Room 118)
- Breakout 3: Administrative support (funding and other resources) for teaching initiatives - *Kristy Daniels* (Lower Lounge)
- Breakout 4: Faculty development: Needs of future instructors, tenure-track and senior faculty - *Cindy Wood* (Dining Room)

11:00 - 11:10 Return to plenary session (Room B1)
11:10 - 12:00 Report from each breakout discussion group (10-12 min. per group)

12:00 - 12:15 Concluding remarks and next step - *Jean Bertrand, University of Georgia*

Welcome to
"*Teaching and Learning in the Animal Sciences — A National Effort to Challenge Old Assumptions and Break New Ground for the 21st Century"*

It is with heartfelt gratitude and honor that we welcome you to Madison for this conference. We hope that the presentations and discussions of the next few days will be stimulating and fruitful to all. In designing this conference, our organizing committee sought to create an opportunity for interaction and exchange of ideas. At the dawn of the 21st century, undergraduate education in the food and agricultural sciences is at a crossroads. One hundred years may seem like a long time, but the challenges our great-grandparents who were making a living from farming the land and raising livestock at the beginning of the 20th century, seem light-years away from the challenges of making a living from the same occupation today. In many ways agriculture at the dawn of the 21st century is bearing the weight of its own success. Now that less than 2 percent of the population is involved in the production of food that satisfies the needs of not only each citizen but of many others all around our planet as well, and now that the majority of urban families in the United States is three or four generations away from the land that their great-grandparents labored over, there is an alarming disconnect and an increasingly widening gap of understanding between the few who produce the food and those who consume it.

The recent NRC report "*Transforming Agricultural Education for a Changing World*" (NRC, 2009) identified numerous challenges of undergraduate education in the food and agricultural sciences. The demographics of students and faculty in colleges of agriculture have been changing dramatically, answers to critical questions are no longer confined to a single discipline, and training ranchers and farmers is no longer the main focus of agricultural education. Effective transformation entails concerted efforts among many stakeholders. It is no longer sufficient to teach scientific facts and figures as a way to train an industry labor force; our 21st century challenges are much larger, if not consequential. Our classrooms ought to become microcosms of societal concerns, and our students must be challenged to face problems in the same way as they will encounter them in the workforce. Curricula in colleges of agricultural and life sciences will continue to expand far beyond agricultural production to include biotechnology, animal welfare, environmental pollution, international trade, hunger and poverty, social justice, human health, and other issues. Our programs should be designed to attract an increasingly diverse population of students regardless of their agricultural background (or lack thereof) to engage in societal issues from a food and agricultural system's perspective. Rooted in their culture, our students must become more cosmopolitan; they should be challenged to gain and apply analytical, critical and independent thinking to address complex and global issues that impact people's daily lives. These few examples of an emerging vision for a 21st century pedagogy in the animal sciences have to start with a national effort to challenge old assumptions and break new ground.

June 11, 2012
Madison, Wisconsin

ORGANIZING COMMITTEE: Michel Wattiaux, UW-Madison (Co-Chair), Jean Bertrand, University of Georgia (Co-chair); Sandy Bertics, UW-Madison, Dave Buchanan, North Dakota State University; Molly Kelley, ADSA Discover Conferences; Hasan Khatib, UW-Madison; Larry Miller, ADSA Discover Conferences; David Thomas, UW-Madison.

Conference Guide

Welcome to the **Teaching and Learning in the Animal Sciences: A Conference to Challenge Old Assumptions and Break New Ground for the 21st Century.** As of this writing, we have a full house of 99 registrants. The conference has been designed to provide ample opportunities for formal and informal interactions among participants. We hope you'll meet old acquaintances, but also will take time to meet new colleagues in the friendly and casual atmosphere of the Lowell Center, the UW-Madison Terrace, or State Street.

*** Conference Attire:** CASUAL attire is quite suitable for this conference.

*** Registration:** Registration hours will be on Tuesday from 4:00 until 8:00 p.m. The desk will re-open at 7:00 a.m. Wednesday outside our meeting room, B1A&B, for those who were unable to pick up their materials Tuesday night.

* **Meals at the Conference:** Meals are a wonderful time for further discussion about session topics and to meet and spend time with colleagues, old and new. Your hotel and conference fees include breakfasts on Wednesday, Thursday and Friday, and lunch on Wednesday and Thursday. Conference breakfasts and lunches will be held in the Dining Room, lower "B" level of Lowell Center each morning. Your nametag is your ticket to these meals, so please plan to wear your nametag during all meals and sessions. Evening meals on Wednesday and Thursday are on your own. There are hundreds of options in the immediate area including nearby State Street (one block South) with over 60 restaurants and 20+ outdoor cafes to choose from. Area maps are available at the front desk.

*** Internet Access:** The Lowell Center offers free wireless Internet access throughout the building. Access codes are necessary and may be obtained through the front desk.

*** Check-Out Procedures:** Check-out time at The Lowell Center is 11:00 a.m. A baggage storage area is located at the front desk. Please plan to check out before the start of the conference on the morning of your departure. Late check-outs must be pre-approved and late fees are applied. Return room keys to the front desk to complete your check-out.

*** Transportation Options:**

Campus-Wide Free Bus - There are several free campus-wide buses, numbers 80, 81, 82, 84 and 85. Contact the front desk for further information.

Taxi Service - To make arrangements for cab service, call the front desk with your name, room number, number of travelers, time of departure, and destination (campus building). For a return trip to The Lowell Center, call the front desk at (608) 256-2621 with your name, room number, number of travelers, time of pick-up and location (campus building). To avoid delay, please make your reservation as far in advance as possible.

*** Airport Information:** The Lowell Center does not provide a shuttle to and from the Dane County Regional Airport; however, taxi service is readily available (see above). For more information, call (608) 246-3380; or visit www.co.dane.wi.us/airport.

*** Emergencies**: If you should have an emergency during your stay, dial **911**.

*** Contact Information:**

- The Lowell Center Conference and Lodging Facility, 610 Langdon Street, Madison WI 53703; Front Desk: (608) 256-2621; Fax: (608) 262-5445; Email: lowell@ecc.uwex.edu
- The Edgewater Hotel, 666 Wisconsin Avenue, Madison, Wisconsin 53703; Phone: (608) 256-9071
- Conference Management (in case of emergency)
    - Molly Kelley, kelleymt@aol.com, Cell: 217/493-3441
    - Michel Wattiaux, wattiaux@wisc.edu

*** For more information, visit the Lowell Center Guest Information Guide at** http://conferencing.uwex.edu/documents/UpdatedguideJuly2010_001.pdf

We hope you enjoy the conference!

Breakout Discussion Groups – Suggested Guidelines

Goal:

- To foster interaction, share visions, and exchange ideas on topics related to the theme of each general session following each invited presentation.
- To formulate a set of recommendations and models of practices that individuals, departments, or colleges could adopt to improve undergraduate teaching and learning in the Animal Sciences.

Organization:

- Each break out discussion group is limited to 25 participants (first come first serve basis)
- A facilitator leads a discussion to engage the participants in specific issues/questions to address. See Table 1 for a proposed general outline of the discussion.
- A note-taker/recorder focuses exclusively on capturing the ideas. Breakout rooms will include a white board, a laptop computer and a USB drive;
- Each facilitator and note-taker/recorder team determines how best to plan their session.
- Each facilitator and note-taker/recorder team has an additional 10 min. after the end of the session to further summarize notes and prepare to present the highlights in a format of their choice (e.g., oral presentation only, ppt slides, or item list in a word document) in the subsequent plenary session.
- The USB drive will be used to transfer files from the computer in the breakout room to the computer in the plenary session room (Room B1-A/B)

Table 1: Proposed breakout group discussion activities and suggested timeline[1].

Time	Steps	Major focus
6 min.		- Intro[2]: Facilitator and note-taker introduce themselves and the ground rules of their discussion group[3]. - In large or small groups, participants address specific questions (see next pages) and other related questions in a three step process:
18 min.	I	**The issues**: What is the problem/challenge? Why is it important? What needs to change? Why should the status quo no longer be maintained? What would be the consequences of inaction?
18 min.	II	**Possible solutions:** What are models that individuals (institutions) have used to address the issues? What worked / did not work? How could the threats be turned into an opportunity? "Institutionalization" of the proposed changes; Implementation incentives or rewards to energize transformation.
18 min.	III	**Highlights**: Summarize the main points of the discussion in the form of highlights formulated as a set of recommendation(s) for action (change) and models of implementation to be presented in the subsequent plenary session.

[1] Examples of guiding and probing questions for each breakout discussion topic have been provided below.

[2] Given time constraint it is best not to begin the discussion with introduction of each participant.

[3] No one person should be allowed to monopolize the stage for more than a few minutes at a time.

Session I — Wednesday June 20th Morning

The changing landscape of undergraduate education — The curriculum and the Instructor

Moderator: Larry Miller (ADSA Discover Conference)

Invited Speaker: Ronnie Green (University of Nebraska)

Breakout Discussion Groups

Breakout	Room	Topic	Facilitator
1	Room B1-A	Instructor's roles (educating citizen vs. training for industry job)	Michael Orth MSU
2	Room 118	International faculty and internationalization of the curriculum	Charles Stoltenow NDSU
3	Lower Lge.	Teaching vs. Research: independent, inclusive or exclusive of each other?	Larry Berger Nebraska
4	Dining Rm.	Excellence in Teaching: Years of practice (trial & error) vs. scholarship	Scott Radcliffe Purdue

Breakout 1: Instructor's roles (education citizen vs. training for industry job)

- What roles have instructors (faculty) in animal sciences played in the past and what roles will they play in the future?
- Beyond disciplinary expertise, what does the faculty bring into the classroom that contributes to effective teaching in the animal sciences?
- Is there an antagonism between teaching a scientific discipline versus fostering critical thinking, communication skills, teamwork, etc. in a student-centered classroom?
- Other related topics?

To help your facilitator's presentation in the plenary session wrap-up with highlights of the discussion, recommendations for action (change) and possible models of implementation.

Breakout 2: International faculty and internationalization of the curriculum

- What issues may arise from international faculty teaching undergraduate in the animal sciences?
- What are the implications of the increasing internationalization of the faculty?
- How do we tap into the full potential of international faculty or faculty with deep international (research) connections to improve the undergraduate curriculum?
- Other related topics?

To help your facilitator's presentation in the plenary session wrap-up with highlights of the discussion, recommendations for action (change) and possible models of implementation.

Breakout 3: Teaching vs. research: Independent, inclusive or exclusive of each other?

- Under what situations are teaching and research synergetic, and under what situations are teaching and research antagonistic?
- Does bringing your research into the classroom makes for more effective teaching?
- What are the dangers of mixing teaching and research in the classroom (expert blind spot)?
- Other related topics?

To help your facilitator's presentation in the plenary session wrap-up with highlights of the discussion, recommendations for action (change) and possible models of implementation.

Breakout 4: Excellence in Teaching: Years of practice (trial & errors) vs. scholarship

- What are the differences among excellence, expertise, and scholarship of teaching?
- Should doctoral programs in animal sciences include (more) expectations on pedagogical skills (courses on teaching and learning, meaningful TA experience, etc.)?
- What are examples of reflective practices?
- What motivates instructors to engage in reflective practices?

- Other related topics?

To help your facilitator's presentation in the plenary session wrap-up with highlights of the discussion, recommendations for action (change) and possible models of implementation.

Session II — Wednesday June 20th Afternoon

The changing landscape of undergraduate education — The Students

Moderator: Hasan Khatib (University of Wisconsin-Madison)

Invited Speaker: Kenneth Esbenshade (North Carolina State University)

Breakout Discussion Groups

Breakout	Room	Topic	Facilitator
1	Room B1-A	Importance of motivation and student learning style	Marshall Stern UoM
2	Room 118	Individual vs. team learning (student learning communities)	Aduli Malau Uo Tasmania
3	Lower Lge.	Digital divide (accessing & using information for decision-making)	Ashley Driver UW-Madison
4	Dining Rm.	Educational needs of increasingly diverse student population	Millie Worku NCA&T

Breakout 1: Importance of motivation and student learning style

- How do instructors take advantage of varied learning styles to create a better classroom?
- Increased interest has been linked to increased performance. How do we design a motivating classroom environment?
- Intrinsic versus extrinsic sources of motivation for students. What are they and what should we do about them to effect learning outcomes?
- Other related topics?

To help your facilitator's presentation in the plenary session wrap-up with highlights of the discussion, recommendations for action (change) and possible models of implementation.

Breakout 2: Individual vs. team learning (student learning communities)

- What are the benefits and limitations of teamwork?
- What can be achieved with teamwork that could not be achieved otherwise?
- How to design functional team projects?
- First year interest groups (FIGS), Residence Learning Communities (RLC)
- Other related topics?

To help your facilitator's presentation in the plenary session wrap-up with highlights of the discussion, recommendations for action (change) and possible models of implementation.

Breakout 3: Digital divide (accessing & using information for decision-making)?

- Communicating with students; What are the expectations?
- How will mobile technology (smartphone, iPad) influence animal science curricula?
- Is "Google World" a threat or an opportunity?
- Should our students learn how to "author" (know how to "publish") on the web or learn how to "consume" (know how to differentiate) internet content?
- Other related topics?

To help your facilitator's presentation in the plenary session wrap-up with highlights of the discussion, recommendations for action (change) and possible models of implementation.

Breakout 4: Educational needs of Increasingly Diverse Student Population

- What does "diverse student population" mean to you?

- What's different in teaching animal sciences to students with little or no background in animal agriculture or with a focused interest in non-farm animals (companion animals)?
- How can an instructor harness students' diversity to create a better learning environment in the classroom?
- Other related topics?

To help your facilitator's presentation in the plenary session wrap-up with highlights of the discussion, recommendations for action (change) and possible models of implementation.

Session III — Thursday June 21st Morning

Creating an Effective Learning Environment

Moderator: Jean Bertrand (University of Georgia)

Invited Speaker: Frank Robinson (University of Alberta)

Breakout Discussion Groups

Breakout	Room	Topic	Facilitator
1	Room B1-A	Teaching and Learning Critical Thinking Skills	Dean Pringle UoG
2	Room 118	Beyond Lecture (practicum, laboratories, computer labs, students projects, etc.)	Keith Bertrand UoG
3	Lower Lge.	Beyond Lecture (internships, study abroad, faculty-led field programs, etc.)	Mark Russell Purdue
4	Dining Rm.	Information Technology (in-class, out-of-class, on-line multistate initiatives, etc.)	Jodi Sterle ISU

Breakout 1: Teaching and Learning Critical Thinking (see http://www.criticalthinking.org)

- What is critical thinking, and why is it important?
- How is critical thinking taught and learned?
- How can critical thinking in the classroom be encouraged, recognized and rewarded?
- Other related topics?

To help your facilitator's presentation in the plenary session wrap-up with highlights of the discussion, recommendations for action (change) and possible models of implementation.

Breakout 2: Beyond Lecture (case study, problem-based learning, hands-on labs, computer labs)

- Is the classroom lecture becoming a thing of the past?
- How should a 50-min lecture period be designed for maximal effectiveness?
- How should we deal with resource-intensive, out-of-classroom experiences at a time of shrinking budgets and increased pressures on people's time
- Should labs be stand-alone or should labs be tied to lecture courses?
- Other related topics?

To help your facilitator's presentation in the plenary session wrap-up with highlights of the discussion, recommendations for action (change) and possible models of implementation.

Breakout 3:

Beyond Lecture (internships, study abroad, faculty-led field program)

- Are internships, study abroad or faculty-led field programs important components of the future animal science curriculum? How do you make these fits in a 4-year plan?
- How do we help students document their personal growth and their academic growth through these experiences?
- What are the barriers to engaging students, faculty and administrators?
- Other related topics?

To help your facilitator's presentation in the plenary session wrap-up with highlights of the discussion, recommendations for action (change) and possible models of implementation.

Breakout 4:
Information Technology (in-class, on-line, multistate initiatives)

- What are the emerging technologies that will help transform teaching and learning?
- How do we harness the power of social media (e.g., facebook) to pedagogical goals?
- What is the role of technology in the classroom (ppt, internet access) and outside of the classroom (course management software)?
- On-line courses and degrees: Should the animal science community get on the bandwagon?
- Other related topics?

To help your facilitator's presentation in the plenary session wrap-up with highlights of the discussion, recommendations for action (change) and possible models of implementation.

Session IV — Thursday June 21st Afternoon:
Fostering Scholarship and a New Teaching and Learning Culture
Moderator: Dave Thomas (University of Wisconsin-Madison)
Invited Speaker: Nancy Irlbeck (CSU)

Breakout Discussion Groups

Breakout	Room	Topic	Facilitator
1	Room B1-A	Desired Learning Outcomes of Animal Sciences BS degree	Michael Gonda SDSU
2	Room 118	Teaching and Learning Communities (peer-review, co-teaching, etc.,)	Miriam Weber Nielsen MSU
3	Lower Lge.	Course evaluation versus getting students' feedback through assessment practices (classroom assessment technique (CATs), class survey, etc.,)	Amin Fadl UW-Madison
4	Dining Rm.	Documenting changes (portfolios, reflections, memoirs, survey data, focus group, etc.)	Brian Bolt; Clemson

Breakout 1: Desired Learning Outcomes of Animal Sciences BS degree

- What should a student know and what skills should they have after completing a B.S. degree in the animal sciences?
- Is the answer to the above question the same today as it was 10 to 20 years ago? What will it be in 10 to 20 years?
- The basics of livestock and companion animal production are similar now to what they were many years ago, but there is much new knowledge on the functional biology of animals. How do we effectively bring students from the basics of animal production to the current state of our knowledge – or do we?
- Society is increasingly concerned with issues such as animal welfare, environmental impacts of livestock production, and health aspects of eating animal products than the biology of animals. Should these societal issues be taught in the animal sciences' curriculum? How? What goes out in order to make room for these topics?
- Other related topics?

To help your facilitator's presentation in the plenary session wrap-up with highlights of the discussion, recommendations for action (change) and possible models of implementation.

Breakout 2: Teaching and Learning Communities (peer-review, co-teaching, etc.,)

- What changes can be made in the environment of the animal science department to improve the effectiveness of our teaching?

- How useful are departmental, college, university, or national teaching groups and organizations in improving my ability to effectively teach?
- What constitutes a good peer-review of teaching abilities?
- Other related topics?

To help your facilitator's presentation in the plenary session wrap-up with highlights of the discussion, recommendations for action (change) and possible models of implementation.

Breakout 3: Course Evaluation versus getting students' feedback through assessment practices (classroom assessment practices (CATs), class survey, etc.,)

- Are student/course evaluations good indicators of an instructor's teaching abilities?
- Summative assessment (end of semester course evaluation) versus formative assessment (on-going formal or informal feedback): How can they be used to improve teaching skills?
- What are the important questions to ask on end-of-semester course evaluations?
- Should pre-post tests used more regularly to measure students learning?
- Other related topics?

To help your facilitator's presentation in the plenary session wrap-up with highlights of the discussion, recommendations for action (change) and possible models of implementation.

Breakout 4: Documenting changes (portfolios, reflections, memoirs, survey data, focus group, etc.)

- What are the best ways to document teaching impact? (students' evaluations, peer evaluations, surveys of former students, etc.)
- What is the best ways to document change over time in teaching ability/effectiveness?
- Statement of teaching philosophy: What is it and how can it be made useful?
- What should be included in the C.V./portfolio/tenure document of an instructor/teacher in the animal sciences?
- Other related topics?

To help your facilitator's presentation in the plenary session wrap-up with highlights of the discussion, recommendations for action (change) and possible models of implementation.

Session V — Friday June 22nd Morning

Providing Incentive, Recognizing and Promoting Effective Teaching Among Current and Future Instructors

Moderator: Dave Buchanan (NDSU)

Invited Speaker: Michel Wattiaux (UW-Madison)

Breakout Discussion Groups

Breakout	Room	Topic	Facilitator
1	Room B1-A	Intrinsic vs. Extrinsic Motivation and Rewards	Olga Bolden-Tiller Tuskegee
2	Room 118	Teaching Excellence or Scholarship in Relation to Promotion and Tenure	Laura Hernandez UW-Madison
3	Lower Lge.	Administrative Support (Funding and Other Resources) for Teaching Initiatives	Kristy Daniels The Ohio State Univ.
4	Dining Rm.	Faculty Development: Needs of Future Instructors, Tenure-track and Senior Faculty	Cindy Wood VPI

Breakout 1: Intrinsic vs. extrinsic motivation and rewards

- What are the internal (intrinsic) and external (extrinsic) sources of motivations that cause faculty to improve their teaching practices?
- What can administrators do to foster the faculty's satisfaction with those internal motivations?

- What sources of motivations can be provided by university administrations or professional societies to encourage teaching excellence?
- Other related topics?

To help your facilitator's presentation in the plenary session wrap-up with highlights of the discussion, recommendations for action (change) and possible models of implementation.

Breakout 2: Teaching excellence or scholarship in relation to promotion and tenure

- What is the value of teaching excellence in promotion-tenure decisions?
- How can teaching excellence be verified and documented?
- What are the characteristics of teaching scholarship?
- What are the characteristics of scholarly teaching?
- Other related topics?

To help your facilitator's presentation in the plenary session wrap-up with highlights of the discussion, recommendations for action (change) and possible models of implementation.

Breakout 3: Administrative support (funding and other resources) for teaching initiatives

- Has the current system failed to recognize and reward excellent teaching?
- Where is the funding for teaching excellence and innovative new teaching initiatives?
- How can funding for research and extension be leveraged to also provide support for teaching?
- Other related topics?

To help your facilitator's presentation in the plenary session wrap-up with highlights of the discussion, recommendations for action (change) and possible models of implementation.

Breakout 4: Faculty development needs of future instructors, tenure-track & senior faculty

- What do teachers in the animal sciences need to achieve and maintain excellence?
- What does a "teaching mentor" look like? How do new instructors acquire effective teaching skills (experienced mentors, co-teaching by experienced and new teachers, teaching seminars, etc.)?
- How do teachers in the animal sciences learn more about teaching?
- What would be the advantages of building better networks among teachers in the animal sciences, and what would those networks look like?
- Other related topics?

To help your facilitator's presentation in the plenary session wrap-up with highlights of the discussion, recommendations for action (change) and possible models of implementation.

Thursday Afternoon Session Options

Thursday, June 21
4:30 - 6:00 PM
Each session is limited to 25 participants. The sign-up sheet will be at the registration desk Tuesday evening and Wednesday morning, and on a clip board on the refreshment table until Thursday noon.

Session 1: Discussion of a Selected Chapter of the Book "How Learning Works"
Facilitator: Michel Wattiaux, University of Wisconsin -- Room 118, Lowell Center
Any conversation about effective teaching must begin with a consideration of how students learn. In this session, Dr. Wattiaux will model a classroom discussion (as a mode of teaching and learning) through the facilitation of a discussion of Chapter 3: "What Factors Motivate Students to Learn" from the book you will receive at registration (How Learning works: Seven Research-based Principles for Smart Teaching). Each chapter of the book starts with "mini stories" that serve to illustrate a learning principle, followed by a summary of the related research literature, its implication and strategies for implementation of effective practices. Even if you have not read the chapter by 4:30 on Thursday, come and enjoy a great opportunity to share your ideas on how learning works!

Session 2: Student Creative Works (videos, demonstrations, music) with Frank Robinson and his Team
Facilitator: Frank Robinson, University of Alberta - Room B1 Lowell Center
Dr. Robinson, his colleagues and students have put a fair bit of time into student creative works (videos, demonstrations, music). His team will show case some of the videos that will be introduced during his presentation earlier in the day. Sit back, enjoy some examples of innovative use of multimedia in a low stress environment and engage in a dialogue with Dr. Robinson and his team of highly dedicated educators.

Session 3: Visit of Classroom of the future: Wis. Collaboratory for Enhanced Learning (WisCEL)
Facilitator: John Booske & Suzanne Smith, University of Wisconsin -- College Library (Meet in the Upper Lounge Lobby for group departure at 4:30 pm)
Wisconsin Collaboratory for Enhanced Learning (WisCEL) is an innovative approach to learning that combines deliberate choices of physical environment including multi-use spaces, classroom technologies, and instructor support. WisCEL supports pedagogies which include collaboration, instructor-as-coach models, self-pacing opportunities, immediate learning progress feedback through software, increased instructor time with students, and international connections, to name a few. We invite you to hear about, discuss, and tour the newly remodeled WisCEL Center at College Library.

Session 4: Writing Workshop - Using Writing Activities to Help Students Learn in STEM Courses
Facilitator: Brad Hughes, Director UW-Madison Writing Center, Room 6191 Helen C. White Building (Meet in the Upper Lounge Lobby for group departure at 4:30 pm)
The research is clear--if you're looking for ways to engage your students and to help your students learn course concepts more deeply, you should make carefully designed writing activities a crucial part of your teaching. During this informal and fun session, we'll review connections between student writing and learning; discuss ways to match writing activities to learning goals; share examples of innovative and creative writing activities proven to work in various size STEM courses; and identify principles and best practices for making writing assignments successful. The assignments we'll discuss include everything from short in-class writing to new web tools for incorporating writing and feedback into large science courses to carefully sequenced experimental research reports. This interactive workshop will be led by Brad Hughes, the director of the faculty teaching program in Writing Across the Curriculum and director of the of the Writing Center at the University of Wisconsin-Madison, which is one of the largest and most comprehensive writing centers in the country. Brad has led workshops on teaching with writing for over 1600 faculty and teaching assistants at UW-Madison and at universities around the United States.

Speaker Biographical Data

Kenneth L. Esbenshade, Ph.D.
North Carolina State University

Dr. Ken Esbenshade is the Associate Dean and Director of Academic Programs for the College of Agriculture and Life Sciences at North Carolina State University, overseeing associate, baccalaureate, and graduate educational programs in the college with more than 5,900 students enrolled. He has been a faculty member at NC State University for more than thirty years with appointments in teaching, research and extension, and he has held administrative appointments as Head of the Department of Animal Science and as Associate Director of Academic Programs for the College of Agriculture and Life Sciences.

Dr. Esbenshade leads one of the largest academic programs in colleges of agriculture among land-grant institutions and the second largest on the NC State University campus. He has fostered curriculum development, the establishment of new degree programs, instruction via distance education, comprehensive program assessment, and collaboration with other educational institutions, particularly the community colleges in North Carolina. He has also championed student success initiatives such as study abroad, student clubs, undergraduate research, e-portfolios, and services pertaining to personal and professional development. As a result, the College experienced record student enrollment and the highest ever recorded student satisfaction ratings.

Dr. Esbenshade is a native of Lancaster, Pennsylvania, and he holds a B.S. degree in Animal Husbandry from Delaware Valley College, and M.S. and Ph.D. degrees in Animal Science from Purdue University. He is a member of several professional societies, as well as Gamma Sigma Delta and Delta Tau Alpha honorary societies. He has received multiple awards for teaching and leadership excellence, and he holds the prestigious university title of Alumni Distinguished Undergraduate Professor in the Department of Animal Science. He is a Fellow of the American Society of Animal Science and a Fellow of the Food Systems Leadership Institute (FSLI) as a member of Cohort 1. He served on the Policy Board of Directors for the Board on Agriculture Assembly for the Association of Public and Land-Grant Universities (APLU) and worked with the Science and Education Resources Development (SERD) unit in USDA-CSREES (now NIFA) in a comprehensive portfolio review of their higher education programs.

Ronnie D. Green, Ph.D.
University of Nebraska-Lincoln

Prior to joining the University of Nebraska in July 2010, Dr. Green served as the senior director of Pfizer Animal Health overseeing global technical services for Animal Genetics, a position he had held since April of 2008.

Ronnie was raised on a mixed beef, dairy, and cropping farm in southwestern Virginia. He received B.S. and M.S. degrees in animal science from Virginia Tech and Colorado State University, respectively. His Ph.D. program was completed jointly at the University of Nebraska and the USDA U.S. Meat Animal Research Center in animal breeding in 1988.

Ronnie has served on the animal science faculties of Texas Tech University (1989-1994) and Colorado State University (1994-2000), reaching the rank of full professor in 1997. He has been recognized with a number of distinguished local, regional and national teaching and research awards for the work he led with 25 Ph.D. and M.S. students and colleagues in beef cattle breeding and genetics in those positions. From 2003-2008, Green served as the national program leader for animal production research for the USDA's Agricultural Research Service and as the executive secretary of the White House's interagency working group on animal genomics within the National Science and Technology Council. In this role he directed a $45M annual research portfolio and was one of the principal leaders in the international bovine, porcine, and ovine genome projects.

Ronnie has published 130 refereed publications and abstracts, 9 book chapters, and 56 invited symposia papers; and has delivered invited presentations in 43 U.S. states, Australia, Argentina, Brazil, Belgium, Canada, Denmark, France, Ireland, India, Japan, Mexico, Netherlands, New Zealand, Switzerland, and the United Kingdom. He is past-president and has served as a board member, recording secretary and as a member of the executive committee for the American Society of Animal Science, and in a number of industry leadership positions for the Beef Improvement Federation, NCBA, National Pork Board, DISCOVER Conferences, and the National Block and Bridle Club (serving as national president in 1998).

Ronnie and best friend Jane are the proud parents of Justin (23), Nate (21), and Kelli (18) all UNL students, and Regan (16) a high school student at Lincoln Christian.

Nancy Irlbeck, Ph.D.
Colorado State University

Nancy A. Irlbeck, is the Associate Dean for Academic Affairs in the College of Agricultural Sciences at Colorado State University in Fort Collins, Colorado. Dr. Irlbeck received a bachelor's degree in animal sciences and a Master's degree in animal nutrition at Iowa State University. Her Ph.D. work in ruminant nutrition was completed at the University of Nebraska-Lincoln. Prior to her administrative appointment, Nancy served in a predominantly teaching appointment within the Department of Animal Sciences at Colorado State University, and for 14 years taught Veterinary Feeds and Feeding in the School of Veterinary Medicine. She wrote a textbook entitled Nutrition and Care of Companion Animals and served as the consulting nutritionist for the Denver Zoo since 1992. She and her husband Steve raise a breeding flock of rare wool sheep on the Colorado-Wyoming border.

Frank Robinson, Ph.D.
University of Alberta

Frank Robinson is a Professor of Poultry Physiology and Production, as well as Vice-Provost and Dean of Students at the University of Alberta. He has B.Sc. in Agriculture (University of Saskatchewan), a M.Sc. in Poultry Science (Virginia Tech) and a Ph.D. in Animal Reproduction (University of Guelph). For over 20 years Frank led a research group investigating reproductive physiology of meat-type poultry. He has taught over 70 cohorts of animal science classes, focusing on introductory animal science and senior poultry production classes. In 2004 Frank developed the program "There's a Heifer in Your Tank" (HIYT) as a means to add value to his undergraduate "Introduction to Animal Agriculture" class. This wildly successful program has continued to evolve with the collaborations of Dana Penrice and Martin Zuidhof. The HIYT team has received several university, provincial, and national awards for building youth leadership in agriculture and for communicating science to the public. Frank has served as Associate Chair (Teaching and Learning), and Associate Dean (Academic) prior to his current administrative appointment in 2008. In 2004 Frank was named as a 3M Teaching Fellow, the highest Canadian recognition for leadership and proficiency in university teaching. In 2005 Frank was inducted into the Alberta Agriculture Hall of Fame. He is a Fellow of the Poultry Association and in 2011 was the recipient of the North American Colleges and Teachers of Agriculture (NACTA) Distinguished Educator Award.

Michel Wattiaux, Ph.D.
University of Wisconsin, Madison

Michel Wattiaux grew up on a dairy farm, was a first-generation university student in Belgium, and completed a PhD in ruminant nutrition at the University of Wisconsin-Madison. After 10 years of international dairy extension work, he took a faculty position in the Department of Dairy Science at the University of Wisconsin-Madison with a 70% teaching and 30% research appointment. Michel's disciplinary research focuses on the link between dairy cattle nutrition and environmental impact (gaseous emissions) and indicators of dairy system sustainability. Michel has gained an international reputation as an educator and has received multiple teaching awards (International Dairy Production Award of the American Dairy Science Association, 2002; UW-Madison Chancellor's Distinguished Teaching Award, 2006; Jung Teaching Award of the UW-Madison College of Agriculture and Life Sciences, 2008; American Dairy Science Association, Land O Lakes Purina Feed LLC Teaching Award in Dairy Production, 2008; USDA Food and Agricultural Sciences Excellence in College and University Teaching Award, North Central Region, 2009 and the University of Wisconsin-System Underkofler Teaching Award, 2012). Michel has published a series of Technical Dairy Guides (textbooks), peer-reviewed research on teaching, and a book chapter on "Signature Pedagogies in the Animal Sciences." He chaired the UW-Madison Teaching Academy and served on numerous teaching-related committees and panels. Currently, Michel teaches six courses per academic year including a two-week field program in Mexico and a course to introduce future STEM faculty to teaching and learning issues in the College Classroom.

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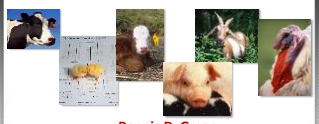
2050's Challenges: Food Animal "Scientist-Citizens" Required



Ronnie D. Green
Vice President and Harlan Vice Chancellor
University of Nebraska

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Presentation outline

- Agriculture, food, energy, and natural resources security at the epicenter of global challenges
- ***Filling the needs for food animal scientists who are global citizens and servants***
- ***Strategic changes required in our approach and outcomes***

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In the midst of the Civil War….

- The Morrill Act
- USDA – the "People's Department" – founded
- The Homestead Act
- Transcontinental Railroad

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20th century goals…..

- Profitability, increase efficiency and productivity, reduce labor
- Natural resources considered free and unlimited, off-field effects unknown, social and economic dynamics secondary

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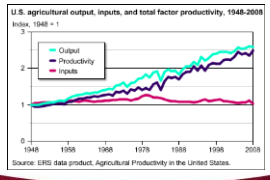
A successful strategy for increased production efficiency



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Ag and natural resources at the center

- Growing global population in a closed system
- Recognition of links between local and global food security, health, poverty and social/political stability
- Increased demand per capita for food, water, fiber and energy – tradeoffs loom large; need for disruptive technologies

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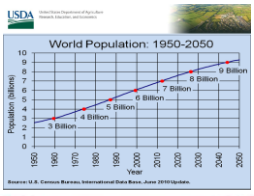
More mouths to feed…..



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Global Population Growth (2010-50)

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2050 global rising "food ambition" projections

- 73% rise in meat consumption
- 58% rise in dairy consumption

- "World Livestock 2011" report, FAO

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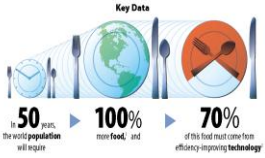
The Challenge – keeping it simple



Source: Food Economics and Consumer Choice (Simmons, 2008, 2012)

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Competition for limited resources

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Global Arable Land and Population (2009)

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Total Global Water Withdrawn (2007)

Source: FAO

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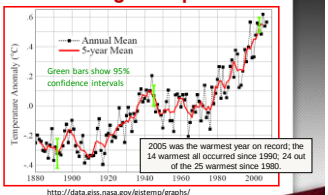
Future change is expected….



http://data.giss.nasa.gov/gistemp/graphs/

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Technology must be leveraged…

"Science and technology must spearhead agricultural production in the next 40 years at a pace faster than the Green Revolution did during the past three decades."

Jacques Diouf
Former Director General, FAO

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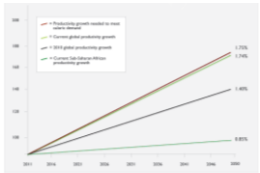
The Global Agricultural Productivity Index™



Source: Economic Research Service, USDA

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Societal shifts . . .

- Clear need for addressing hunger while simultaneously addressing obesity
- Increasing "disconnect" of consumers from production agriculture
- Need to reverse the "people drain" from rural America
- Increasing need to preserve natural resources
- Growing divergence between "industrial," "organic," and "local" food production models

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Societal to Industry Shifts . . .

- Increased call for decreasing the "environmental footprint" of production
- Competition for energy sources and feedstuffs for alternative energy production
- Increased attention to animal well-being and welfare leading to regulation of process
- Increased brand / process/ historical identity of products
- Increased purchasing power for "non-traditionally produced" products

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We must continue to evolve….

http://www.naute.com/images/evolutionofman.jpg

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What Does 21st Century Animal Science Education Demand??

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Filling the food ("farm") animal scientist pipeline?

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Yahoo doesn't do its homework . . .

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Prospects good

The U.S. Department of Labor projects significant growth in selected jobs during 2008-18 in the Monthly Labor Review published November 2009. Among them:

- agricultural inspectors, up 12.8%
- animal scientists, up 13.2%
- biochemists and biophysicists, up 37.4%
- market research analysts, up 28.1%
- sales managers, up 14.9%
- veterinarians, up 33%

- "Employment Opportunities for College Graduates," USDA

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Jobs in agricultural and food systems, renewable energy, environment

"During 2010-15, five percent more college graduates with expertise in agricultural and food systems, renewable energy, and the environment will be needed when compared to 2005-2010."

- "Employment Opportunities for College Graduates," USDA

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For graduates in food, renewable energy, environmental specialties 2010-2015:

- An estimated 54,400 annual openings
  - 74% in business and science
  - 15% in agriculture and forestry production
  - 11% in education, communications, government service
- Expect approximately 53,500 qualified grads to be available

- "Employment Opportunities for College Graduates," USDA

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Ag is Sexy and You Know It….

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The 2050 future demands . . .

We must raise our expectations of our students, ourselves and our colleagues as teachers, because the future is demanding an increased knowledge and skills portfolio.

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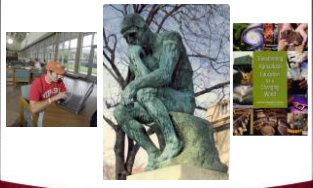
We must mentor good thinkers…



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The interfaces are as important as the historically primary domains

The challenges we face do not fit neatly into academic departments and majors. They are complex problems that require multiple areas of expertise and diverse skill sets.

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"Systems thinking is fundamental"

Gordon E. Dickerson, University of Nebraska
USDA-ARS US MARC

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Problems Matter ….. Not majors?

"Majors do not matter nearly as much to today's students – they are more interested in working on solving critical problems --- e.g. "water for food".

Jeff Selingo
Chronicle for Higher Education
May 1, 2012

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Water for Food | FOOD for the FUTURE | Rural Future Landscape

Center for Plant Science Innovation
Center for Red Meat Innovation
Food for Health
University of Nebraska

Gut Function Initiative
Nebraska Gateway for Nutrigenomics
Redox Biology Center
Nebraska Center for Virology

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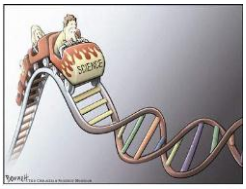
Agricultural life sciences……



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GUT function initiative

Translating discovery into Innovation

Focus on Fundamental Discovery
How does the gut ecosystem develop and function in individuals?

→Host factors
→Microbial factors
→Dietary factors

Translation

→novel anti/pro-microbials
→prebiotics and functional foods
→animal breeding (markers)

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Host genetic factors that shape the microbiome

Individuality in gut microbiota composition is a complex polygenic trait shaped by multiple environmental and host genetic factors

Diabetes, CHD, Obesity, Allergies, Colon Cancer, IBD

Biomarkers for Disease susceptibility
Structure of The ecosystem
Targets for Intervention
Biomarkers for Production traits
Biomarkers for Pathogen transmission

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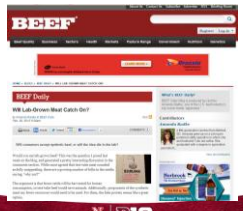
Meat from the lab?



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Learning to work as team members to "problem solve" is vital for future success

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Hands-on, experiential learning is a must

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ConAgra Foods · Bayer CropScience · BUNGE · nebraskaGlobal · MONSANTO · MERCK Animal Health · Cabela's · Cargill · GALLUP · Nestlé · JOHN DEERE · Water for Food · NBA

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Our students must be media savvy, write fluently and communicate effectively "face-to-face"

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Diverse backgrounds influence students' species of interest

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And We Must Build Global Citizens

- Interpersonal skills essential
- Understand and value differences in cultures, beliefs
- Understand international trade and markets

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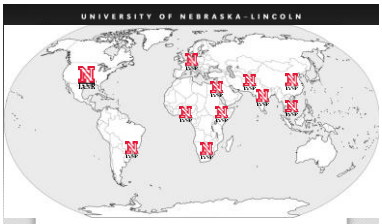

AFGHANISTAN (DOD ADT), **BRAZIL** (USP-ESALQ, CAPES), **GHANA** (FARA), **ETHIOPIA**, USAID (**MENA**), **ZAMBIA** (IDE), UNESCO-IHE, **CHINA** (SAG, China Ag, Northwest A&F), **INDIA** (JAIN, Obama-Singh, MSSRF), **VIETNAM** (MARD)

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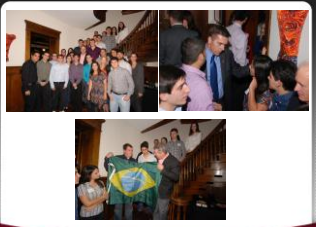

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Who will teach the 2050 generation of food animal scientists??

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Landscape Shifts

- Animal science faculties will continue to grow increasingly "global" demographically – an opportunity but also a challenge.
- A higher percentage of faculty members have little to no experience directly in production agriculture – a trend that is not sustainable under current trends.

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Evolving…..

- We may need to evaluate a requirement for experience directly in production animal agriculture for teaching faculty to be proficient.
- Teaching, research, and service requirements can be met without conflict if the culture of academe is one of balance.

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Evolving……

- "Professor of practice" faculty are increasingly prevalent in undergraduate programs – this is a huge opportunity – in balance with tenure-track faculty.
- Greater relationships with industry will deepen the undergraduate experience – and all faculty should exhibit successful engagement in this regard.

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Evolving……

- Scholarship of teaching MUST BE encouraged and rewarded:
  - "Flipping the classroom"
  - Integrating 4-year team problem-solving developmentally for the student
  - Integrating entrepreneurship in to the undergraduate experience
  - Developing effective means for developing the global citizenship skills of every student using new and creative, financially feasible platforms
  - Integrating the student body to be global and not domestic or urban vs rural

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Evolving….

- We must get serious about "training the trainer" in graduate education
- All faculty must teach by example ethical behavior

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WE MUST elevate the stature of animal sciences (agricultural) research and education in the arena

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"He who knows all the answers has not been asked all the questions."

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Will We Need to Change to Meet the 21st Century Needs?

Animal Science Students: Who They Are, How They Learn, and Their Learning Environment

Kenneth L. Esbenshade

Alumni Distinguished Undergraduate Professor, Department of Animal Science
Associate Dean and Director of Academic Programs
College of Agriculture and Life Sciences
North Carolina State University

Changing Demographics

Results from the 2010 United States Census clearly show that the demographic trends in the United States that began during the second half of the 20th Century are continuing. The U.S. population continues to grow older, concentrate in urban areas, and be more diverse.

The Population is Aging:
The median age of the population increased from 28.1 years in 1970 to 37.2 years in 2010 (United States Census 2010, 2011). The aging population is the result of the Baby Boom population moving into older age groups, a longer expected life span, and a stabilization of the birth rates. Although the absolute number of individuals that are 18 years of age or younger has remained fairly stable at approximately 62 million, the percentage of this age group has dropped from approximately 30% to 20% of the population during the time interval from 1970 to 2010 (Figure 1).

The Population is Concentrating in Urban Areas:
Urban areas are defined as a geographic entity containing a population of 50,000 or more (2010 Census Urban and Rual Classification and Urban Area Criteria, 2010). There were 3,573 urban areas identified in the 2010 U.S. Census, with the remaining areas identified as rural. There has been a gradual shift of the U.S. population from rural to urban areas. In 1910, only 28% of the U.S. population resided in urban areas. By 1950, the percentage residing in urban areas was more than 50 percent for the first time and the percentage increased to 81% in the 2010 Census (Figure 2). The western part of the United States contains the most urban areas followed by the northeast, with California and New Jersey both having almost 95% of their populations residing in urban areas in the 2010 Census. Maine and Vermont were the most rural states with approximately 61% of their populations living in rural areas. The states with the largest absolute number of residents living in rural settings are Texas, North Carolina, and Pennsylvania. The absolute number of residents living in rural areas has remained relatively stable from 1910 to 2010, decreasing 10% from 66 to 60 million; whereas, the number of residents living in urban areas dramatically increased from 36 to 250 million, an increase of 594%.

The Population is Becoming More Diverse:
The definitions for self selection of race categories used by the U.S. Census Bureau in 2010 were as follows:

- White – persons having original origins of Europe, the Middle East, or North Africa.
- Black or African American – persons having original origins of Black racial groups of Africa.
- American Indian or Alaska Native – persons having original origins in any of the original peoples of North and South America and who maintain a tribal affiliation or community attachment.

- Asian – persons having original origins of the Far East, Southeast Asia, or the Indian subcontinent.
- Native Hawaiian or Other Pacific Islander – persons having original origins of Hawaii, Guam, Samoa, or other Pacific Islands.
- Some Other Race – persons not included in one of the other categories.

In the category of Some Other Race, respondents were asked to list their race. Most often the respondents provided entries such as multiracial, mixed, interracial, Hispanic, or Latino. The terms "Hispanic" and "Hispanic or Latino" are used interchangeably by the US Census Bureau, and individuals in these categories are viewed as having a common heritage, nationality group, lineage, or country of birth. Hispanic/Latino individuals have original origins of Cuba, Mexico, Puerto Rico, Central America, South American or other Spanish Culture, and may be any race (Humes, Jones, & Ramirez, 2011).

According to the 2010 Census, 72% of the people living in the U.S. were White, 13% were Black or African American, and 5% were Asian, with the remainder being in the other race categories (Figure 3). The percentage of the population that were Black or African American did not change appreciably during the time period from 1910 to 2010 ranging from a low of 10% in 1920, 1930, 1940, and 1950 to a high of 13% in 2010. In contrast, there was a significant growth in population of races other than White or Black/African American beginning with the 1980 census (Figure 4). This increase resulted in a commensurate decrease in the percentage of the population classified as White. The dramatic growth in population that is not White or Black/African American was primarily in the categories of Asian, Pacific Islander, Other, and Two or More Races. The percentage change in population from the 2000 Census and 2010 Census was an increase of 43%, 35%, 32% and 24% for Asian, Native Hawaiian and Other Pacific Islander, Two or More Races, and Some Other Race, respectively (Humes, Jones, & Ramirez, 2011).

The Hispanic population in the U.S. increased 43% between the 2000 and 2010 censuses, reaching a total population of 50.5 million people in 2010 and representing 16.3% of the total population (Table 1). Of the individuals of Hispanic or Latino origin, 53% chose White as their race and 37% chose Some Other Race as the classification of their race (Humes, Jones, & Ramirez, 2011).

Higher Education is Becoming More Diverse:

The trends observed in the racial categories of the population during the past several decades are expected to continue in the future (An Older and More Diverse Nation by Midcentury, 2008). By 2050, it is projected that the United States population will be 46% White, 30% Hispanic, 12% Black/African American, 8% Asian, and 4% other (Figure 5). The percentage change from 2010 to 2050 of individuals by race/ethnic groups is projected to be 3% for White, 163% for Hispanic, 123% for Asian and 33% for Black/African American.

Enrollment in higher education has also been projected for the future. There were approximately 14.8 million students enrolled in college in 2010 and that number is expected to increase 10% by 2050 to a total of 16.3 million students. Based on the percentage of students within a racial group that was observed to be attending higher education in the 2000 Census, it is estimated that there will be 9.2 million White/Non-Hispanic students, 2.4 million Hispanic students, 2.3 million Black or African American students, and 2.4 million students of other races and ethnicities attending higher education in 2050 (Figure 6). In accordance with these projections, the student body in 2050 would be 56% White/Non-Hispanic, 15% Hispanic, 14% Black or African American, and 15% other races and ethnicities (Figure 7). (Murdock, 2006)

The projections by the US Census Bureau of the number and percentage of students attending higher education in 2050 are based on current college attendance patterns within race categories. There may be additional changes to the college attendance patterns as more students in race categories other than White attend college at higher rates. Further, since the median age varies among race categories, there will likely be a higher percentage of individuals attending higher education in race categories that have a lower median age. The net results would be an even greater increase in the diversity of students attending college with substantial increases in the number of Hispanic and Asian students by 2050.

Animal Science Students: Who They Are

Interest among students in animal science fields has continued to increase reaching 11,193 students majoring in animal science in 2010, an increase of 8.1% from 2007 (FAEIS News, 2012). The demographic profile of students entering higher education in agriculture continues to change rapidly. Compared to the 1980s, current enrollment in colleges of agriculture consists of more students from urban areas (Dyer, Brejia, & Andreasen, 1999; Dyer, Lacey, & Osborne, 1996; Peiter, Coffey, Morgan, & Kantrovich, 2004). In a survey of students enrolled in the College of Agriculture and Natural Resources at Michigan State University from 2004 to 2008, the respondents were 64% female, 87% White, and 55% from urban areas (Shrestha, Suvedi, & Foster, 2011). Specifically related to the animal sciences, a survey conducted in the Introductory Animal Science classes at Texas A&M University in 2008 (n = 847 students) showed that 46% of the students indicated they were from an area of more than 50,000 residents which would put them in the urban category by U.S. Census Bureau definition (Holub, Boleman, & Ramsey, 2011).

Animal Science Students: How They Learn

Students have different learning styles and teachers of subjects related to agriculture, including animal science, must recognize and accommodate various learning styles to be effective instructors. The learning process has become more defined as scientists, educators, and learning theorists provide theories, models, physiological studies, and sets of ideas about how people learn and how to construct environments to make learning more conducive and efficacious. Learning starts with the brain receiving stimuli, and as the brain processes the information, individuals draw connections and conclusions. The brain's capacity is not predetermined at birth, but rather undergoes continual development throughout the life of an individual. Also, the general construct of the human brain has changed over time and continues to evolve with the advent of modern technology (Carr, 2010). Individual and societal changes and events, coupled with a brain that is adaptable, lead to a complex process by which individuals build upon prior knowledge and experiences to evaluate new stimuli in ways that result in learning new information and ideas.

<u>Personality Preferences:</u>

Even though the human brain has changed over the eons of time and each individual's brain is unique, educators and psychologists have determined that there are broad categories that define how people perceive the world and make decisions. As early as Socrates, educators realized that students learn more effectively when they are able to question hypotheses and when information is presented in relevant ways. Through the ages, other philosophers added theories of how information is retained by humans and relationships between human behavior and learning.

In the modern era, a well known and popular model for defining personality preferences is the Myers-Briggs Type Indicator (1980, 1995), which was developed based on the work of Jung (1971). Responses to the Myers-Briggs questionnaire are used to place individuals into 16 different preference types based on the following four pairs of cognitive functions: extroversion-introversion, sensing-intuition, thinking-feeling, and judging-perceiving.

Preferred Learning Styles:

In a similar manner, theories of how individuals perceive and process information have led to the concept that individuals have preferred learning styles. Learning styles have been defined as a preference that individual display on 'how to learn' new information and is not an assessment of the ability of an individual to learn, i.e., measure of intelligence (Sternberg, 1994). Learning styles is the manner in which learners concentrate on, process, and retain new and difficult information (Dunn, 1990).

Various models have been developed since the 1970s based on the theory that individuals have defined learning styles (Pasher, McDaniel, Rohrer, & Bjork, 2009). One of the more widely accepted models is the Gregorc Style Delineator (Gregorc, 1979). The Gregorc Model seeks to describe how individuals perceive the world and how they assimilate new stimuli and information within their current construct of knowledge. The model combines two perceptual qualities, concrete and abstract, with two ordering abilities, sequential and random. Concrete learners prefer to learn through their physical senses, i.e., what they can touch, see, hear, taste and smell; whereas, abstract learners prefer the world of ideas and feelings and use intuition and reason to interpret ideas, concepts and feelings. Individuals that prefer sequential approaches prefer a process that is followed 'step by step' in an orderly process; whereas, those that prefer random approaches deal with matters in the 'here and now' and can jump readily from one thought, idea, or concept to another depending upon what is important at the moment.

Combining these perceptual qualities and ordering abilities, the Gregorc Model categorizes individuals into four distinctive learning styles: Concrete Sequential, Concrete Random, Abstract Sequential, and Abstract Random. The following is a brief description of each of the four learning styles (Gregroc, 1982).

- Concrete Sequential learners prefer direct, hands-on experiences. They like touchable, concrete materials, and orderly presentations. They are organized, practical, habitual, and desire perfection. They think logically, instinctively, and deliberately. Their creativity is in making the original more effective.

- Concrete Random learners live in the physical world and like to learn by trial and error. They prefer not to have a plan, they want options. They tend to jump to conclusions and prefer to work independently or in small groups. They want a lot of stimuli, and they are gamblers, risk takers, and competitive. They think instinctive, intuitively, and impulsively. Their creativity is original, inventive, and unique.

- Abstract Sequential learners have excellent abilities with the written, verbal, and image symbols, and they develop ideas in a logical way. They prefer a sequential presentation that is rational and substantive. Their thought processes are intellectual, analytical, correlative, fluid and quick, focusing on models, theories, and ideas. Their creativity lies within models, theories, and synthesizing.

- Abstract Random learners live by the heart, not the head. They prefer to learn in unstructured environments such as group discussions. They make sense of the world by

using feelings and emotions, and they prefer not to be restricted by unnecessary rules and guidelines. Their thought process is based in feelings, and their creativity is imaginative and often expressed through music and art.

Preferred Learning Styles Among Animal Science Students:

There are few published articles regarding the learning styles of students studying in the animal sciences. Hoover and Marshall (1998) reported that 58% of the students enrolled in four animal science courses preferred a field-independent learning style which was characterized as analytical, structured, and intentional. More recently, Worley-Davis (2012) reported that students enrolled in an introductory poultry science course were predominantly of the Concrete Sequential learning style. These findings were the same whether the students were in an associate-degree or baccalaureate-degree program. Taken together, these studies indicate that animal science students prefer to learn in an environment that is structured, organized, and orderly with material provided in an orderly and logical manner with hands-on experiences that emphasize learning from the six senses.

It is important to note that learning styles are preferences, and they are not absolute. Learners can adapt to instructional circumstances and can learn outside their preferred learning style when necessary. It has been suggested that students learn best if they have the same learning style as that of the instructor. This was primarily based on the observations that certain subject areas have a larger than random number of students and teachers of a certain learning style, as is the case in the animal sciences. However, this does not necessarily mean that students with learning styles other than the one preferred by the majority of the students cannot be successful in that subject area or the instructors with different learning styles cannot be successful teachers.

Learning is Based on Prior Knowledge:

Regardless of the preferred learning style, learning can only take place if students master the factual knowledge of the subject area, understand the facts in the context of a larger framework of knowledge relating to the subject, and organize the knowledge in such a way so that in can be retrieved and used in application. Basic facts and information must be learned in order to develop competence in new subject matter. Data, trends, outcomes, and reasonable arguments from prior observations are the baseline facts and information that serves as a foundation upon which new information can be placed.

However, facts without understanding are not knowledge, but rather a series of disconnected facts without meaning. Cognitive scientists have demonstrated that learning takes place under the influence of prior knowledge, preconceived notions, and cultural and social contexts. This concept was most advanced by the publication of a book, Fish is Fish (Lionni, 1970), in which a fish and a tadpole become the best of friends. They discuss what it might be like to live on land, but of course they cannot explore these ideas because they can only breathe in water. In time the tadpole grows into a frog and eventually ventures out of the water onto the land. The frog returns to the pond and reports to the fish what he has observed. The frog describes all kinds of things like birds, cows, and people, and the fish creates mental images of what the frog is reporting. Each image the fish creates is a fish-like form that is adapted to accommodate the frog's descriptions. Birds are fish with wings, cows are big fish with udders that float around in space, and people are fish who walk upright on their tailfins. This tale demonstrates the perils of constructing new information based on current knowledge without appropriate context.

The final step in mastering a new subject area involves the student generating reasonable arguments and explanations of their own, drawing analogies to other situations, and creating solutions and applications. These new explanations, solutions, and applications then become the

new facts that are integrated with existing knowledge to expand the learner's knowledge. This new and expanded knowledge base must be organized by the learner in such a way that it is retrievable and useable.

Animal science students come to the classroom with preconceived notions about how farm animals are raised and being cared for. Unless their instructors are able to discern their baseline of knowledge and build from that level, students will fail to fully grasp new concepts and information. Students may successfully complete assignments and pass exams, but long term understanding of the material will only be achieved if students are able to build on existing knowledge.

The Age of the Digital Native:

Members of Generation Z, individuals born between 1995 and 2012, are about to emerge on our college campuses. Who are they and what does their appearance mean for college teachers? They are the digital natives who have always had technology and have always been connected. They have their own language, approaches to solve problems, and ways to learn. They have smart phones and expect to get hundreds of hits on Google and Facebook hourly. They provide feedback, post pictures, and share information online without concern. They use the internet for all their assignments, and they absorb information in short blasts. They would rather watch UTube than TV. They can do various things at the same time, often listening to music, chatting on Facebook, reading school notes, eating, and talking with friends simultaneously. They are connected universally. They talk with family and friends across the country or around the globe using Facetime or Skype, and they can take and upload video in seconds.

Members of Generation Z have always known terrorism and the dark side of humanity. They have experienced economic turmoil and seen the struggle for equality and civil rights through the lenses of their technology devices. They know the grand challenges of humanity and realize that they will be asked to solve some of the worst environmental, social, and economic problems in the history of mankind.

Digital natives believe in the power of technology. They want information in 'clouds.' They do not believe in exclusivity. They want to check each fact before accepting it and check opinions from others before buying products and services. They give and receive information freely and often, and arrive at conclusions collaboratively.

What does this mean for higher education? First, technology does not change basic personality types or learning styles of individuals; therefore, students will still learn in similar ways. Second, base information and facts will be influenced from a much wider perspective. A professor's opinions and background information will be investigated on the internet by these students. They will also read summary statements about a subject as background information. Third, these students will be comfortable with each other and increased diversity in the classroom will be expected. Fourth, knowledge building will come from many sources including collaboratively from classmates. And finally, evaluation of faculty performance and course content will be instantaneous and constant.

The Learning Environment

Teaching and learning are inextricably linked. In addition to understanding how people learn, teachers must also use effective teaching strategies to provide the greatest opportunity for learners to comprehend and incorporate new knowledge. There are various teaching strategies (Figure 8) including lecture-based teaching, skills/competencies-based teaching, inquiry-based

teaching, individual- or group-based approaches to teaching, and technology-enhanced teaching (How People Learn: Brain, Mind, Experience, and School: Expanded Edition, 2000). Is one of these approaches better than the others and which is best suited for animal science students?

Perhaps the question is not which approach is best in general, but rather which approach is best with the current group of learners based on their current level of understanding, based on their backgrounds, based on their learning styles, based on the level of knowledge to be obtained, and based on the subject matter that needs to be conveyed. An analogy would be that we should not ask if a hammer, screwdriver, or pliers is best for the job without first analyzing what we are trying to accomplish. Rather, we should first assess what needs to be accomplished and then determine whether a hammer, or a screwdriver, or pliers is needed.

Effective teachers will first assess what needs to be learned, taking into consideration the current knowledge base of the learners, before deciding how to teach a subject. Specifically, they will determine desired learning outcomes, assess the prior knowledge of the learners, evaluate the social and demographic background of the learners, and assess available learning environments (i.e., classroom characteristics, animal and specimen availability, etc.) before deciding which teaching strategies are most appropriate for that particular subject.

The most effective instructors teach similar subject matter differently to different groups of students, meaning that the same subject may be taught in a different manner from year to year. Moreover, different approaches will be used throughout a semester to teach various subjects depending upon the student audience. These versatile teachers will organize the student learners, information to be taught, the learning environment, and the teaching strategies almost in 'real time' to ensure learning takes place.

Finally effective teaches must create opportunities for learning by organizing the learning environment. Classrooms, teaching laboratories, and farm units must be viewed as part of the equation along with teaching models and specimens to reinforce ideas and concepts. Effective teachers can create learning environments in essentially any setting and situation, utilizing teaching approaches that reinforce subject concepts and permit students to utilize new information in building their own competencies.

Summary

Animal science students of the future will be from urban area, be more diverse, and may include nontraditional learners as the population ages. The preferred learning styles of animal science students will continue to require direct, logical instruction with hands-on experiences, although teaching to other learning styles will be required to be fully effective. Animal science students are part of the technology revolution, and technology will play a greater role in their education in the future. Due to these factors, animal science students will have less background knowledge of farm animals and harbor preconceived notions about animal agriculture. Effective teachers of animal science will recognize these traits in future students and use various teaching strategies to develop students that are competent in the animal science subject area and be able to solve problems and address issues related to animal agriculture in the years to come.

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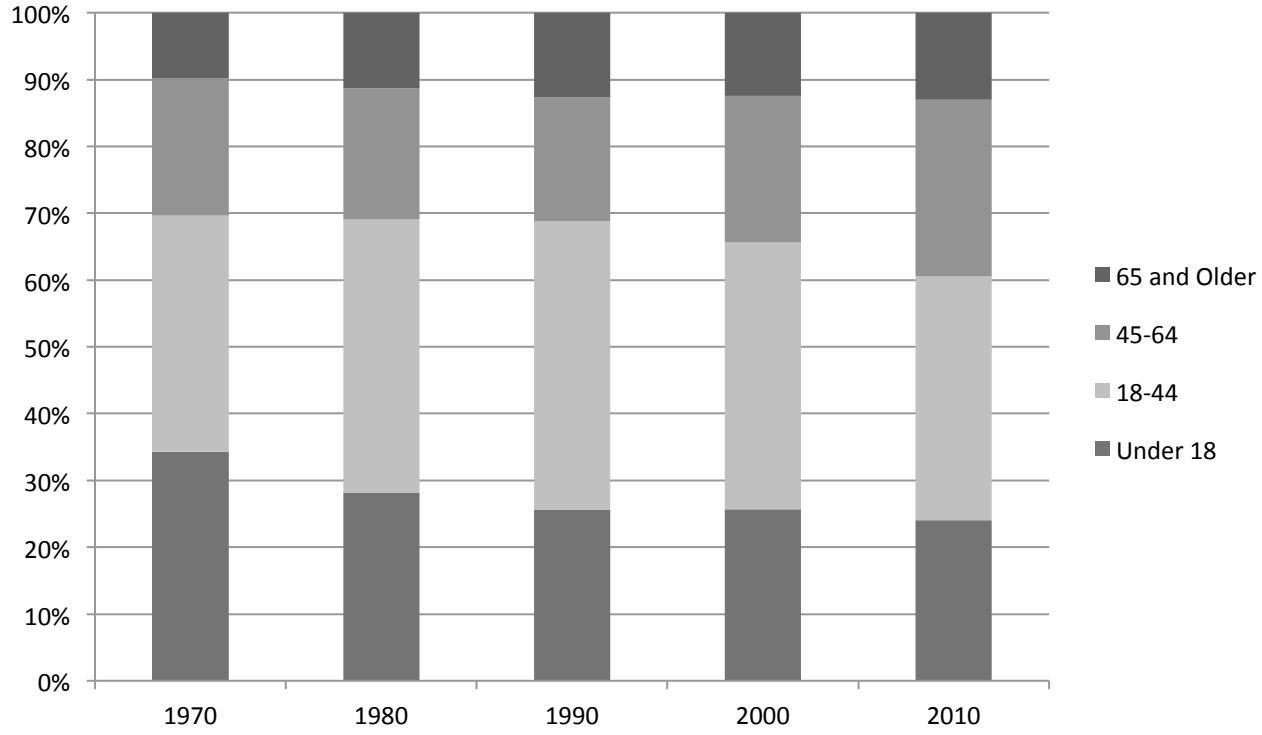

Figure 1. Percent age distribution within the United States population (United States Census 2010, 2011)

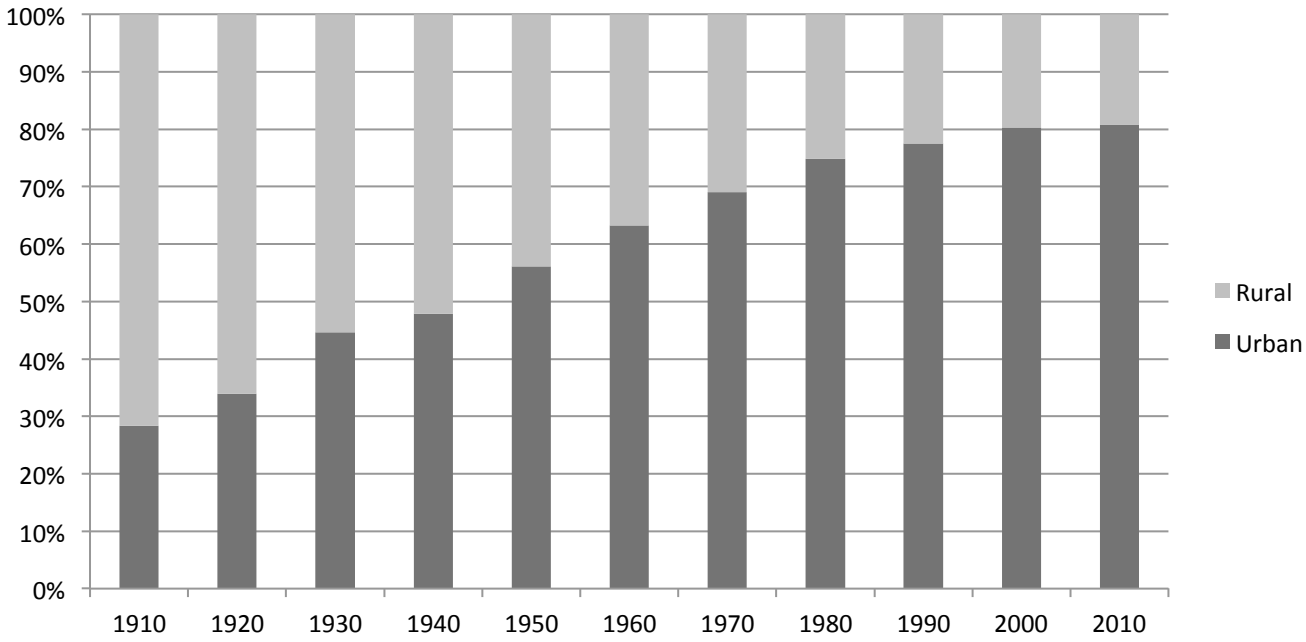

Figure 2. Percent of U.S. population living in rural and urban areas (2010 Census Urban and Rual Classification and Urban Area Criteria, 2010)

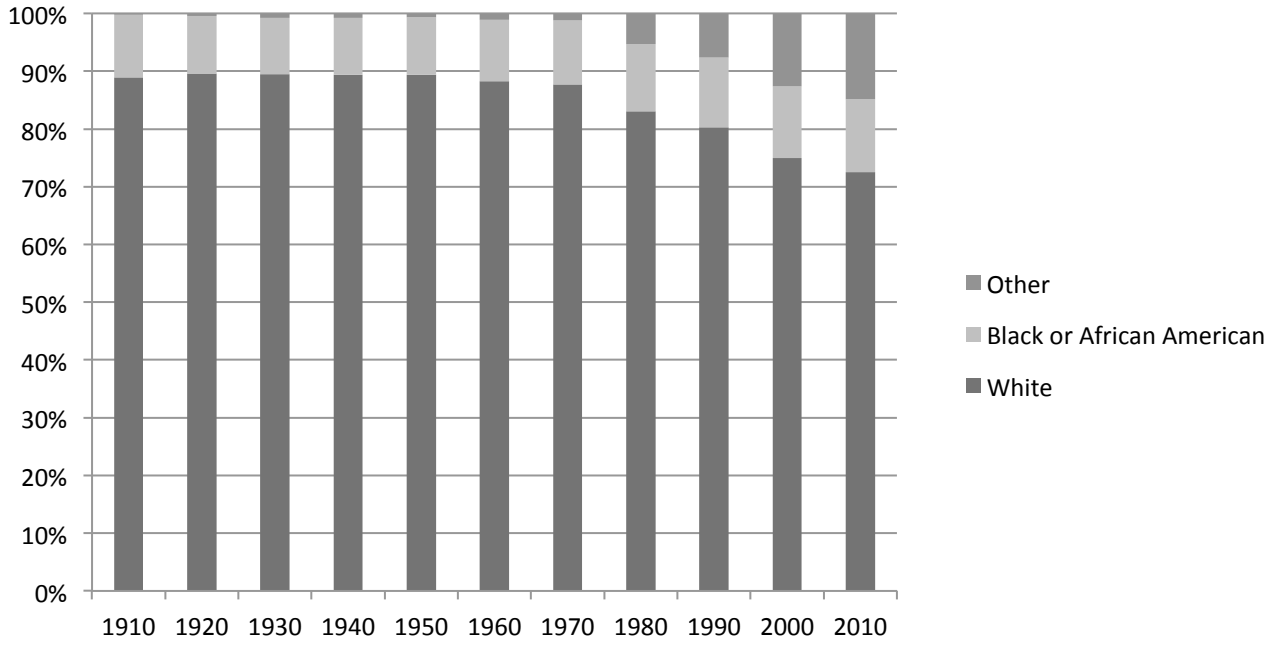

Figure 3. Percent of U.S. population classified as White, Black or African American, or Other (Humes, Jones, & Ramirez, 2011)

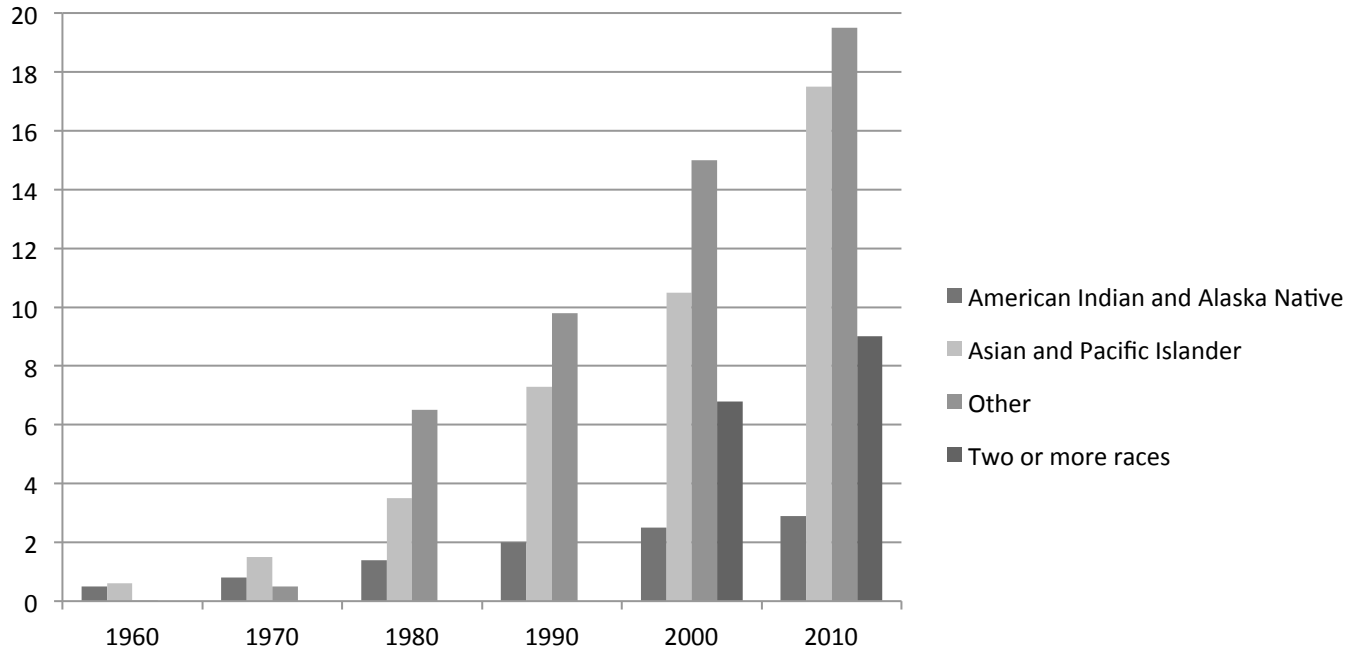

Figure 4. Population of Races Other than White of Black/African American (Humes, Jones, & Ramirez, 2011)

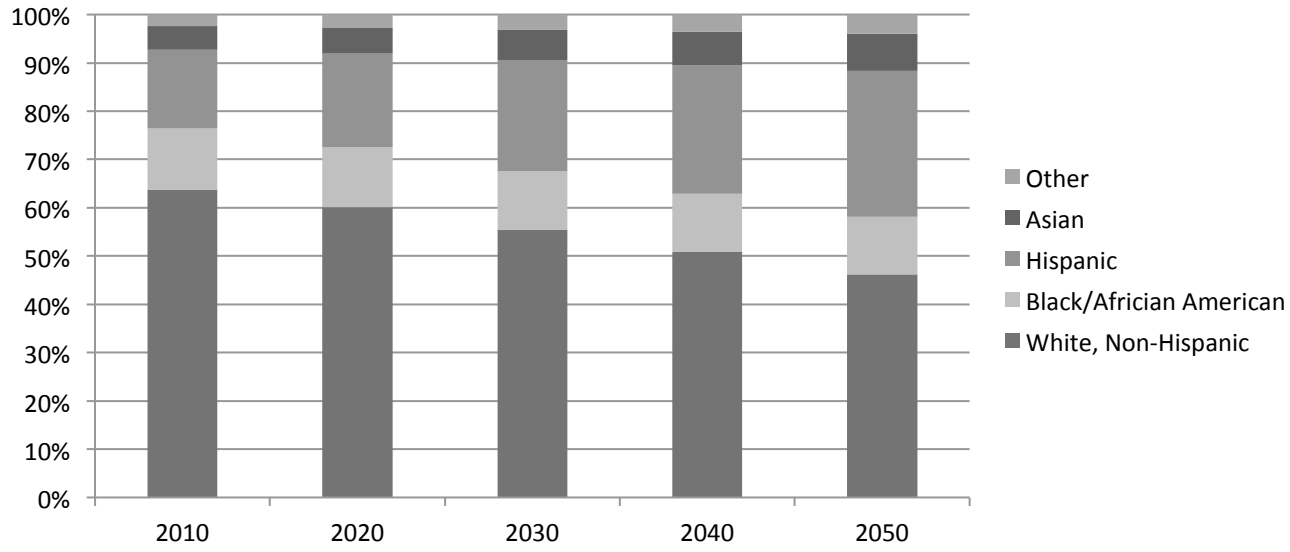

Figure 5. Projected percentage of the population of the United States by Race and Hispanic Origin from 2010 to 2050. Data for 2010 are from the 2010 census (An Older and More Diverse Nation by Midcentury, 2008; Humes, Jones, & Ramirez, 2011)

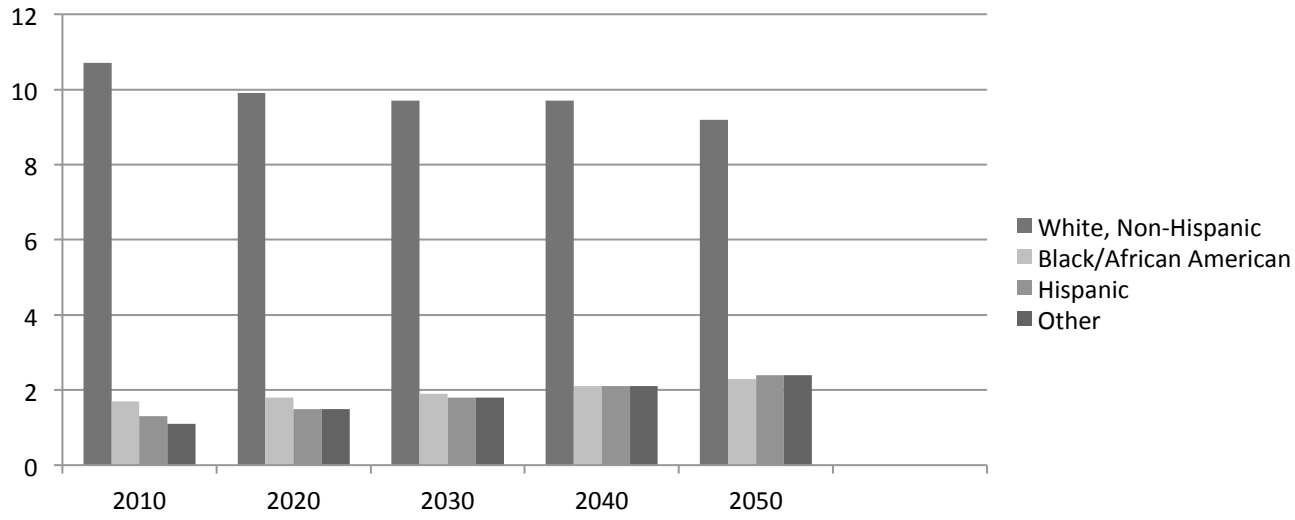

Figure 6. Projected college enrollment by race from 2010 to 2050 (Murdock, 2006)

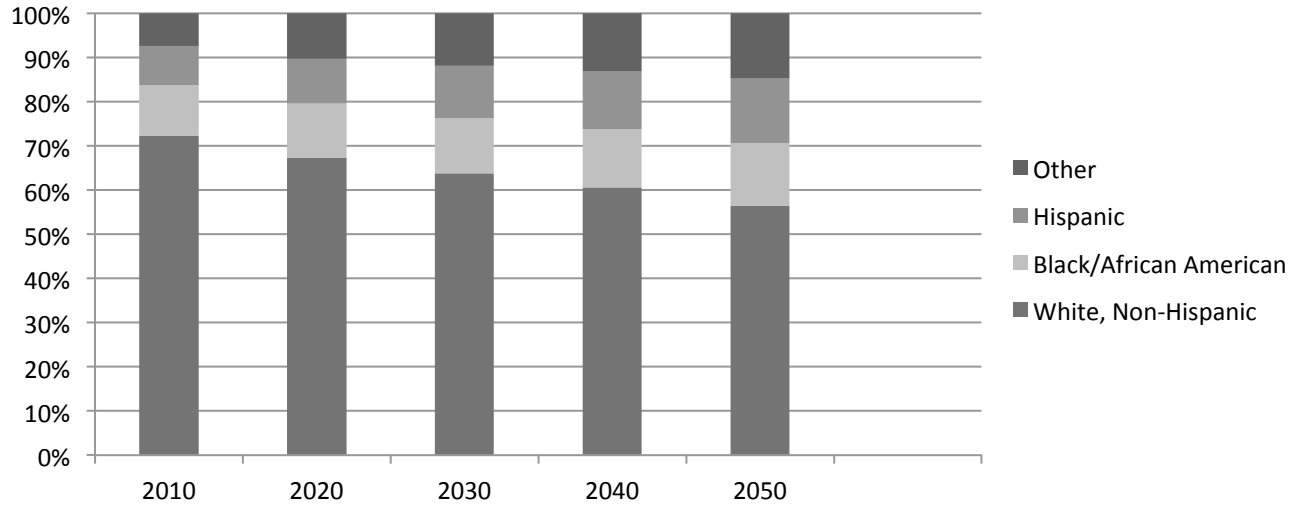

Figure 7. Projected percentage of college enrollment in the United States by Race/Ethnicity (Murdock, 2006)

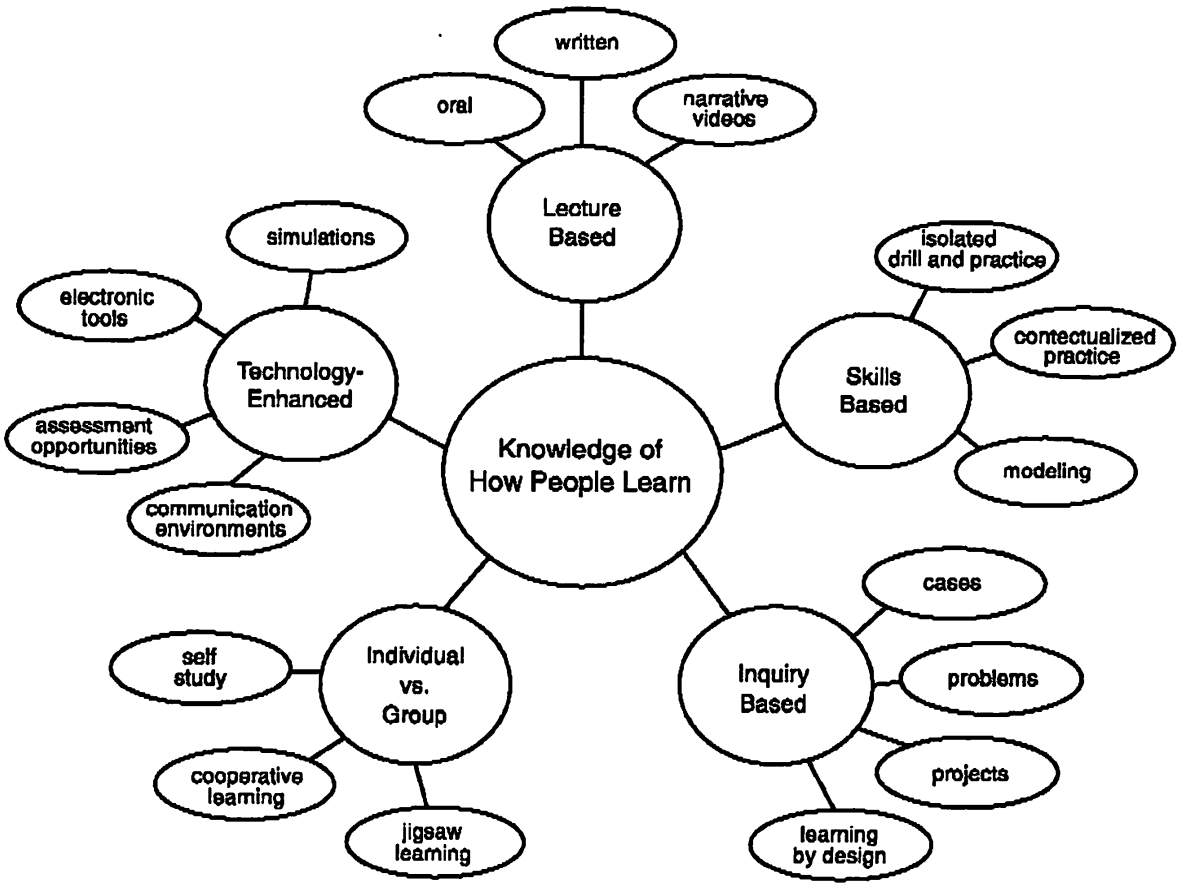

Figure 8. With knowledge of how people learn, teachers can choose more purposefully among techniques to accomplish specific goals (How People Learn: Brain, Mind, Experience, and School: Expanded Edition, 2000)

Table 1: Total population of Hispanic or Latino Origin and percent of Hispanic or Latino Origin of the total population (Humes, Jones, & Ramirez, 2011)

Year of Census	Hispanic/Latino Population (millions)	Percent of the US Population reporting as Hispanic/Latino
1980	14.6	6.4
1990	22.4	9.0
2000	35.3	12.5
2010	50.5	16.3

Notes

Beyond Conventional Teaching in Animal Science: Experiences in "Free Range" Learning

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INTRODUCTION

Instruction in animal husbandry, nutrition, breeding, physiology and health has been a cornerstone of agricultural education with land grant colleges in the US and agriculture-based universities in Canada since their inception. Over the years, some programs have grown and others have down sized, largely influenced by relevance to local commodity groups, primary researcher programs, affiliations with veterinary colleges and university and government budgets. At the University of Alberta, recent drivers for change in student enrolment patterns have included the introduction of a B.Sc. in Animal Health degree and the opening of the University of Calgary Veterinary College in 2008. While student enrollment in Agriculture has declined at the University of Alberta (Figure 1), this decline in recent years has been matched by increased enrolment in the new Animal Health program (Figure 2). In response to these and other drivers, administrators and instructors have brought about changes in the learning environment. This paper is a report of efforts made and initiatives implemented by the authors in an ongoing evolution of the development and assessment of experiences in "Free Range Learning" at the University of Alberta over the past two decades.

Enrolment Issues: The reasons for decline in student interest in some classical animal science programming are not known. It is likely that a cumulative negative career image may exist. Loose (2012) listed the "top five useless degrees" in the United States on a web site. This site listed agriculture (#1), animal science (#4.) and horticulture (#5) based on negative growth in positions for graduates. Some negativity may be associated with press coverage of zoo-enotic disease issues (BSE, H1N1 influenza), animal rights demonstrations, vegetarian lifestyle growth and raised awareness of issues with sustainability and climate change. Other programs in environmental sciences may have competitively attracted students with interest in applied life sciences based on student interest in these issues in secondary school programming. Economic down turns in some animal agriculture sectors have negatively impacted farming communities and this lack of prosperity may have discouraged young people from continuing in family operations, or discourage them from entering animal production as a career. Furthermore, with fewer people living on farms, consideration of agriculture careers may be less likely as urban primary and secondary education can present a negative misrepresentative view of agriculture. There is very likely a feeling that if you have not come from a farm, you will probably not end up on one.

Responding to Enrolment Issues: The time has come for concerted efforts to build human capital in youth in declining areas such as agriculture. Non-traditional strategies should be considered to reverse the above issues. Young people who may not have a historical connection with agriculture need exposure that will help them to build their own relationships based on positive experiences, creative inquiry, hands-on learning and perhaps, fun. In animal science in particular, this should be easier than in some other commodities, due to the appeal of animals which can turn into a durable human-animal bond. This can start with family pets, but grow to quality animal contact through agriculture summer camps, farm-themed day or week-long experiences, to interest in careers. The appeal of veterinary medicine as a career is likely because it is a recognizable career dealing with animals, unlike a career in animal nutrition, breeding or on-farm food safety. Animal science as a discipline has relevance to many people

who eat, and the food-consuming public can be engaged in a dialogue of the science behind the food they eat with high quality programming ("learning when you least expect it"). Furthermore, if students studying basic sciences can be exposed to agricultural applications of these disciplines they may alter their academic and career journeys. Once students become engaged in animal agriculture through volunteering at animal research/production sites, doors for further dialogue may be opened. Community interest can also fuel animal agriculture program growth with increased press coverage and with contributions from community members from people who yearn for a return to rural roots, perhaps a generation or two removed. Our efforts at the University of Alberta have been focused on convergence of the arts with animal science, and the use of social media to stimulate student interest amongst non-traditional learners.

Embracing the Change Process: Recognizing that change is necessary is the first step in an extreme course make-over. Declining enrolment can be a powerful signal that a tune up or overhaul is necessary. In some cases instructor boredom can trigger change and a "eureka" moment can be part of it. Some changes can result from institutional influences including new campus initiatives such as integrating teaching and research, problem based learning, and community service learning. Fresh ideas can come from interaction with peers, perhaps initiated at conferences or workshops. Additional resource allocation to novel teaching initiatives by university administration or agricultural commodity groups has played a role at the University of Alberta in transforming learning. Finally, effort to enhance student engagement in a class, a program or a university has been a driver for change as surveys such as the National Survey on Student Engagement (NSSE) and university rankings become tools for students in program selection.

Personal experience through our learning evolution has confirmed that moving away from a traditional class and laboratory format can be risky. A risk assessment exercise is advised to identify what might go awry and what the short and long term responses will be. Throughout changes we have made, honesty with the learners in communicating that although they are the first students to experience new programming, that they are supported through the change process is essential. Students embrace change when assurances of support are present. When change is presented as a positive adventure instead of a responsive reaction to poor performance evaluations, students show buy-in. Other potential risks include loss of ability to cover aspects of curriculum content, uncertainty in developing appropriate evaluation rubrics, an increased budget for course delivery and an increased human resource requirement (teaching assistants, learning coaches,). Risk assessment should include planning for increased success of programs and the implications in resource allocation of an expanded program.

Integrating Teaching and Research: Research-intensive universities are sometimes labeled as that and this can be construed to mean that they are not teaching-intensive. With teaching-intensive colleges being part of the academic landscape, efforts have been made to more appropriately position teaching in research-intensive institutions by integrating excellence in research with excellence in teaching. In 1998, the Boyer Commission Report, "Reinventing Undergraduate Education: A Blueprint for America's Research Universities" **(**Boyer Commission, 1998) addressed strategies for engaging students in research-intensive institutions. This report listed 10 principles for engaging students (Table 1). This framework has been used by the authors in many aspects of learner experiences.

In 2004, the University of Alberta established a campus-wide task force to develop a framework for moving towards the integration of teaching and research campus-wide (Working Group on Teaching and Research, 2004). From this initiative came four institutional points of emphasis in creating a successful undergraduate learning environment. These points included helping

students experience and conduct research, learning about research, developing research skills and setting the foundation for an inquiry-based life. Several Faculties have initiated undergraduate research opportunities. In 2010, undergraduate research was included in University of Alberta Academic planning priorities and in 2011 the Undergraduate Research Initiative (URI) opened to assist students in embracing opportunities for research. The Student's Union of this university held an undergraduate research symposium with 130 posters representing original student work in the arts and sciences. Clearly, there have been advancements in inquiry-based learning in the last decade.

OUR LEARNING EVOLUTION

Part 1. Engaging Senior Students in Undergraduate Research Projects (1987-2003)

For 18 years, the primary author had lead responsibility for a senior undergraduate poultry production class (Robinson, 1997). Over this time period, this class evolved from a standard laboratory /lecture class into a learning experience with lectures, but the laboratory component was replaced by an original group research project. Enrolment grew from 6 to over 20 students and with this growth additional professors assumed roles as project mentors. In addition to the curricular objectives, several additional objectives were incorporated. It was intended that this learning experience would instill respect for past research and the knowledge that has resulted from it and to provide students with the opportunity to create new knowledge and publications that may arise. With a philosophy of "learning to do by doing" students had the opportunity to develop skills at working in small groups and to use new technology that they may encounter in industry upon degree completion. It was hoped that students would learn about a subject in considerable depth such that they would become the experts. It was intended to boost student confidence through communication with peers, professors and real world industry people and with publication of data in a refereed journal.

Prior to the start of the term, the instructor and project mentor planned potential projects, prepared a brief outline with timelines and obtained necessary funding and ethics approvals. On the first week of the term, students selected a project from a list (Table 2) and groups were formed. Throughout the 13-week term, student engaged in project work, a literature review, data analyses and interpretation and a manuscript was prepared following guidelines for publication in the journal, Poultry Science. The instructor, mentors and teaching assistants served as reviewers and provided feedback and a "free read" prior to paper submission for grading. Proceedings were published informally in a booklet. Students were also required to prepare a 2-page agricultural press article emphasizing the impact of the project. A concluding research symposium attracted poultry industry leaders, academic staff and fellow students. About 40% of these student papers were subsequently published in refereed journals, although, sometimes after considerable editing.

The feedback from the course evaluations resulted in alterations in the class in subsequent terms. Diligence was needed to ensure that an appropriate balance was achieved between mentors providing enough, but not too much assistance. Project scope was monitored as some students wished to expand the project without awareness of time required as they found the experience positive and rewarding. Student comments reflected appreciation for the opportunity to conduct research including the opportunity to get to know professors, graduate students and staff which served as a valued connection to what they were learning in this class, and in other classes. Some projects opened doors for students in terms of employment. Some students graduated having published one or two papers in refereed journals. Several students were awarded prizes or certificates of merit in competitions at research conferences. A significant number of students

subsequently enrolled in further independent study research courses, and/or entered graduate programs in similar or related areas of poultry science due to research exposure. Teaching staff were positive about the project work, and in some cases, faculty benefitted from increased publication rates. Graduate students who served as mentors gained experience in student supervision and manuscript editing. Funding to support projects was variable, but generally was sourced through ongoing researcher basic grants. An unintended consequence was sustained collaborations between faculty members based on an initial co-supervision of undergrad students. Industry partners appreciated student interaction and relevant information which arose.

This learning experience is no longer part of this class, as the group projects have been moved to the capstone class as described later in this report. Some students carry out independent research projects with a professor in a similar, but less formalized process.

Part 2. Evolution in an Introductory Animal Science "Cornerstone" Class

A fundamental question in first-year curriculum planning has been: "What should come first, the big picture overview or the discipline-based details? In our experience, students need to become engaged in the issues in animal agriculture and then through formal course work and open ended problem solving, learn what they need to advance themselves. As we establish students to become life-long learners, they must become familiar with seeking knowledge and assessing the quality of it. The current undergraduate generation has grown up with web-based knowledge acquisition and they are less dependent on classical text books than previous generations have been. Nonetheless, they must be encouraged to stay up to date with new published knowledge and build connections with researchers and practitioners.

Our experience with inquiry-based learning fit well with senior students as described above. However, it was not sure how successfully we could apply these same principles in an introductory class. Many introductory courses have very large enrolment and hence, little opportunity for building community. These course are often very content-intensive and are comprised of students with very diverse backgrounds, with many students having little or no background in the subject. Given that these students do not have a knowledge base yet, how could they possibly carry out research? We ventured out with the thesis that, it was not the question or the answer that was important, but it was the processes developed in answering the question, and the sense of engagement that mattered most. We have also come to learn that the size and scope of the question can be small initially, but students can gain experience.

Another objective of a cornerstone course was to "warm-up" the first year experience. Many first year students only enroll in basic science classes, with little or no connection to their home faculty (and possibly their primary interest). With taking a relatively small enrolment class in first year, it was anticipated that students would get to know other people through group work, project presentations and other small group settings. It was also intended that they would become conversant with professors and industry players to help reaffirm career aspirations (or not). While this was not an entirely academic objective, student engagement has been found to be enhanced when students meet other people, establish friends, and feel a sense of community in their learning environment. As well, providing students with applications of basic science principles can help sustain interest in science through a somewhat formidable transition from the high-school to post secondary learning environment.

The following is a description of four projects that have been incorporated at one time or another into Animal Science 200 since 2004.

A. Name that Tool - Familiarization with Equipment Used in Animal Agriculture:

Having students become engaged at the immediate start of the term assists in building community, particularly when students have a diverse background. The "Name that Tool" project was initiated within the first week of the term and was intended to involve principles of inquiry, communications and an opportunity for the student to become the expert (Robinson et al., 2007a). Students were asked to select an item (for list of some items, see Table 3) which was gift-wrapped to limit them selecting something that they may have had familiarity with. Students worked individually to determine the identity and primary use of the tools as well as becoming familiar with consequences of not using it and alternatives to use. Students were encouraged to talk to anyone including fellow classmates in carrying out the project. The deliverables included a single PowerPoint slide outlining the above, as well as a short 2 minute presentation to the class. Students were encouraged to be creative in their project delivery.

Based on 14 cohorts of experience, students have been seen to embrace this project with enthusiasm and few students are able to identify their tool initially. At the presentation of results session, classmates freely offer comments about experiences with the tool which initiates discussion and considerable community building. Creative students have engaged in humor as seen in infomercials, dramatizations of application, and video clips. The instructors have found that this project sets the tone of what is expected for subsequent class projects. This project could be altered to include feed ingredient samples, animal breeds, histological anatomical photos etc.

B. Value-added Animal Food Technology: How Much is that Doggie in the Window

To have students become familiar with the processes in "farm to fork" food technology and the diversity of current novel food products, students randomly selected a card which contained a photo of a brand-name value-added food product (Table 4) during the first week of the term. Students worked individually to familiarize themselves with the origin of the primary animal agriculture component of the food product and the steps in processing that resulted in the packaged product.

Students were allocated 1 week to complete the project followed by a 90 second presentation to their laboratory group. The choice of presentation format for this project was decided upon by the student, with the requirement that it was an oral multimedia presentation (PowerPoint, Prezi, song, poem, skit, or video). Students were assessed on content, presentation and creativity. Each student was required to submit a one paragraph summary (maximum of 150 words), along with an estimation of the farmer's financial share (value added by farmer) in the value of the food product as follows:

$$\textbf{\textit{Farmer's Share}} = \frac{\textit{portion of main Ag ingredient in product X price farmer receives for product) X Yield}}{\textit{retail price of product}}$$

Price farmer receives for product = revenue – cost of production
Yield = % of usable product (e.g. meat) from what the producer sells (e.g. carcass)

This project resulted in highly creative presentations however, clarity in the description of the expected calculations of value added economics was found to be essential. A degree of student frustration with difficulty in determining actual food item content due to confidentiality concerns on the part of food manufactures should be anticipated and explained in the context of patent issues. While precision in calculations was not always attained, the objectives of the project

were met or exceeded as students embraced the project with enthusiasm and creativity. An appreciation for novel food products and the pricing of them was apparent.

C. Building Vocabulary in Animal Agriculture: You are what you "Ate"

Animal science 200 has attracted an increased number of students who are not registered in the agriculture program. Some of these students are from arts-related disciplines and these students have demonstrated a great deal of creativity and diversity that has been valued. This project was designed to encourage creativity, and to help students understand that science can be communicated in a variety of novel means. Other objectives were to help students expand their vocabulary in an animal science context and to facilitate students getting to know each other prior to establishment of group work for larger projects during the term.

During the first week of classes, individual students were assigned a word ending with 'ate' that related to animal agriculture (Table 5). Each student was instructed to construct and deliver a 2 minute oral presentation during the lab time 1 week later to creatively describe the significance of their word to animal production or products. The meaning of the word needed to be made clear in the description. The presentation could be based on a single run-on sentence that tells a story of how the word is important in animal agriculture. Creativity was encouraged (limericks, haikus, and other poetry). Students were encouraged to use a "prop" (appealing to the sense of sight, sound, smell, touch, or taste) relating to the use of the word for their presentation (a photograph, or a physical item). Also, a one-page summary of the presentation in poster format was required.

The range of project submissions varied greatly. While some students were conservative, most students fully embraced the project with poetry, music and diverse presentations. This type of project has helped students understand the level of creativity that is anticipated by the instructors in subsequent larger projects.

There's a Heifer in Your Tank (HIYT) – Science Answers to questions you didn't know you had about animal agriculture

The most significant component of inquiry in Animal Science 200 has been "There's a Heifer in Your Tank". This course component which comprised about 35-40% of the term mark has become a focal point for students, university staff and members of the community at large. It began as a means to engage students by helping them put agricultural issues in context so that they could make a connection with content (Robinson et al., 2006; 2007b). The stated objectives were: to provide opportunities to work independently, or in small groups to develop problem solving skills and to improve oral and written communication skills by seeking and communicating the science behind the food we eat. This "edu-tainment" project had an element of quirkiness that was anticipated to appeal to a wide array of people. Further details of past and current HIYT programming can be found at http://www.heiferinyourtank.ca.

The original HIYT: The original HIYT student outcomes in the Fall of 2004 were very different from current ones. The initial plan was to have teams of two students answer the science behind a quirky question that was selected from a list of about 30 prepared by the instructor. Samples of questions are presented in Table 6. Questions were designed to provide either basic or applied answers, and to cover a diversity of species, disciplines and in some cases involve interdisciplinary work.

Students were instructed to define their questions, the science underlying the issue and their answer within an oral presentation format in 3.5 minutes using no more than 8 PowerPoint slides. Both students were required to be involved in the presentation. Early planning was based on a public forum with a feel and setting of a standard research presentation with the audience becoming engaged in topics that they had not often thought about. A panel was established, in an 'American Idol' manner, featuring four prominent University and agriculture industry people. Their role was to help engage students who experienced stage fright, to ask questions to give students the opportunity to provide more detail, and to engage in dialogue with each other to add warmth to the event.

A written assignment was also required from each group (Robinson et al., 2008). A 1-page report was prepared, containing a minimum of 10 "science points" in an easy-reading magazine style. The primary point of the article was to engage the reader to inspire them to become aware of the issue, not necessarily educated about the issue. Students were asked to include up to two photos. The first papers were edited and put into a booklet format for each student in the class in a full-color format.

The "There's a Heifer in Your Tank" name of the program resulted from one of the original student questions (If your car burned methane, how far could you travel on one day on the methane from one cow?). This question came to define the quirky elements of "the science behind the questions you didn't know you had about animal agriculture". An attempt to brand the HIYT program to secure a placement in the student population as well as the university and agriculture communities was undertaken. A logo was developed (Figure 3) that has continued to represent the program 8 years later.

This first HIYT changed the course of future HIYT events, largely due to the impact of student creativity. Several groups introduced elements of humor into their presentations, and audience and student engagement exceeded expectations. A feeling of community developed that was strong and sustained throughout the term in the class room and out. University and external media featured this event in a very positive way. Students asked to come back as volunteers for the event the following term.

The continuing HIYT evolution. Over 16 cohorts, 1000 students and 150 quirky questions, this program continues to evolve. Most terms, a theme has been chosen to loosely focus the questions (Table 7). For example, the "Walk a Day in My Shoes" edition featured careers in agriculture from the focal point of the shoes people wore to work. A highly successful "Deep Routes" edition (Fall 2008) featured contributions of aboriginal people to current agricultural practice with a presentation by an aboriginal elder (Clark et al., 2009). Further details of these events can be found at http://www.heiferinyourtank.ca.

The format for HIYT student work evolved in the second production to include drama and music. Students focused on the science points, but engaged the audience in novel means. These productions were professionally video-recorded. Interaction with the panel and the hosting community has been enhanced over time. More recently, the HIYT event has become centered around the production of YouTube videos. A professional film producer has worked with the students to enhance the technical quality of the projects. A recent HIYT Chautauqua in the Fall of 2011 showcased diversity in presentations including a children's story book about hog production, an infomercial and a music video about bio-security on farm. The winter 2012 event featured the people behind animal agriculture breakthroughs in the past 150 years. Some featured people were in attendance and students undertook to become familiar with some of these people.

Some HIYT events have involved travel (100-150 km) to agricultural communities. Other events have been incorporated into Edmonton Northlands "Farm Fair", a week- long event culminating in the Canadian Finals Rodeo. Some events have taken place on the University of Alberta campus, in theatres or more recently in large tiered classrooms. Attendance at these events has varied from 350 to 650 people.

Student Alumni Involvement: An unintended benefit of the HIYT program has been the strong sense of community that has developed in the class and has been sustained in alumni events. Early HIYT productions involved about 25 student volunteers (stage setup and take down, ushers, refreshment servers, etc). Some productions involved student voluntary alumni challenge to create a HIYT production in a 24 hour period. A videographer captured the planning, rehearsal and the actual presentation as a video to engage the community in a sense of fun.

As the program has grown, past students are recruited each term for 2-4 paid "undergraduate student learning coach" positions (Koeckhoven et al., 2008). These students, assist the class with ideas, encourage creativity, assist at the productions and help to plan the events, but are not involved in any student grading. In the past 3 years, these senior students have acted as MCs for the event and the theme of the night is reinforced through their creativity. These positions are highly sought after and the standards are very high.

External Community Involvement: The role of the external communities in HIYT productions has grown as well. Depending upon the theme and location, HIYT events have featured cultural events to complement the student work. For example, events have been supported with the addition of community choirs, Ukrainian dance groups, provincial politicians, rodeo personalities and University of Alberta senior administrators. In an attempt to reinforce the feeling of community, some events have featured fund development through live and silent auctions to support scholarships, the campus food bank or other local charitable organizations that impact the community (e.g. rural school hot lunch programs). One HIYT event featured a community contest for a cookie recipe in which all but one ingredient needed to be grown within 100 km of the event site. Other events have featured participation from local school children who had worked with the HIYT to examine agricultural issues as part of their class curriculum. Consequently, most HIYT events have a feeling of community engagement that has elements of being uplifting.

A key component of rural HIYT productions has been building community outside the evening event. Some students spend the entire day in the rural community in elementary and secondary schools with presentations, music and career presentations. Attempts are made to visit senior citizen facilities to help reinforce memories on agriculture with retired people. The impact of these events may be intangible, but help to build a sense of agriculture community.

Earlier in this document (Figures 1 and 2) the declines in agriculture enrolment at the University of Alberta were identified as concerns for the future. It is interesting to note that during this time, enrolment in Animal Science 200 has not decreased overall, but may have increased (Figure 4). This fact is borne out with an increased number of non-agriculture majors taking the class. Student satisfaction, as evidenced by instructor evaluations has been high.

Part 3. Culmination of a Program of Inquiry: Senior Year Capstone Project

For the past 15 years, University of Alberta B.Sc. Agriculture students in their final year of study have undertaken a one semester-long group research project. This learning experience has

undergone revisions over the years, and originally, groups of three or four students were assembled from different majors to provide an overview of general agriculture issues (Table 8). For the past 8 years this class has been separated out into each major.

Hence, the Animal Science capstone course focuses on a group of two to four students who are asked to identify a problem to help them "integrate and build on concepts, tools, information and knowledge from their Animal Science program, and apply them to practical problems". A second objective is to have students gain experience in scientific method and acquire an appreciation for linking problem solving and research. Students are expected to obtain new knowledge through teamwork, discovery and experiential learning and through this process gain an understanding of the key areas where public perception presents challenges and opportunities for animal agriculture. Through project work and industry contact, students are intended to improve oral and written communication skills as well as becoming more familiar with professionalism and ethical conduct.

This experience starts with similar-interest students identifying a problem from a list of issues, or pursing an original interest. A faculty mentor is assigned who meets with the students frequently over the term and provides advice on project scope, professional connections and issues that arise. Mentors encourage student investigation of the historical context, economic, environmental, and social impact, market considerations, and animal care and welfare aspects related to the selected issue. The students prepare a proposal as to how they will address the problem, and what they intend to deliver at the end of the term. Students are expected to dialogue with industry professionals including professors, researchers, producers, and allied industries in working out a science-based solution. Students are requested to record their experiences, including modifications to the original plan. A public colloquium is held at the end of the term, attended by experts representing a range of disciplines. Students make recommendations on how the community would best respond in addressing the problem.

In practice, this learning experience has taken on much of the creativity that students experience in the original cornerstone course (Animal Science 200) described above. The deliverables can take the form of a documentary video, trade publication, or a specific product targeted at behavior change in the problem solving area the students address. In the past year, several projects have focused on agriculture education and the development of tools to assist the public to gain an appreciation for issues and food production. The class often seems to pull students out of passive learning and into a new territory where they assume responsibility for following through on their plans. In some cases, this can be a challenge for some students, but other students who have embraced inquiry at multiple levels during their degree embrace it.

MOVING FORWARD

Our progression from classical classroom/laboratory format has evolved through immersing students in inquiry, engaging them with the public, and building connections with producers, researchers and each other. Our graduates are able to embrace problem solving, find information in novel places, and produce written material, videos, and other forms of "edutainment" that are accessible via the web. The principles for further changes are based on pro-activity and not just sitting back and watching a decline in student numbers, or other assessment markers. We have focused on defining a culture of agricultural education that impacts students of animal science (past, present and future) where they are now (e.g. casual conversation, creative communication, social media). This plan is sometimes based on cultivating learner engagement through quirky attention-soliciting aspects of animal agriculture. The impact of combining the arts, communications, science points and elements of inquiry have led us to see animal science as a

vibrant context rich discipline. Building a network of engaged people from the agricultural community, elementary and secondary schools, other post-secondary programs, basic scientists and agriculture practitioners provide a base for student creativity, connection building and support. Finally continual reassessment, refinement and new programming will keep learners and instructors motivated and engaged.

A key challenge for the future will remain to be building human capital in animal agriculture areas. The future will evolve but our program is exploring summer internship program in building agricultural leadership through exposure to week-long learning experiences in various animal agriculture commodities. Youth programming must be seen as positive, and show students where they could fit later. Attention needs to be put on supporting youth learning about agriculture in both rural and urban areas. The future will be different from our past and recognition of this will drive change.

In retrospect, this evolution has been fuelled by the collective enthusiasm of the instructors, graduate teaching assistants, undergraduate learning coaches and the students themselves. Their participation, and that of academic and agricultural industries, funders and community members is gratefully acknowledged. It is our hope that readers may not necessarily do what we have set out to do, but be inspired to break away from tradition and engage in free range learning, regardless of the discipline.

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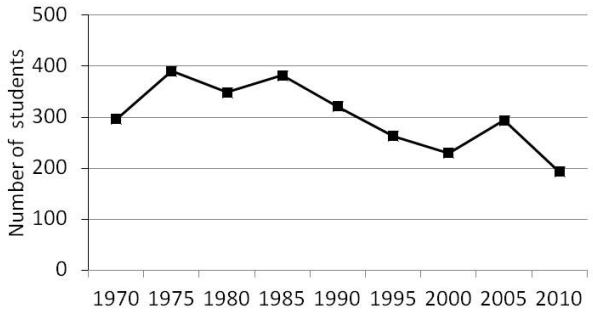

Figure 1 Enrolment in B.Sc. Agriculture Program at the University of Alberta (1970-2010)

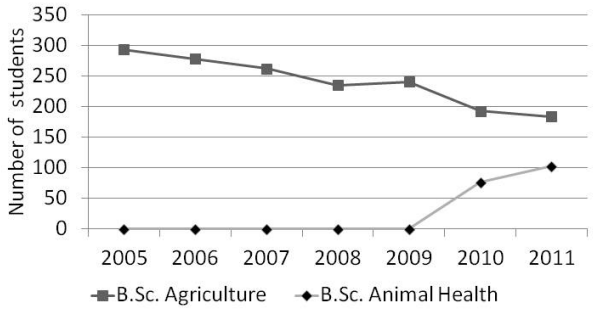

Figure 2: Enrolment in B.Sc. Agriculture and B.Sc. Animal Health Program at the University of Alberta (2005-2011)

Figure 3: There's a Heifer in Your Tank visual identity used to support programming in an Introductory Animal Science class at the University of Alberta (1994-2012)

Figure 4: Enrolment Animal Science class at the University of Alberta (1993-2012)

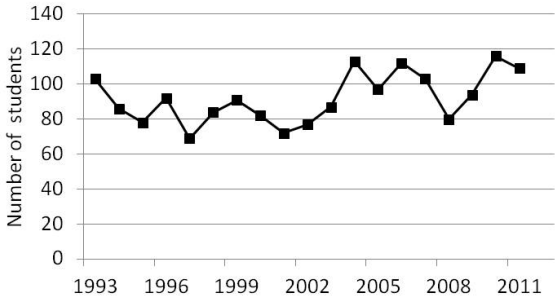

Table 1. Ten ways to change education (Boyer, 1998)

Make research-based learning the standard
Construct an inquiry-based freshman year
Build on the freshman foundation
Remove barriers to interdisciplinary education
Link communication skills and coursework
Use information technology creatively
Culminate with a capstone experience
Educate graduate students as apprentice teachers
Change faculty rewards systems
Cultivate a sense of community

Table 2. Sample projects in an undergraduate poultry science class

Determining if egg storage length prior to incubation affects turkey embryonic metabolism
The effect of exposure to cool temperatures on growth rate of chicks
Consequences of variation in nutrient allocation and daylength on point-of-lay condition of conventional and high yield broiler breeder females
Comparison of Flavomycin and Zinc Bacitracin on performance and post-mortem intestinal strength of broiler chickens
Effect of post slaughter chilling practices on the microbiological quality, safety and storage life of broiler chickens
Can eggs be an enriched source of multiple vitamins?

Table 3. Sample list of items used in Name that Tool project

Broiler breeder nest pad	Cage laying hen toys
Calf weaning device	Calf drenching kit
Cattle horn weights	Elastrator ring
Horse shoe	Light filter for fan
Milk machine filter	Poultry deboning cone
Poultry semen collection shelf	Rumen magnet
Sheep prolapsed device	Sheep shears
Swine artificial insemination rod	Thermostat wafer

Table 4. Partial selection of "How much is that doggie in the window?" value-added foods

bacon	beef burrito
beef jerky	beef liver
blood sausage	bronze organic turkey
buttermilk	cheese strings
cheese whiz	chocolate milk
cottage cheese	Egg Beaters
goat milk	ground turkey
hot dog	jujubes
omega-3 eggs	pork hocks
prairie oysters	probiotic yogurt
sour cream	Spam
strawberry yogurt	turkey bacon

Table 5. Partial selection of "You Are What You Ate" project terms

asphyxiate	bicornuate	butyrate
castrate	constipate	copulate
domesticate	emasculate	eructate
eviscerate	exsanguinate	flatulate
gastrulate	habituate	impregnate
incubate	innervate	irradiate
lactate	masticate	micturate
mutate	ovulate	palpate
photostimulate	ruminate	salivate
surrogate	thermoregulate	urinate

Table 6. Sample list of HIYT questions (for complete list see www.heiferinyourtank.ca/)

If your car burned methane, how far could you travel on the methane produced from one cow? (There's a Heifer in Your Tank)
How many gummy bears can you get from one cow?
If the manure produced from all the pigs in Alberta was put in a space the area of main campus, how deep would it be?
Why do we want twins or triplets in sheep, but not in cows or horses?
Would a Leghorn lay more eggs in a year if it were kept on six 28 hours a day week compared to seven 24 hour days?
Do double-yolked eggs arise when hens are mated twice per day?
If a hen lays eggs and defecates out the same opening, why are most eggs laid sparkling clean?
How do they get the velvet in antler velvet capsules?
Why don't sheep shrink when they get wet?
Why do we naturally age beef but not chicken?
What are hot dogs really made of?
Where do natural sausage casings come from?
Which end of the cow does methane come out?
Is it logical or ethical to humanely euthanize all male egg-type chicks?
Can cows consume hormones in nature?
Can horses fake a pregnancy?
Did the Scots design the original value added animal product?
If days to market weight is decreasing by 1/2 a day per year, does that mean chicks will hatch and go to market on the same day in 2080?
Why do we castrate most male pigs but not male chickens?
Is the red in a rare steak blood?
Can you taste the TLC in a pig?
Do hens listen when the rooster crows?
Do fast food restaurants care about animal welfare?
Why do cattle eat their placenta? Do they like the taste or is it peer pressure?
Is all offal awful?
Do fertilized double-yolked eggs hatch twin chicks?
Relatively, who metabolizes more calcium…a dairy cow or a laying hen?
Can chickens breathe through their bones?
Does a piglet really have a favourite teat?
If a hen doesn't have a placenta, doesn't a chick have a navel?
Why don't we milk pigs?
If a boar wore tightie-whities would it become infertile?
Are French Charolais bulls more romantic than other bulls?
The colour red, is it just for bulls or do chicks dig it too?
Why did Saskatchewan let all the rats into Alberta?
GNRH Says GO GONADS: The Musical
Can you heat your house with milk?
Why aren't we sexing poultry semen?

Table 7. Themes and venues for 16 editions of "There's a Heifer in Your Tank"

Year	Term	HIYT Theme	Location /Venue
2004	Fall	First Edition – general theme	U of A Campus
2005	Winter	Second Edition – general theme	U of A Campus
2005	Fall	Northlands Edition	Farm Fair International (Edmonton)
2006	Winter	Community Edition	U of A Campus
2006	Fall	Walk a Day in My Shoes Edition	Farm Fair International (Edmonton)
2007	Winter	Rural Edition	Westlock Alberta
2007	Fall	Heifers in the Headlines Edition	Farm Fair International (Edmonton)
2008	Winter	Pysanka Edition	Vermillion Alberta
2008	Fall	Deep Roots Edition (Aboriginal Agriculture)	Farm Fair International (Edmonton)
2009	Winter	Mythbusters Edition	Camrose Alberta
2009	Fall	MooTube Edition	U of A Campus
2010	Winter	When Pigs Fly Edition	Lacombe Alberta
2010	Fall	Emerald Hooves Edition	U of A Campus
2011	Winter	'Ology Edition	Fort Saskatchewan Alberta
2011	Fall	Chautauqua Edition	Farm Fair International (Edmonton)
2012	Winter	Who Put the Culture in Agriculture Edition	U of A Campus

Table 8. Sample projects in senior capstone class

Animal welfare: Progressive science, eager minds and best practices
Get real: Factual facts from actual farmers
Agriculture fluency – AG 101
Immuno-castration – A welfare-friendly alternative for pigs?
Heat detection in dairy cattle
Medium eggs – why do Alberta egg producers produce too many?
Dairy challenge – identifying practical ways to improve real dairy farms
Dung on the tongue: Johne's disease in the beef industry
Hatching innovation: Is it better in the barn?
Putting the ability into traceability
Trimming away lameness: Will painless trips to the parlour pay off?
Reducing the carbon hoof-print… One burp at a time

Notes

Creating a Culture of Scholarship of Teaching and Learning in Animal Sciences Can We Go Where No One Has Gone Before?

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INTRODUCTION

According to USDA data, by 2050 the world population will increase from today's 7 billion to 9-11 billion. In order to prevent global starvation, we need to increase food production 50-70% with less land, less water and less resources and we do not have the technology to do so at this time. The only way for the world to have a safe and secure food supply is if the best and brightest men and women are brought into agriculture to create that technology to increase food production. We in animal sciences need to train our students for jobs that do not yet exist and not train them as clones of ourselves. We need to train them to think outside the box in ways that have never happened before**.** If the future holds a safe and secure global source of animal protein, there are social and ethical issues that we as animal scientists will need to overcome before that happens. There are those that say we in higher education work in silos or ivory towers, and for the most that is often true. Perhaps it is time to self evaluate on what we need to become to train the students of today for tomorrow. It is said that history repeats itself, but does it really? How do we assess that what we are teaching is effective? How can we use that assessment to improve the scholarship of teaching and learning? Using the passage of one woman – myself – through the animal science education system, perhaps we can use this as a place to decipher just how far we have come and use it to direct the focus on where we are going?

WHERE WE CAME FROM

I grew up on a diversified livestock and crop farm in Iowa, a child of the 50's, as so many of us did back then. As a small child and oldest of eight, I grew up helping to care for all of the animals. I learned to count by feeding 100 ears of corn to the sows morning and night. My first anatomy lessons were butchering chickens, hogs, cattle and the deer that my father hunted. I was taught love, respect and patience for animals as I worked in the farrowing and milking barns. I learned that the animals had to be fed before I could eat; and, no matter where I wanted to go the animals had to be fed and the cows milked first. Much of what I learned in those growing years still cannot be learned from a book, but only from doing. I learned critical thinking by shutting gates or I would spend time chasing animals. Most of my classmates in elementary through high school had similar backgrounds, so it was easy to accept all of this for the norm.

In 1969 my family moved to a new farm and, thus, a new school. I was very excited when I found that I could register for animal science classes and happily did so. Much was my surprise when I was called to the principal's office and informed that I could not take the animal science classes as a young woman. I was firmly guided to home economics and cooking, but I demurred and took chemistry and biology. Because the high school Catholic nuns believed in my abilities, I applied to Iowa State University (ISU) after graduation.

I walked into Kildee Hall at Iowa State University (ISU) as an Animal Science student in the Fall of 1973, a shy and naive pig farmer's daughter. As a first generation student, little did I dream of ever going to a university. I was one of few women in the classes, though I was unaware of the "discrepancy" until it was pointed out to me. I had grown up in a rural area and traveled with my father to the sale barn, the feed store and other agri-related enterprises. It did not seem strange to be the only woman with the men of our community and, thus, not at college.

I left Iowa State in 1976 without my degree and in 1977 started working for the Soil Conservation Society (SCS – now called the Natural Resource Conservation Service) first as a state soil technician and then federal. For the first few years I was the only woman in the state of Iowa working as a technician for the SCS. Often as I worked with my partner, the producers assumed that I was his daughter and this perception compromised my effectiveness. When I worked with one of the state aides, producers thought I was his girlfriend. I worked with the SCS until the fall of 1981 when I returned to ISU to finish my animal science degree. In 1981 there were more women in the class and even a woman instructor in the new area of equine sciences.

Upon returning to ISU in 1981, one of the new changes was the addition of personal computers. With the addition of this exciting machine there was a cultural shift as we in the animal science community entered the computer age. My teachers had to change their curriculums to accommodate this new information. *Change*. Graduating in 1983 I began working on my Master of Science in Animal Nutrition at ISU and served as an academic advisor for the Farm Operations program. I began my teaching career in the winter program for Farm Operations. It was easy to teach as the majority of the students were from the land and understood what food production – crop and livestock – was all about.

In 1986 I traveled to the University of Nebraska-Lincoln (UNL) to start a doctorate program in ruminant nutrition. Again, I was the only woman for the first two years though there were women in the other disciplines. I was on a teaching fellowship and was surprised to find that many of my students were not familiar with the agricultural principles that I grew up with. My teaching had to change to allow for them and to be effective in what I taught.

In 1990 I moved to Colorado State University (CSU) in a teaching position. Again, I was surprised as an even greater percentage of my students knew very little to nothing about production agriculture; therefore, my teaching had to change to accommodate their lack of information. There was one woman professor who retired shortly after I arrived that told me that she had to make her way in the department; I could make mine. She did little to help a young woman Assistant Professor in a male-dominated department. Three months after I arrived, another woman joined our staff and I had a colleague, Temple Grandin. Another woman came and left, but always it seemed to be Temple and I that stayed. She was laughed at and struggled to make her way in a world that had yet to accept her as a professional and very capable. *Change.*

In the early 1990's I presented a paper at the Western Section of Animal Sciences having to do with companion animals and their importance to agriculture. A professor from one of the more western states was in the audience. He raised his hand after my presentation and asked, "Little girl, do you mean to tell me that you think the dog is part of agriculture?" I answered him with conviction, "Yes sir I do…." and before I could offer an explanation, he spit tobacco juice in a waste can and walked out. Change can be painful.

Coming of Age

Change, new principles, and new beliefs are hard to accept and the struggle to accommodate those changes can be painful. Computers changed the world in the early 1980's and will continue to do so as we move into cloud servers and distance education. Women coming into the male-dominated animal sciences field in the 1970-90's was threatening to some, and yet today in the Department of Animal Sciences at CSU, there are more women students than men. *Change*. Dogs and other companion animals being accepted as agriculture and a part of animal sciences was a threat to some in the early-mid 1990's and now increasing numbers of animal science programs throughout the US and the world include companion animals in their curriculum. In the

early 2000's the Executive Board of American Society of Animal Sciences was requested to consider including exotic animals under their auspices. Today there is a giraffe on the webpage logo. *Change*. What changes will there be tomorrow as fewer and fewer students come from the land? It is thought that by 2050, more than 70% of the global population will come from urban environments. Animal science teachers must continue to change and adapt, as they have in the past, to teach the students of today, "digital natives" who never knew life without the internet or cell phones – much less smart phones.

We have ever changing demographics in our animal science community (Buchanan 2008) with more interest in diverse animal populations including food, companion and exotic animals. The animal science students of today need to be taught beyond simple fundamentals of textbook learning. They need to be taught the application of animal science principles as fewer come into the classroom with working knowledge of the animal world. And students in our classrooms want to know application! What is of great value is that students may not know they are interested in food animals. I have personally had more than a score of interns helping with my personal sheep flock. Many of these interns are equine majors from urban backgrounds and they find the love of the horse is transmitted to sheep and other livestock species. They did not know about the other animals! The value of well managed internships and independent studies cannot be underestimated in aiding students to apply basic principles of animal husbandry.

If animal science students are to take part in creating the technology for tomorrow's animal protein production, they need a working knowledge of science. Schillo in 1996 stressed that we cannot "spoon feed" our students scientific facts, but they need to integrate, design and make decisions within the scientific systems – they need to think critically! What this will require is a *CHANGE* in teaching as the faculty member must move on beyond didactic lecture and Power Points. They must engage students in decisively creating science.

And as our students are creating the science within the animal model, they need to be ethically and morally trained (Schillo 1996). They need to be cognizant that animals have emotions (Morris et al., 2011) that can be measured via neurological science. They will need to know how to care for that animal without causing pain, how to increase the care and welfare for the animal in their charge. It seemed just yesterday that Animal Care and Use was implemented. *Change*. This is and will be a quantum leap for many of our faculty and producers coming from a system where animals were numbers. And yet, who is the producer that cannot tell the personalities of many of his/her animals? Though this change may be difficult for the teacher, the students have already accepted that, never knowing the system of animal numbers for names. The only animals they may know are the dog, cat, or horse of their family or watching Animal Planet on television.

Fostering scholarship and a new teaching and learning culture in the animal sciences classrooms is continually evolving with changes (Buchanan 2008). As illustrated in the history above and as by Taylor and Kauffman (1983), the animal science community has been continually changing. And yet, I have no doubt that all of us are aware of the silo divisions in our departments and colleges with limited interaction with other programs in the eternal quest for grant dollars. Students of tomorrow cannot be trapped within this system, but learn to create technology by incorporating knowledge and processes from all disciplines in a global fashion. They need to think and analyze in a systematic approach, in a transdisciplinarity fashion. According to Wikipedia (2012) transdisciplinarity studies "indicate a research strategy that crosses many disciplinary boundaries to create a holistic approach. It applies to research efforts focused on problems that cross the boundaries of two or more disciplines."

WHAT DO STUDENTS OF TODAY DESIRE

The students coming into the university setting are much different than what I "remember" over the past few years. I have not read and documented this from the literature and this statement comes from me and my professional colleague observations. Students of today are more urban and even fewer have food animal experience. For the most they want to become veterinarians and we have attributed this to they do not know of any other animal career. Perhaps that is a challenge for us? What can we do to educate incoming students to the potentials available within the animal education system? I can say they want to make a difference in the world. They want to make money. They want to have environmental friendly and sustainable food production systems.

One of my students provided this quote that summarized most of what all of the others had indicated when asked, "As a whole generation, I believe that it is our goal to become successful in terms of money, gratification and independence. I think that there are so many new fresh perspectives that are out there in many different areas and they are just waiting to be unleashed. There may need to be a little provoking to get us to think in a different way and we do better based on the 'incentives' that are presented. Despite that, I believe that most of the students today want to be successful and have a goal to work towards, in order to better their future and those around them (Milstein 2012)."

ROADMAP TO THE FUTURE

We as animal scientists have already been given a roadmap; we have the directions to guide us where we need to be in the years to come. The American Society of Animal Science (ASAS 2012) mission states that ASAS "fosters the discovery, sharing and application of scientific knowledge concerning the responsible use of animals to enhance human life and well-being." The beliefs of that society are as follows:

- Animals are essential to human life and well-being.
- Care and use of animals should occur in a socially, ethically, and environmentally responsible manner.
- The highest standard of professional ethics must be applied.
- Care and use of animals should be based on scientific knowledge.
- Generation and application of new knowledge must be based on scientific inquiry.
- Scientific knowledge should be communicated in an open and dynamic manner.
- Science-based knowledge should be disseminated through teaching and outreach.
- Professional development of scientists, educators, and producers is essential to the expansion and communication of science concerning animals.
- ASAS must continually develop and change to meet the needs of its members.
- The ASAS membership must be global and diverse.

Now we know where we as animal scientists have come from and we know where we need to go; so, how can we within our animal science programs move beyond the norm? How can we think outside of the box to train the students of today to meet tomorrow's challenges (National Research Council 2009)? Perhaps one way would be to include those individuals - stakeholders - that are on the cutting edge of change within and around our animal world to enhance student awareness?

STAKEHOLDER CONNECTIONS

Future animal scientists need to keep current and be aware of current issues, legislation, policy, and industry logistics within the animal community and industry areas. The most effective means to facilitate current awareness is to bring in outside stakeholders that are working on the front

line of change. Many animal science departments now have external advisory boards of which can be brought not only into the boardroom, but the classroom. Often these advisories are alumni and other industry connections. The selection of these members is critical, as if you chose those individuals with similar beliefs and strategies, or there will be no growth and no change. Choose those individuals who are entrepreneurial and think outside the box.

Find entrepreneurial individuals that will speak to a class within the area of their expertise and about their experiences. The impact of bringing in a George Seidel to talk about sexing cattle semen or a Temple Grandin to talk about livestock handling is immeasurable to students. By introducing students to men and women in the industry, they not only learn from them; but, they find out that these successful people are "just" people too. People that had to start out - like our students will shortly - and have successfully built a business, patented a new idea, traveled across Mongolia, and more!! Bring in regulatory agencies; rural sociologists; directors for zoos and aquariums, humane societies, big cat sanctuaries, legislatures, animal welfare groups, Nobel Prize winners and/or faculty from other universities and more. Our students need to be exposed to information and ideas that are contradictory to what they think so that they become enabled to find the facts in an issue, critically think about the issue, and to make decisions on what they have found. They can never get too much practice in critically solving an issue. A department can also create strategic partnerships with food banks, local industries, and even universities outside the country; ultimately letting the community, surrounding area, and world become the student's classroom.

ASSESSMENT OF TEACHING

All universities are subject to accrediting at the program and university levels to justify that we are meeting state and national standards in how and what we teach and, most importantly, that students are learning. Measuring student learning sounds logical so that teachers would know that they are accomplishing their goals. And yet, when the word "assessment" comes up, faculty and administrators start to groan. Perhaps it is because of how we have been assessing learning in the last few years, as assessment has been a measure of accountability (Wehlburg 2011) rather than learning. So how can we as animal scientists truly assess if students are learning what we are teaching them? Can we develop those assessment tools to uniquely measure our teaching effectiveness?

To effectively assess what we teach, we first need to determine what animal science students need to learn – learning objectives (Wehlburg 2011). Once objectives are determined, we need to decide how to measure "that" learning. The issue with measuring learning objectives is that some can be incredibly difficult to measure. For example, how do we measure that a student is culturally aware? Because of this difficulty in measuring, what measuring is done is often not effective. As a result, instructors turn to the "bean counter" approach and measure those things that are easy to account for, like how many students graduated and how many students acquired positions in the field. In response, Wehlburg (2011) suggested that when there is difficulty in effectively measuring an objective to ask the question, "What would a student be able to do who had this skill or knowledge?"

Assessing learning is different than grading and, when assessing, you are evaluating the whole student population to see if they as a group are learning. Grading tends to evaluate the progress of a single student. Once a learning objective is effectively measured, it is possible to determine if students are learning that information and can be used to make teaching and learning decisions for future classes and curriculum (Wehlburg 2011).

It is in the process of successfully measuring student learning that faculty can initiate the creation of the scholarship of teaching and learning. The information of successfully assessing teaching and learning now needs to be shared via publication, presentations (Wehlburg 2011), and/or accrediting agencies. This is how assessment works. Effectively documenting teaching, student learning, and assessing this process publicizes that animal scientists are adequately teaching and training those future leaders of tomorrow.

DO WE DARE

The continual change in teaching practices to increase teaching effectiveness sounds like a complicated process; but, by competently assessing what we teach, to evaluate if students indeed learn will springboard the animal science disciple forward. Either way, change will come. It is just if we have the courage to control the process or let the process control us. For example, the Pearson Foundation (2012) reports that ownership of tablets and other electronic devises has risen dramatically. Tablet ownership has increased from 7% among college students in 2011 to 25% already in 2012. Surveyed college students feel that within five years, tablets will replace textbooks. Students believe that the tablet will transform learning. How will animal science faculty respond to this CHANGE in technology?

How will animal science faculty respond to the social mental change for animal status? How we respond may decide if a safe and secure global animal protein source will be a reality. Ignore the change and I personally fear there will not be. So what can "we" as animal scientists do? It all starts with the future leaders. We are training them. We can access how they learn and make decisions to improve that learning process. We can guide them to use facts and avoid emotional traps so commonly used by some animal welfare groups today. The challenge is there and we can move the process forward by enhancing the learning process for today's students – access that learning – and improve it again and again.

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Recognizing and Promoting Effective Teaching and Learning Practice Among Future and Current Instructors: Laying New Ground for the 21st Century.

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Nothing, absolutely nothing has happened in education until is has happened to a student (Carroll, 1994).

ABSTRACT

Our objective was to review the primary literature in the animal sciences and the broader landscape of educational research in institutions of higher education, on three inter-related themes: a) traits and attributes of effective instructors, b) evaluation and reward systems as applicable to fostering effective teaching practices among future faculty, pre-tenured and tenured faculty and c) the transition from a historically teaching-centered pedagogy to a future pedagogy centered on students gaining knowledge and skills relevant to the 21st century. Although there is no blueprint for being an effective teacher and teachers jeopardize their growth if they try to imitate others, there are traits that help characterize good teachers such as communication skills, recognition of the complexity of the subject matter for novices, setting clear expectations, focusing on learning, and using a variety of instructional strategies. What makes teaching in higher education unique is the depth of disciplinary knowledge combined with the opportunity for instructors to integrate teaching and research. Content knowledge (CK) is necessary but insufficient for effective teaching as excellent instructors rely heavily on reflective practices and pedagogical knowledge (PK) to improve their teaching ability and develop pedagogical content knowledge (PCK) or the knowledge of how to teach so students learn a discipline (excellence). Formal documentation and dissemination of PCK in the form of quantitative or qualitative evidence in a community of practitioners is a defining trait of a teaching scholar.

In spite of decades of research in relative effectiveness of various teaching methods so students learn, changes in classroom have been hampered by a number of factors, including, but not limited to: a) a lack of preparation of newly-hired faculty, b) a faculty reward system criteria (e.g., for promotion and tenure) that continue to emphasize what the teacher does (instructional-centered criteria) rather than what student learned (learning-centered criteria) and c) a lack of proper financial compensation for teaching relative to research. Teaching awards have their own limitations as a form of reward, but grants and sabbatical leaves may be the seeds of change. Fortunately, there is increasing recognition of the unique aspects of teaching in baccalaureate, masters or doctoral institutions and there are numerous initiatives aimed at supporting the growth of authentic educators whose values and goals are in alignment with those of their department and institution.

Our forefathers in the animal science had broad views of their teaching mission. Advances in science and technology, changes in student population and the expansion of career opportunities available to the graduates of four-year programs have impacted substantially the pedagogical landscape of animal sciences throughout the 20th century. However, numerous challenges remain ahead because curriculum ought to be designed for jobs that may not exist yet and for future professionals that may work in trans-disciplinary and multi-cultural working environments. Shifting the paradigm from teaching to learning is a high order task, which will be informed by future research in cognitive and educational sciences. For the time being, however, motivated animal science educators can design their courses so students learn "by design" and they can place their teaching in the context of a national agenda to foster high impact practices that have been shown to foster a set of essential learning goals in undergraduate education.

INTRODUCTION

Animal sciences, poultry science, dairy science and studies of companion animals, therein referred to as "animal sciences" are taught across the nation in distinct types of institutions of higher education (Baccalaureate, Masters and Doctoral, CFAT, 2012). The recognition and promotion of effective teaching in these institutions varies considerably because the institutional context influences dramatically the teaching and learning process. There is something unique about teaching and learning in each of these institutions; however, our effort will focus primarily on Doctorate-granting universities. Although these institutions include approximately 10 percent of all degree-granting institutions in the United States, they have a disproportional impact on undergraduate education nationwide because the vast majority of current and future faculty in our colleges and universities has gained a degree from a Doctorate-granting university. Our objective was to review the primary literature in the animal sciences and in the broader landscape of educational research in institutions of higher education in general, on three inter-related themes: a) traits and attributes of effective instructors, b) faculty evaluation and reward systems; as applicable to fostering effective teaching practices among future faculty, pre-tenured and tenured faculty and c) the transition from a historically teaching-centered pedagogy to a future pedagogy centered on student gaining knowledge and skills relevant to the 21st century.

TRAITS AND ATTRIBUTES OF EFFECTIVE INSTRUCTORS

Effective Teachers

The Concept: The Merriam-Webster dictionary defines the adjective effective as: (a) "producing a decided, decisive, or desired effect" or (b) "impressive, striking." However, in her discussion of standards of faculty performance, Kreber (2002) referred to effectiveness as "beyond the minimal standards." Identifying effective or exemplary teaching is extremely difficult, if not a knotty problem, in part because of the highly contextualized environment in which it is taking place. Reputable authors and scholars have argued that teaching is still as much an art as it is a science. For example in his book "The Courage to Teach", Parker Palmer (2000) explained that when asked what makes for poor teaching, students are generally quick in their response, however they have more difficulty in describing what makes for good teaching. Similarly, Lowman (1996) argued that "exemplary teaching shares much with any idealized concept, such as truth or beauty: it is difficult to achieve consensus on a general definition, but most people think they know a specific example whey they see it."

K-12 Research: In contrast, teacher education research programs led by educational scientists have revealed dimensions of teacher effectiveness. Interestingly, the K-12 literature indicated that except for the first few years (Hanushek et al., 2005), years of teaching experience were not correlated with student achievement gains (Munoz and Chang, 2007, Stronge et al., 2011). However, Stronge et al. (2011) identified: 1) instructional delivery, 2) student assessment, 3) classroom learning environment, and 4) personal qualities of the teacher as areas proven to impact students' achievement. Highlights of the literature on what effective K12 teachers do in their classroom are as follows:

- Effective teachers are adept at using a variety of instructional strategies (referred to as "instructional differentiation" such as direct instruction, individualized instruction, discovery methods, hands-on learning, etc.).
- Effective teachers focus students on learning. They provide students with the basic skills and critical thinking skills to be successful.
- Effective teachers emphasize clarity. Instructional clarity entails both explaining content clearly to students and providing them with clear directions.

- Effective teachers recognize the complexity of the subject matter for novices and design instruction in which students are expected both to memorize facts and to exercise critical thinking rather than do one or the other.
- Effective teachers have the ability to communicate high expectation to students.
- Effective teachers use appropriate technology to help students engaged in higher order thinking skills.
- Effective teachers rely on formative (informal and formal) assessments to monitor student learning and offer meaningful feedback to students. They check for student understanding throughout the lesson and adjust instruction based on the feedback.
- Effective teachers manage classroom environment by establishing and maintaining a positive and productive learning environment based on respect, fairness and trust.
- Effective teachers have personal qualities that convey that they care about students. Teachers who exhibit these qualities have higher levels of students achievements than teachers perceived by students as uncaring.

The same authors designed an experiment to measure the impact that fifth grade teachers from three public school districts had on student learning (in math and reading). They attempted to relate instructional practices and behaviors of effective teachers with students' score on standardize tests. Their data confirmed that teachers have a measurable and substantial impact on student learning. Students taught reading by bottom-quartile teachers could expect to score, on average, 33 percentile lower than those taught reading by the top quartile teachers (21st vs. 54th percentile, respectively.) Similarly, students taught math by bottom-quartile teachers could expect to score, on average, 32 percentile lower than those taught math by the top quartile teachers (38st vs. 70th percentile, respectively.) In both cases, the difference could be attributed to the quality of teaching occurring in the classroom during one academic year (Stronge et al., 2011). In this regard, the K-12 literature is informative as such data, for better or worse, likely does not exit in the higher education literature.

Research in Higher Education: Educational scientists have shown clearly that students engagement in educationally purposeful activities in the single best predictor of their learning and personal development. It could be argued that instructors who design a course syllabus with the seven Principles for Good Practice in Undergraduate Education (Chickering and Gamson, 1987) in mind would be on the path to effectiveness. These principles are: 1) student-faculty contact, 2) cooperation among students, 3) active learning, 4) prompt feedback, 5) time on task, 6) high expectations, and 7) respect for diverse talents and ways of learning. Notwithstanding these principles, attributes of effective instructors in higher education have been much less documented than in the K-12 system. However in an intricate study designed to differentiate what university science instructors *say* about their teaching compared with what they *do* in practice, Kane et al (2004) interviewed, video-taped classroom and conducted subsequent recall interviews with 17 instructors recognized for the excellence of their teaching. These authors concluded that reflective practices was the core of excellent instructors who exhibited the following five attitudes and behaviors in their instructional practices:

- Subject knowledge: Excellent instructors are experts in their field and they continue to acquire subject knowledge expertise long after the doctorate is completed.
- Pedagogical Skills: Excellent instructors communicate clearly with students in terms of class organization and expectation, but more importantly their strength lies in the clarity of presenting and engaging students in the course content. They can explain clearly course content because they can relate what they know to what students know. In other words, these instructors' effectiveness is not hampered by the "expert blind spot" (Nathan and Petrosino, 2003), a term used by educational scientists to describe the inability of an expert to remember how, as a novice, they talk about, understood and learned the subject

they are so passionate about. Thus, excellent instructors have the ability to know how to teach the content of their discipline such that it resonates with those who have a nascent interest in that discipline (see Paulsen, 2001 and Pedagogical Content Knowledge below).

- Interpersonal relations: Excellent instructors have an ability to create an atmosphere of one-to-one interpersonal relationship even if they are standing in front of 200 unknown and nameless students. Excellent instructors are mentors of young people who are concerned with caring for the students' need.
- Research/teaching nexus: Excellent instructors, typically have no difficulties describing the effect their research had on their teaching and vice versa. They bring their research expertise into their teaching. For example, they use of primary research material and they help students think critically about the whole process of science.
- Personality: Excellent instructors are enthusiastic ("infectious") and passionate for the subject they are teaching. They have a sense of humor and they are approachable and humane.

These authors observed that excellent instructors engaged in regular, purposeful reflections on their teaching practices. Reflection, they argue, is the process through which instructors integrate the various dimensions described above. The authors identified four types of reflections exhibited by excellent instructors. *Technical* reflection focused on the practical aspects of classroom teaching: teaching methods, process of improvement, modifying content from year to year, etc. Second, *descriptive* reflection reveals their ability to analyze their own performance and justify the reasons for their action. Third, *dialogic* reflection describes the ability to "hear their own voice" exploring alternative ways to solve problems. The fourth (and least frequently observed) type of reflection was *critical* reflection, which was described as thinking about the effects upon others of one's actions as a source of motivation to improve one's own performance. Other authors have also highlighted how reflection is a powerful mechanism for improvement of teaching (McAlpine and Weston, 2000; Trigwell et al., 2000; Leibowitz et al., 2012).

Excellence in Teaching Versus Scholarship of Teaching and Learning (SoTL)

The Concept: In 1990, the Carnegie foundation for the advancement of teaching releases an influential report calling to expand the definition of scholarship beyond the traditional realm of scientific discoveries in one's discipline (Boyer, 1990). Universities that engaged in reforms in response to the report moved in challenging paths and uncharted territories. After years of confusion and difficulty in defining the concept of scholarship in teaching and learning (SoTL) in relation to excellence in teaching (Diamond 2002), Kreber (2002) proposed four criteria to distinguish each concept from one another: (1) the source of information individuals draw upon as "building blocks" of their knowledge of how to teach (i.e., pedagogical knowledge), (2) the focus of their reflection, (3) the extent and nature of their communication of insights, and (4) the conceptions of teaching and learning (Table 1). In short, excellence in teaching relies essentially on one's own trials and errors to identify what works and does not work, it uses a "holistic" approach to hone in one's own teaching skills and is "local" as insights are rarely shared with a broad community of colleagues. In contrast, SoTL is characterized by systematic reliance on literature as a source of pedagogical knowledge (the knowledge of how to teach), it uses a "reductionist" approach to focus on specific issues most often related to learning (rather than teaching), and is "community based" as insights are actively disseminated to a community of practitioners through, for example, publications or invited presentations. The author provides examples to illustrate the greater commitment of a scholar compared with an excellent teacher but argued that both are important and should be recognized and rewarded in their own right. In a follow-up study, Kreber (2003) proposed the following definition of SoTL: "The scholarship of

teaching and learning is an activity that, in the context of promoting student learning, meets each of the following criteria:

- It requires high levels of discipline-related expertise.
- It breaks new ground and is innovative.
- It can be replicated and elaborated upon.
- It can be peer-reviewed.
- It has a significant impact.

The author found a significantly higher level of agreement with the aforementioned definition among a selected group of scholars ("experts" in the area of university teaching and learning; n=10) than among a larger group of scholars whose expertise lies in various academic disciplines ("regular" scholars; n=99). Since then, attempts have been made to reward multiple forms of scholarship including SoTL (O'Meara, 2005, O'Meara, 2006). Although Asmar (2004) described successful attempts to engage faculty of a research intensive university to improve their teaching practices, SoTL has not been adopted widely. Boshier (2009) summarized the reasons for low adoption as follows: First, confusion occurred because of lack of agreed upon definition and continued use of the word SoTL as a synonym for other activities; second, SoTL is difficult to operationalize both at the level of individual faculty and especially (but not exclusively) for research intensive institutions; third, the over-reliance on peer-review publications as the main criteria to measure scholarship, and fourth, SoTL fits poorly in the 21st century language and modus operandi of universities as businesses delivering education as a commodity to be sold.

Identifying Excellence in Teaching in the Animal Sciences

Historical Review. In the early part of the 20th century our forefathers in the animal sciences were deeply concerned about the animal science curriculum (Kildee, 1925), effective methods of instructions (Gay, 1938), pedagogical aspects of teaching animal husbandry courses (McCampbell 1925), and the "harmony" (or lack thereof) between teaching and research work (King, 1931). McCampbell (1925) identified five causes of poor teaching among the animal husbandry instructors of his days, four of which, one could argue, are still relevant in many cases today, almost 90 years later. For example, he asserted: (a) "*They have had little or no training in the fundamentals underlying the science of teaching*", (b) "*Very often the young instructor … has been thrust into the classroom … without any supervision or assistance*", (c) "*Too often it is assumed that the popular instructor is an effective teacher*" and (d) "*The demand made upon the time…for work outside the classroom… tend to lessen his interest, enthusiasm, and effectiveness as a teacher.*"

In the 1930's The Animal Sciences society organized a symposium titled: "Symposium on Matters to be Stressed in the Education of Men Specializing in Animal Husbandry: Effective Methods of Teaching Animal Husbandry." Unfortunately in the subsequent 40 to 50 years only a few teaching-related manuscripts were accepted for publication in the Journal of Animal Sciences. In reviewing 75 years of teaching animal sciences, Taylor and Kauffman (1983) attributed the "fine screen of reviewers" as the cause of the paucity of teaching-related publications and the reason why the teachers of his time (i.e., the 1980s) were still pondering the same pedagogical issues as those discussed by their (and our) forefathers at the beginning of the 20th century. Clearly, the publication of manuscripts in the dairy and animal literature under specific teaching standards would establish the ground for long term advances in teaching effectiveness. As the peer-review process legitimizes and validates a scholarly work, an additional venue to demonstrate scholarship would be available (for promotion and tenure or for other purposes), and ultimately all instructors in the dairy and animal sciences instructional community would stand to benefit from the ensuing publications. As a result of another teaching-

related symposium organized in 1980 by the American Society of Animal Sciences four past recipients of Distinguished Teaching Awards documented their thoughts and experiences on teaching (Kauffman et al., 1984). The authors identified 18 items related to their philosophies and 8 teaching approaches that they considered important. In the animal sciences the discussion of teaching evaluation in the context of promotion policies was discussed as early as in the 1960s (Castle, 1968).

Modern-day Excellence in Teaching in the Animal Sciences: In a recent study (Wattiaux et al., 2011), animal and dairy sciences faculty from doctoral/research universities were surveyed to clarify teaching performance expectations for the purpose of promotion and tenure of assistant professors. A survey tool including 15 evaluation criteria was available on-line and at the registration desk of the 2005 joint meeting of the American Dairy Science Association and the American Society of Animal Sciences. The dataset analyzed included 47 faculty (41 tenured and 6 tenure-track) with a substantial teaching responsibility from 27 different departments in 25 states. Results are presented in Table 2. Although evaluation of the instructor and evaluation of the course by students were two criteria perceived as currently over-emphasized, more than 50% of respondents indicated that they should be used in the evaluation process. Interestingly, in spite of the fact that all the 27 departments represented in the study were from doctoral/research institutions (as per the Carnegie's classification), the significance of over-emphasis or under-emphasis of many other criteria varied depending on the respondent's perceived institutional mission: research more important than teaching (R) or teaching at least equal to research (RT). Faculty in the R group perceived a current over-emphasis of the following criteria to define excellence in teaching:

- authoring peer-reviewed publications, book chapters or undergraduate textbooks,
- obtaining funding for teaching-related projects,
- establishing new courses for curriculum improvement.

In contrast, faculty in the RT group reported two criteria as currently under-emphasized:

- providing students with course packages,
- documentation of personal assessment of one's own teaching by preparing a portfolio.

When asked about recognition within their department, 68% of respondents indicated that efforts in teaching improvement were properly rewarded. The concerns about the suitability of student ratings of the instructor or the course found in this study agreed with the work of others (Paulsen, 2002). Reasons may include misconceptions (Cohen, 1990) and doubt that the tool used is reliable and valid. Nevertheless, when properly constructed and designed, validated students ratings of course evaluation can have utility (Kulik, 2001). Results also suggested that animal and dairy science faculty placed a higher value on criteria recognizing excellence in teaching based on intra-departmental dynamics (i.e., interactions with "close-up" peers and students) rather than recognition within a broader community of scholars as would be evidenced by authorship or success in generating funding for teaching.

FACULTY EVALUATION AND REWARD SYSTEMS

More than 50 years ago, Washburn (1958), an animal scientist, looked back at the first 50 years of the land-grant university system and argued that "*Teaching in general, however, has been treated as an orphan—being always considered secondary to research and other departmental activities.*" Reward systems are important because they send messages and provide concrete examples of faculty achievements that epitomize institutional values (i.e., its culture). In studying faculty evaluation systems across the United States, Hardré and Cox (2009) found that they were not created equal — many differences exist, even among institutions of the same type. Some systems enable a high degree of interpretation and control by the responsible

administrative unit or committee, whereas others standardize procedures and support a high degree of repeatability over time. Assessment and evaluation may inform an employee's sense of belonging through a negotiation process between an individual's intrinsic values and goals with those of the institution and its leadership. The more an individual either initially shares, or eventually espouse the institutional values the greater the congruency and likelihood of successful outcomes.

Since the release of the landmark report of the Carnegie foundation for the advancement of teaching on the role of the professoriate (Boyer, 1990), the supremacy of scholarship of discovery (disciplinary research) in faculty evaluation has been reassessed as many universities have engaged in institutional reforms to be more inclusive of other forms of scholarship including the scholarship of teaching (O'Meara, 2006). Some researchers asserted that faculty members experience tension about allocating their time and energy between (disciplinary) research and teaching (Marsh and Hattie, 2002) whereas another body of literature asserts that faculty should be encouraged to consider research and teaching as complementary (Colbeck, 2002) whether the institution is research intensive or not (Kassiola, 2007). In their study, Hadré and Cox (2004) found that within research universities, there were colleges and departments where teaching was overtly recognized and valued. However, such intent was not uniform within and across campuses. The tension that exists between teaching and research, typically at research-intensive universities is a phenomenon that has been well documented in the United States (Serow, 2000, Hadré and Cox, 2004), in Australia (Chalmers, 2011) and in the United Kingdom (Parker, 2008; Young, 2006).

Although there are many intrinsic and extrinsic sources of motivation, promotion of assistant professor to the rank of associate professor with tenure is among the most powerful reasons for which assistant professors seek to build a track record of scholarly activities. Salary and teaching awards are two other modes of rewards that will be reviewed below.

Teaching-Related Incentives and Rewards

Promotion and Tenure: Even though undergraduate teaching and learning are at the heart of academic institutions, they have rarely played a substantial role in the evaluation of faculty throughout the 20th century. In a recent study O'Meara (2005) surveyed chief academic officers of 4-year institutions to determine whether there had been changes in policies to encourage multiple forms of scholarship in faculty roles and rewards (in response to Boyer's report). The data indicated that for the purpose of faculty evaluation, teaching counted more today than 10 years ago to a significantly greater extent in institutions that had engaged in policy reforms than in so-called traditional institutions that had not engaged in such reforms (Table 3). Similarly, the impact of scholarship on students had a greater influence on promotion and tenure in institutions that had engaged in policy reforms compared with traditional institutions. Furthermore, the author found that the increase in the value of teaching in the last 10 years was significantly greater in Doctoral/Research (D/R) institutions than in Masters or Baccalaureate universities. For promotion and tenure, D/R universities gave a greater influence to "whether" and "where" scholarly products were published and whether the scholarship resulted in external funding compared with the Masters or Baccalaureate institutions. In contrast, the Masters and Baccalaureate institutions gave a greater influence of the impact of scholarship on students in the process of promotion and tenure compared with the D/R institutions (Table 3). Not surprisingly results indicated also that percentage of tenure and promotion cases emphasizing teaching scholarship in the last 5 years was higher in institutions that had engaged in reforms compared with traditional institutions and it was lower in D/R compared with Masters or Baccalaureate institutions.

Salary: An important incentive wielded by universities to motivate faculty is pay. In a study designed to determine the relative value of teaching and research in faculty pay in 1993

and 1999, Fairweather (2005) analyzed 6,482 and 10,626 full time, tenure track faculty in 4-yr colleges and universities responding to the National Survey of Postsecondary Faculty (NSOPF). As indicated in Table 4, results indicated that teaching remains a negative factor in pay. In 1998, every additional hour spent in the classroom cost faculty from $ 474 to 758 depending on the type of institution. In contrast, one additional career publication provided faculty with a revenue ranging from $ 68 to 211 depending on the institution. Spending more time on classroom teaching remains negatively related to pay, with the trend worsening most rapidly in institutions whose central mission focuses on teaching (comprehensive and Liberal Arts institutions) than in research or doctoral institutions. Traditional scholarly productivity remains the strongest behavioral predictor of faculty pay, although some trends suggest that its importance in pay may be stabilizing or even slightly decreasing. The author concluded that institutional leaders should not expect the academic marketplace to increase the value of teaching on its own. Furthermore if as suggested by Hearn (1999), salary-related policies could not be adjusted to counteract the trends in the marketplace (which may be particularly true in research-oriented institutions), then leaders may have to rely on alternative forms of reward for teaching (e.g., promotion and tenure).

Teaching Awards: As opposed to "continuing" rewards in the form of job security (tenure) or salary-base adjustment (promotion), the benefits of teaching awards are sometimes perceived as less permanent and more transient. Nevertheless a pre-tenure teaching award may contribute significantly to promotion and tenure. Teaching awards are rare at the departmental level, but most colleges, universities, and professional societies have introduced them to recognize and reward excellent instructors and to signal that teaching was valued among a community of colleagues. In addition, the USDA has an annual call for new teacher, regional and national awards to honor excellence in teaching in the food and agricultural sciences (USDA, 2012). The six evaluation criteria used include:

- Teaching quality assessment;
- Statement of teaching philosophy and teaching methodology;
- Service to the teaching profession and professional growth in teaching;
- Service to students;
- Professional growth and scholarly activity; and
- Endorsement by administrator, alumnus and colleagues.

It is only with recent updates of nomination guidelines that award applications also require evidence of a high degree of pedagogical engagement (e.g., criteria #3&5, above) through reflective practices, or scholarship of teaching or learning. The evaluation criteria used for the UW-Madison College of Agricultural and Life Sciences teaching awards are presented in Appendix 1. Recently, Chalmers (2011) reviewed the teaching award literature from Britain and Australia primarily and cited a number of authors who have challenged the notion that teaching awards fulfill their intended purpose of recognizing and rewarding excellent teaching. She concluded that: "*While teaching awards have been established with the best of intentions, there is little evidence that these have contributed to substantial change in the culture and substance of rewarding and recognizing the status of teaching relative to research*." Indeed, Frame et al., (2006) have reported active resistance among colleagues or administrators who perceive teaching awards as low level rewards and questioned the wisdom of spending time and efforts an a teaching award nomination compared with pursuing another publication or grant application. Even worse, Gosling (2004) found the unexpected effect of teaching awards to isolate winners from their department and disciplinary colleagues. Similar concerns have been raised in the United States' literature (NRC 2009) suggesting for example that teaching awards relying too much on student evaluations are little more than popularity contests. Another commonly reported criticism is the lack of clarity in criteria and rigor in the selection and decision-making process, hence confusion about what is being recognized and rewarded. As described earlier, excellence

in teaching is not synonymous with scholarship of teaching (Kreber, 2002). The identification of recipients for teaching excellence awards is indeed a complex and sensitive process. Meredith (1988) found a need for rater (members of selection committee) reliability and training even after providing them with a seven-point scale in an attempt to standardize the scoring system.

FOSTERING EFFECTIVE TEACHING: FUTURE FACULTY, TENURE-TRACK AND POST TENURE.

Professional trajectory and the extent to which academics may elect to seek to enhance their teaching practice may turn out to be a knotty problem that may change over the course of one's career. The desire to change may involve a myriad of factors such as biography (early life experiences, prior training, etc.), dispositions (values, attitudes and emotions) and contextual influences (institution and departmental values, performance review process, teaching resources, etc.). In a study designed to understand how academics enhance their teaching in a research university, Leibowitz et al. (2012) found that intrinsic rather than extrinsic sources of motivation was propelling individuals towards action.

Future Faculty - Laying the Foundation

In spite of teaching responsibilities in hiring contracts of many newly hired faculty, preparing graduate students interested in undergraduate teaching has not been a priority throughout the 20th century. However, there is an increasing awareness for the need to prepare and train future faculty for their roles as undergraduate instructors starting in graduate school (Pruitt-Logan and Gaff, 2004). Disciplinary content knowledge acquired through years of graduate school has little to do with the knowledge, skills and aptitudes necessary for effective undergraduate teaching (Bass, 1998, Paulsen, 2002). In 2003 the Delta program on the UW-Madison campus has promoted the development of a future faculty in the natural and social sciences, engineering, and mathematics (STEM) that is committed to implementing and advancing effective teaching practices for diverse student audiences as part of their professional careers (Delta, 2012). The program is founded on three pillars: *Teaching-as-Research* (an introduction to reflective practices as a necessary condition for effective, excellence, and scholarship of teaching), *Learning Community* (a self-sustaining and on-going sense of membership and leadership roles of graduate students and faculty involved in the program), and *Learning-through-diversity* (unfolding the complexities of classroom environments created by the multitudes of interactions at play among the instructor, the students, and the subject matter to be taught and learned). The program's ideas are interrelated: the Teaching-as-Research is explored via learning community opportunities that are based on learning-through-diversity. Every facet of Delta is designed around models familiar to STEM researchers. Courses are discussion or project-based and students are encouraged to approach their learning about teaching using their burgeoning research skills. For example, they are challenged to engage in teaching issues by defining a problem, explore the literature for prior knowledge, hypothesize, design and implement a solution. Students pursuing the capstone Delta certificate may actually collect and analyze data to measure student learning outcomes or other relevant variables. Since its inception over 1600 UW-Madison graduate students and post-docs, as well as 650 faculty and staff members have participated in Delta and almost forty percent of the future faculty have participated in high-engagement programs and courses (defined as at least one semester long). Fourteen percent have participated in multiple courses, which is required of those choosing to complete the capstone Delta certificate. Although the program was initiated as a multi-institutional effort including six universities (Howard University, Michigan State University, Texas A&M, University of Colorado-Boulder, University of Wisconsin-Madison and Vanderbilt University), lessons learned from the early prototype has been expanded to a network of 25

institutions under the center for the integration of research, teaching and learning (CIRTL, 2012). Possibilities for multi-institutional collaborative efforts among (future) animal scientists may exist within the CIRTL initiative.

Pre-tenure – Valuing a New Teaching Culture

For those (most of us) who have not benefited of the type of future faculty initiatives described above, the learning curve may have been steep as we entered our first few semesters of teaching college students. Encouraging effective practices among recently hired tenure-track assistant professors has come sometimes with a free book on teaching tips (e.g., McKeachie et al, 1994) from the office of academic affairs. Although well intended, these books are to a certain degree the equivalent of the power point lecture presentations of an expert to a class of inexperienced novices. They may be perceived as partially irrelevant because they are void of the important contextual details or the over-arching goals of a specific curriculum. Although beginning instructors should be aware of "do's and don'ts" as early as possible in their teaching career, effective teaching is more than techniques and recipes. In contrast, steps to promote a serious engagement of early-career faculty in teaching are those that support their efforts to create synergy between research and teaching. The National Science Foundation (NSF) faculty Early Career Development (CAREER, 2012) program and the Howard Hughes Medical Institute professor program (HHMI, 2012) support faculty who excel in and integrate both teaching and research.

Besides understanding the undergraduate classroom from the instructor's perspective, a tenure-track faculty must pay attention to the institutional values, and the conventions within their colleges, and departments. Some authors have indicated that sometimes a tension may exist between institutional and departmental levels. Thus, to be fully understood, standards of values and incentives must be examined at each administrative level. Appendix 2 provides an example of guidelines used by the Biological Division of the University of Wisconsin-Madison, to recognize and value excellence in teaching for tenure and promotion. Another University of Wisconsin-Madison initiative will serve to illustrate institutional attempts to encourage early growth and development of teaching expertise among newly hired faculty. Though still in an early stage of implementation, the Madison Program for Teaching and Learning Excellence (MTLE) builds on the integration of newly hired faculty with a support network of teaching and learning organization across campus. The MTLE fellows will participate in a three-stage program over a full academic year. It will start with a semester long discussion-based learning series to engage TLE Fellows to form a community surrounding discussions of how people learn (Bransford et al., 2000), teaching belief and culture, and a philosophy of teaching that stems from inquiry into their own and their students' learning (Weimer 2002). In the second part, MTLE fellows will attend a 5-day summer institute (workshops) focused on backward design principles for course development (Wiggings and McTighte, 2005), promoting higher-level critical thinking skills on Bloom's taxonomy (Bloom, 1956; Anderson and Krathwohl, 2001), implementation of collaborative group-based learning (Johnson et al., 1998), peer-instruction (Crouch and Mazur, 2001), and high impact practices that have been recognized as benefiting students from diverse backgrounds (Kuh, 2008). In the third stage, MTLE fellows will receive financial support to hire a teaching assistant to help implement and assess their teaching strategy. They will be encouraged to attend each other's classroom as a form of peer-review of teaching and as an attempt to strengthen the formation of a faculty learning community (Petrone, 2004). In addition, home departments of MTLE fellows will receive compensation for their support of undergraduate teaching. Expected outcomes of this program include 1) improved undergraduate education, 2) improved understanding and implementation of learner-centered course design, assessment and instructional methods, 3) increased and sustained use of high impact educational

practices, and 4) improved satisfaction and success for MTLE fellows as they develop their professional identity as researcher, instructor and mentor.

Post-Tenure – Fostering Continued Commitment to Undergraduate Education

Post-tenure review has become the academic norm. Post-tenure review has been designed essentially as an accountability mechanism to protect academic freedom in the face of mounting scrutiny of public universities in particular (Neal, 2008). Current literature suggests that the academy has responded to public calls for post-tenure accountability largely with form, rather than substance.

Differences in faculty priorities have been identified across the career trajectory (Walker, 2002). A number of studies found that faculty productivity shifted after tenure (Bently and Blackburn, 1991). The nature, timing and causes of those shifts are however difficult to understand. Anecdotal evidence has suggested that after a period of sustained successes in research some faculty yearn to improve the quality of their teaching. In his study, Serow (2002) tried to address the question of how post-tenured faculty who see themselves, and are seen by others, as committed undergraduate teachers understand their roles (within their own careers and within the reward system of their university). The study was conducted as semi-structured interviewed of 29 senior faculty (27 associate or full professors) deeply involved in undergraduate education and recognized for teaching excellence at a research university (25 of the 29 had been recipients of university-wide teaching awards). Results indicated that 11 of the 29 had an on-going research program funded in the range of fifty thousand to 2 million dollars, but 18 faculty no longer had a research program. The author identified two clusters characterizing the "coping" mechanism of these committed undergraduate instructors. The first cluster included faculty that used tenure as a shield. They used their reputation as excellent educators and a decent relation with departmental heads and colleagues to focus on matters of importance to them. The second cluster included faculty that had an "oppositional" flavor. They actively sought to elevate the status of teaching within the university as a whole.

Post-tenure sabbatical leave is a special respite that could be promoted as a time of reflection on teaching practices. Sabbatical are paid leaves for personal and professional development. The release from routine work duties provides an opportunity for renewal, mitigation of job stress and renewed vigor (Zahorski, 1994). Though not work free, a sabbatical may provide opportunities for renewal. Properly designed a sabbatical leave may assist faculty gain a variety of skills, which may enable them to be more effective teachers, scholars, and professionals (Simerly, 1990). Sabbatical leave promotes well being (Davison et al., 2010) and there is a general belief that performance improves after sabbatical (increased sense of self-efficacy). Although no research is available, sabbatical abroad funded through a Fulbright program or consulting compensation could have substantial impact on the internationalization of the curriculum in the agricultural and life sciences (Van Eyck et al., 2012).

20TH CENTURY VERSUS 21ST CENTURY PEDAGOGY

Teaching Paradigm of the 20th Century

Early animal sciences teachers had a broad view of their teaching mission. They saw higher education in agriculture as "*a liberal education insofar as it liberalizes the mind, disciplines the conduct, refines manners, broadens aesthetic interests, and strengthens the capacity for happiness, efficiency, and social service*" (Ruth, 1935). In essence, our teaching forefathers were training young men (in those days no woman allowed!) in a set of core values deemed necessary to the success of family farming, such as independent thinking, self-reliance, and decision-making or as Wentworth (1933) put it, "*graduates who can create their own niches in the world.*" However, the changing student population and the expanding career opportunities

available to the graduates of four-year programs have substantially impacted the pedagogical landscape of both animal sciences (Buchanan, 2008) and dairy science (Kensinger and Muller, 2006) throughout the 20th century.

Although the foundational and core courses of the animal sciences curriculum are well established (Kauffman, 1992), assembling a set of courses to train students for new jobs – or jobs that yet do not exist – and to provide powerful life-changing experiences is a moving target. A curriculum should be more than the sum of its parts and should be designed to meet the needs of increasingly diverse student populations, industry needs and societal concerns. In addition to focusing on core courses, the curriculum should be under continual scrutiny to maintain flexibility, adaptability and relevancy. Kauffman et al. (1971) and colleagues highlighted the work of Bloom (1956) to argue that educational experience of animal science students should include the cognitive domain, the affective domain (interest, attitudes, and values), and the kinesthetic or psychomotor domain (manipulations requiring neuromuscular coordination). Teaching facts out of real-world context in teacher-centered classroom rarely stimulates students' interest; therefore, individual research projects, individual and group laboratory projects, student travel and field trips, and intra- and inter-collegiate competitions have been proposed as means to engage students more fully in the learning process (Kauffman et al., 1971; Kauffman, 1992). Today, this list can be expanded easily to include computer laboratories, discussions of case-studies, pre-assigned web postings or other forms of content-rich multimedia material.

In an attempt to reveal the "habits of mind" of animal scientists and how their mode of instruction models desired behavior and helps students think and act like disciplinary experts, Wattiaux (2009) explored the so-called "signature pedagogy" in the animal sciences throughout the 20th century and proposed a vision for the future. The author suggested that compared to other disciplines, agricultural sciences and in particular animal sciences programs have been designed foremost to provide students with a learning environment in which they gain the knowledge, understanding, analytical skills, and leadership skills to manage effectively complex biological, economic, and social systems (i.e., a farm or any part of it) and thus make decisions and solve problems of animal agriculture. In addition to gaining knowledge within the discipline, the ability to judge, to decide (in the face of uncertainty) and to communicate have been defining features of our pedagogy. Perhaps judging activities and the judging contests, which have been omnipresent in dairy science (Guthrie and Majeskie, 1997) and animal sciences programs (Davis et al., 1991) epitomize best our 20th century pedagogy.

Learning Paradigm of the 21th Century

As the 21st century unfolds, higher education in agricultural sciences must be transformed profoundly to respond to the ever-increasing complexity of food production systems (Meyer, 1993). Our classrooms ought to become microcosms of societal changes, and our students must be challenged to face problems in the same way as they will encounter them in the workforce. Today, curricula in Colleges of Agriculture and Life Sciences are being expanded far beyond agricultural production to include biotechnology, animal welfare, environmental pollution, international trade, hunger and poverty, social justice, and other issues. Teaching scientific facts and figures out of any real-world context has been referred to as a form of indoctrination rather than education (Schillo, 1997). The author argues that critical thinking skills can be achieved only if the uncertainty of scientific activity is acknowledged. Thus, we must train our students to ask questions rather than focus on answers (Lasley, 1979) and challenge them to learn how the scientific method, as a human endeavor, can contribute to solving complex and global issues that have impact on the daily life of people. To do so, our students must have first-hand opportunities to use their knowledge and skills to address real-world situations. To this effect, capstone courses have been introduced in the agricultural sciences curricula (Crunkilton et al., 1997) and there is

evidence of perceived benefits of such courses (Andreasen and Trede, 2000). In 2012, the curriculum committee of the College of Agriculture and life Sciences at the UW-Madison clarified the language describing the six criteria necessary to classify a course as a capstone. As such a capstone is a course in which students are required to integrate diverse bodies of knowledge to solve a problem or formulate a policy of societal importance with the intent of facilitating the transition to post-baccalaureate life. A capstone should: 1) develop problem-solving skills. 2) expose student to multidisciplinary approach, 3) develop teamwork and interpersonal skills, including the ability to communicate effectively to multiple audiences, 4) develop skills in accessing and using information resources (e.g., electronic databases, library resources, national repositories), 5) address societal, economic, ethical, scientific, and professional issues, and 6) include written, oral, and/or multimedia reports by each student to communicate and extend that experience. The capstone course is expected to be completed during the student's final 2 or 3 semesters. The intent is to have the student utilize and integrate their undergraduate learning into a culminating experience.

Although capstone courses will be essential to our future pedagogy, creating and placing such courses at the end of a four-year road map may restrict their impact. In addition to capstone courses, capstone-like experiences dispersed throughout the students' academic program may have cumulative effects and yield students much better prepared to succeed in the workforce after graduation. For example, case study or problem-based learning could be incorporated in core courses to specifically address misconceptions or concepts difficult to understand. Discussion based courses within the discipline could be promoted as a legitimate way of teaching and learning (Brookfield and Preskill, 2005), especially if combined with out-of-classroom projects (Wattiaux et al., 2006). Furthermore, properly structured out-of-classroom independent studies, internships, service learning, undergraduate research, study abroad, and other international programs could provide students with academically based professional capstone experiences. Many of these practices have also been identified as teaching and learning innovations that showed substantial benefits, especially for college students from historically underserved backgrounds (Schneider, 2008). To date, these and other high impact practices (e.g., first-year seminar, writing intensive courses) remain essentially optional, but they have been adopted by the American Association of Colleges and Universities (AAC&U, 2012) as part of the Liberal Education and America's promise (LEAP) program (not to be confused with "Liberal Arts"), which has proposed a set of robust "essential learning outcomes" to empower individuals and prepare them to deal with complexity, diversity and change (LEAP, 2012). Kuh (2008) suggested that for an educational experience to be high impact, students must:

- Invest significant time and effort:
- Interact with faculty and peers about substantive matters;
- Experience diversity;
- Respond to frequent feedback;
- Reflect and integrate on their learning; and
- Discover the relevance of learning through real-world applications.

The author suggested that it is in combination with one another that these behaviors become powerful and thus the associated practice is worth referring to as "high-impact." University administrators are promoting high impact practices as "stand-alone" experience that students should engage throughout their four-year program. However, using elements of high impact practices in core disciplinary courses could be encouraged and used as an indicator of an instructor's attempt to improve teaching effectiveness. Ultimately, however teaching evaluation should include also some measures of student learning outcomes. Direct measures of learning outcomes are still in early stages of development, but Stark-Wroblewski et al. (2007) proposed pre-post learning measures to complement other measures of teaching effectiveness.

Shifting the Paradigm from Teaching to Learning

As a way illustrate the challenge and daunting task of shifting our classrooms from an emphasis on how teachers teach to how students learn, let's consider the following revealing history of science story involving Gallileo Galilei (1564-1642). This great Italian philosopher and astronomer pointed to the heavens with his newly improved telescope and his observations suggested, to his own initial dismay, that the earth rotated around the sun. His discovery put him at odds with the church and 1800 years of a belief system that started with the Greek philosopher Aristotle (384 BC- 322 BC). It could well be that in the science of teaching and learning in higher education we are today where Astronomy was with Galileo 400 years ago. In spite of the early stage of cognitive and educational sciences, there is mounting evidence to challenge the long-held view that good college classrooms must rotate around the teacher (teacher-centered). Could college classrooms be built such that teaching revolved around learning (student-centered)? Such an endeavor would require an understanding of "how college students learn" (Bransdford et al., 2000; Ambrose et al., 2010). Essentially, there are two fundamental theories on how people learn. The behaviorist theory (Skinner, 1904-1990) builds on the principle of cause-and-effect or stimuli-response. Accordingly, teaching is viewed as a process of arranging "contingencies of reinforcement" (actions) effectively to bring about learning as a reactions. Teachers, their instructional materials and classroom activities are the stimuli, the skills that students demonstrate are the responses, and the teacher's role is to provide an environment in which positive reinforcement (reward) is made contingent upon a correct (desired) response. However, since the 1960s the constructivist approach to learning has become the prevailing theory among US educational scientists. The work of Vygostki (1896-1934), a Soviet psychologist, indicated that learners construct their knowledge, which lead to development, which is inseparable from the social context in which it takes place. Thus, teachers must first understand the learners' independent abilities (i.e., what they already know or can do on their own) in order to create a challenging learning environment to assist them to achieve higher levels of performance given assistance of instruction. Although these two theories have been researched in the context of child development, and the implications of this science have been applied to primary and secondary educational (K-12) system in the US, it is not difficult to recognize that we all act at times as behaviorists ("*tell me what to do!*") and at other times as constructivists ("*let me try, I want to do it!*").

College classrooms are extremely complex systems composed of three fundamental parts: the instructor, the students and the subject matter, in which multiple interactions have, all together, a greater influence on learning outcomes than any parts considered alone. A course is not a series of lectures and tests. A course is a means to an end. According to the "backward design" (Wiggins and McTighe, 2006) a course should be designed starting with identification of the learning goals (what should students be able to do at the end?), then determining what acceptable evidence will be collected through assessment to demonstrate students' achievement, and finally planning instruction and class activities as learning experiences. Although this three-step approach may be counterintuitive, it demands that instructors focused first on the "end-point" (goal), then determine how to assess the desired knowledge or (critical-thinking or problem-solving) skills to be gained (e.g., create the exams, homework, or lab reports) and finally decide on what tools from one's teaching toolbox to use to provide students with the best learning experience (instruction). Hence, instructors' behavior shift from imparting knowledge to enabling learning; they act less as a mode of content delivery and more as architects of a targeted learning environment.

CONCLUSIONS AND RECOMMENDATIONS

Our review of effective teaching, excellence in teaching and scholarship of teaching and learning, as indicative of the degree of commitment to the teaching profession, pointed to a set of learned behaviors. Although certain predispositions may contribute to one's teaching ability, it is essentially a trade that can be improved upon with practice and dedication. Research in the K12 system has demonstrated the sizable impact of what teachers do in their classes on students learning outcomes. This type of research is however not without controversy and for all practical purpose impossible to replicate in undergraduate programs for lack of reliable and valid standardized test constructed around unified learning goals.

Instead of an end-point, excellence in teaching may best be viewed as an on-going process of self-improvement. On the other hand, scholarship of teaching and learning is characterized by attempts to gain insights from— and disseminating insights to —a community of practitioners. In higher education, the role that teaching plays in the faculty evaluation and rewards system is only starting to become the focus of serious attention. Concerned institutions, given their culture and values, should strive to clarify the degree to which measures of faculty's teaching effectiveness should rely on personal attributes (e.g., qualification, personality), the teaching process (e.g., instructional practices), the products of teaching (e.g., student learning, educational offerings, teaching-related publications) or a composite of the above. The review presented here reinforced recommendations proposed earlier to improve the evaluation of teaching for the purpose of promotion and tenure (Wattiaux et al., 2010), namely the process should: a) provide tenure-track faculty with written guidelines at the time of hiring, b) ensure that student evaluation tools are reliable and valid, c) mentor carefully new faculty within the departmental and institutional culture and d) encourage self-reflection and documentation of attempts to address pedagogical issues in one's own teaching. In addition, attempts to include measures of students'learning (or perception thereof) will become more important in the future as a means to document teaching effectiveness more convincingly and comprehensively. Market forces may put down pressure on the salary of dedicated undergraduate educators particularly in research/doctoral institutions. However, administrators should not ignore other forms of extrinsic rewards (teaching grants, teaching assistantships, technical support, etc.) and should remain keenly aware of the intrinsic rewards that often time compel these dedicated educators to action. Administrators, especially in research/doctoral institutions, should also keep in mind that teaching awards may be double edge swords, but perhaps more important to long-term cultural shifts are programs targeted to graduate students (future faculty) and newly-hired faculty that are financially supported, adequately staffed and properly designed. Such programs may facilitate faculty-learning communities and contribute to a new generation of faculty with professional identities that integrate undergraduate teaching with disciplinary research early and effectively in their career.

College classrooms are extremely complex systems composed of three fundamental parts: the instructor, the students and the subject matter, in which multiple interactions have, all together, a greater influence on learning outcomes than any single part considered alone. Progressively the prevailing teaching-centered pedagogy of the 20th century is shifting to a learning-centered pedagogy in the 21st century. Our classes should engage students in capstone-like experiences that borrow from high impact educational practices proven to serve the needs of diverse student populations. Short of comprehensive, valid and reliable measures of learning (grading scheme aside), instructors should continually strive to improve the design of their classes such that students learn by design (i.e., desired learning outcomes, modes of assessment and instructional activities are in best possible alignment with one another).

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Table 1: Proposed criteria to distinguish excellence in teaching from scholarship of teaching and tearning (inspired from Kreber, 2002).

Criteria	Excellence	Scholarship
1 - What are the sources of information relied upon as "building blocks" of pedagogical knowledge?	- Own trial and errors. - No evidence of relying on literature or knowledge from a community of experts or peers.	- Own trial and errors. - Evidence of relying on literature or knowledge from a community of expert or peers.
2 – What is the focus of the instructor's reflection?	- Focus on the hole ("holistic"): keep what "works" and reject what does not work. - Focus on Teaching	- Focus on the parts ("reductionist"): identify parts that need improvement. - Focus on Learning.
3-Extent and mode of communication of insights on teaching and learning?	- Little, local and limited in scope (essentially none, except for a nomination packet to a teaching award committee)	- Extensive, far-reaching and broad in scope (produce, publish and disseminate information for used by others)
4- Conception of T&L: Who are the beneficiaries of the instructor's knowledge?	- One's own interest - One's own students	- One's own interest - One's own students - Community of teachers

Table 2: Views of animal scientists on current over-emphasis or under-emphasis of 15 evaluation criteria to assess excellence in teaching for the purpose of promotion and tenure (Wattiaux et al., 2010).

Evaluation Criteria (Survey Item)	RT[1]	Is[2]	Sd[3]	Dif[4]	*P value*
1: Student evaluation of the Instructor …….....	R	96	52	-44	*<0.01*
	RT	100	64	-36	*<0.01*
2: Student evaluation of the course …….....	R	96	52	-44	*<0.01*
	RT	100	64	-36	*<0.01*
3: Authoring peer-reviewed publications …….....	R	88	44	-44	*<0.01*
	RT	68	59	-9	*0.75*
4: Authoring undergraduate text book or book chapter	R	84	44	-44	*<0.01*
	RT	73	69	-4	*0.99*
5: Establishing new courses for curriculum improvement ...	R	84	48	-36	*0.02*
	RT	32	59	27	*0.15*
6: Obtaining funding for teaching-related projects	R	84	52	-32	*0.03*
	RT	68	77	9	*0.75*
7: Being on an editorial board to review manuscripts ……..	R	76	48	-28	*0.09*
	RT	46	64	18	*0.34*
8: Invited presentation on teaching at conferences	R	72	56	-16	*0.39*
	RT	45	59	14	*0.55*
9: Presenting an abstract at teaching conferences ……	R	60	56	-4	*0.99*
	RT	50	54	4	*0.99*
10: Peer-review (evaluation) of the instructor ……	R	68	64	-4	*0.99*
	RT	59	63	4	*0.99*
11: Organizing / facilitating teaching-related workshops …..	R	68	56	-12	*0.51*
	RT	36	54	18	*0.27*
12: Peer-review (evaluation) of the course ……	R	52	60	-8	*0.82*
	RT	46	64	18	*0.42*
13: Being recognized for the quality of advising ……...	R	50	68	18	*0.80*
	RT	55	77	22	*0.23*
14: Providing students with "course packages" …….	R	52	48	-4	*0.99*
	RT	23	54	31	*0.04*
15: Documenting personal assessment of one's own teaching (portfolio) ……...	R	48	44	-4	*0.99*
	RT	23	77	54	*<0.01*

[1] Survey respondents who self-reported that research was more important than teaching at their institution (R, n=25) or that teaching was at least equally important to research at their institution (RT, n=22), for
[2] Percentage of response indicating that the item is currently used;
[3] Percentage of response indicating that the item should be used;
[4] McNemar test for the "Is" minus "Should" difference.

Table 3: Changes in the relative value of research, teaching and "extension" by type of institution as reported by high level administrators of 4-yr colleges nationwide (O'Meara, 2005).

	Ref[1]	Trd[1]	D/R[2]	Mstr[2]	Bac[2]
For the purpose of faculty evaluation, do the following activities count more or less today than they did 10 years ago? (1=less, 2=about the same, 3=more)					
Publication	2.53	2.47	2.56	2.53	2.45
Teaching	2.41 [a]	2.24 [b]	2.60 [x]	2.31 [y]	2.28 [y]
Engagement/Professional Service "Extension"	2.39 [a]	2.06 [b]	2.31	2.32	2.22
What degree of influence do the following issues have on the final decision by committees to recommend or deny tenure & promotion today? (1=No, 2=Minor, 3=Major)					
Whether scholarly products are published	2.65	2.69	2.93 [x]	2.68 [y]	2.50 [z]
Where scholarly products are published	2.30 [d]	2.41 [c]	2.82 [x]	2.34 [y]	2.08 [z]
The impact of scholarship on students	2.47 [a]	2.21 [b]	2.16 [y]	2.40 [x]	2.48 [x]
That the scholarship resulted in external funding	2.10	2.06	2.58 [x]	2.11 [y]	1.82 [z]

[1]Type of institution: institutions that have engaged in formal reform (Ref, n=462) or not (traditional, Trd. n=219) defined as having made at least one change in the mission and planning documents, revising promotion & tenure materials or contract language and criteria, providing flexible workload programs, and/or offering incentive grants to encourage multiple forms of scholarship.
[2] Institution categorized by the Carnegie foundation of the advancement of teaching as Doctoral/Research (D/R), Master's (Mstr) or Baccalaureate (Bac).
[a b] Mean of Ref and Trd differ (P<0.001)
[c d] Mean of Ref and Trd differ (P<0.05)
[x y] Mean of D/R, Mstr and Bac without a common superscript differ (P<0.05).

Table 4: Marginal cost of teaching and marginal revenue of publishing (expressed in constant 1998 dollars) by type of institution and year (Fairweather, 2005).

	Research		Doctoral		Comprehensive		Liberal Arts	
	1992-3	1998-9	1992-3	1998-9	1992-3	1998-9	1992-3	1998-9
ClassHr[1]	-$728	-$758	-$580	-$614	-$208	-$540	-$138	-$474
TotPubs[2]	+$119	+$211	+$206	+$157	+$111	+$68	+$131	+$190

[1]ClassHr = One additional hour spent in the classroom at the mean.
[2]TotPubs = One additional career publication at the mean.

APPENDIX 1:

Evaluation criteria for the UW-Madison College of Agricultural and Life Sciences (CALS) Teaching Awards.

The College has two separate awards. All nominations are evaluated on the basis of the same five criteria listed below. Criteria A, B and C have the same relative contribution in the evaluation process of both awards. However, criterion D has a greater weight then criteria E for the award intended to reward excellence in the classroom whereas criteria E has a greater contribution then criteria D for the award intended for excellence outside the classroom.

A) Endorsement:
- The degree to which the nomination letter(s) and the letter(s) of reference substantiate the nominee's commitment and dedication to her/his role as an educator or an agent of change in carrying out the educational mission of the College and the University.

B) Statement of Teaching Philosophy:
- The statement should be prepared by the nominee and written within the context of teaching within a discipline (area of expertise) to highlight the overarching goals, the methods, the accomplishments in managing the teaching and learning process and the vision for future improvement. The statement should be limited to two pages.

C) Evidence of Sustained Pursuit of Professional Growth and Competencies:
- Evidence of sustained innovation and creativity to maximize learning by a diverse student population as exemplified by the pedagogical use of information technology, computer labs, field trips, undergraduate research, study abroad, etc.;
- Evidence of having challenged common assumptions and the "status quo" in a scholarly way as demonstrated by teaching-related journal publications, grants, presentations, abstracts, posters, portfolio, book chapters, text books or other forms of publication;
- Evidence of continued involvement in teaching professional development opportunities.

D) Description of Teaching Responsibilities and Assessment of Teaching:
- List of courses taught in recent years, short descriptions, and enrollments;
- Summary of numerical score(s) of departmental end-of-semester course evaluation or other form of assessment highlighting the nominee's strength in specific areas relative to peers (please include a copy of evaluation forms);
- (Optional but recommended) Short written comments from former students (dated email(s) showing the request for comments and the reply is acceptable)
  (Optional but recommended) Summary of written comments from colleagues who are familiar with the nominee's teaching practices because of co-teaching, peer-review of teaching or other mode of interactions.

E) Evidence of Contribution to Teaching as a Profession "beyond the classroom":
- Description of ways in which the nominee's activities have influenced colleagues or future faculty (e.g., mentorship activities);
- Highlights of "ripple effect" or "multiplication effect" of the nominee's teaching-related activities in the College and beyond;
- List of accomplishments (changes) that occurred as a result of the nominee's contribution to a teaching-related committee for the department, the College, the University or professional societies.

APPENDIX 2:

Recognizing and Valuing Teaching for Tenure and Promotion a the University of Wisconsin-Madison (modified from Allen, 2009)

At the university of Wisconsin-Madison, which has a long-tradition of shared governance, the promotion and tenure of dairy and animal scientists is under the purview of a 12-member Biological Sciences committee. Tenure dossier at UW-Madison must describe achievements in research, teaching outreach (extension) and service, a candidate must show "excellence" in one area and "significant accomplishment" in a second area. Any candidate with a teaching appointment is judged partly on the basis of teaching. The metrics to evaluate teaching include:

- *Number of courses and students taught* (taking into consideration new courses and student mentoring outside of class)
- *Student evaluations* (numerical ratings and students' written comments, preferably unabbreviated, for each course);
- *Peer-review* in which two faculty observe class sessions in separate semesters and write an evaluation. For those seeding tenure on the basis of excellence in teaching, an independent committee of master teachers from outside the home department is brought is to assess the candidate's teaching;
- *Evaluation of teaching materials* (syllabi, assignments, etc.) including also a two-page statement of teaching philosophy and practice;
- *Measures of impact* of the candidates' teaching-related work beyond their own classroom, including:
    a. Peer-reviewed articles, textbooks, and other pedagogical material,
    b. Evidence that the candidates educational-related material has been adopted by instructors on other campuses,
    c. Presentations at regional, national and international meetings;
    d. Teaching-related grant to develop courses or curricula or to conduct pedagogical research;
- *Letters from off-campus experts* ("arm-length" reviewers) on teaching in the candidate's field who have reviewed and assess the candidate's (teaching) dossier.

Encouraging Students to Use Their Multiple Intelligences to Enhance Learning: C^4 Project

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An intelligence is defined as a computational capacity to process information and involves the ability to solve problems. Gardner (1993) identifies seven Multiple Intelligences (MI) including Verbal/linguistic, visual/spatial, logical/mathematical, bodily/kinesthetic, interpersonal, intrapersonal and musical and he believes that everyone possesses each MI at varying degrees. By developing alternative teaching methods and pedagogy to teach concepts, more students with a varied range of MI can be reached. Literature on MI includes Armstrong (2000), Campbell et al., (2004), Kagan and Kagan (1998) and Sternberg (2008).

The Corrugated Cuboidal Collaborative Creation (C^4), or the box project, is an assignment in an upper level undergraduate animal science course. The assignment employs a cardboard box as a medium for a classroom presentation. Students self-select a question and form a group with the purpose of developing a presentation that addresses the question. Each group is given a cardboard box, which may be altered in any manner. Boxes are often painted, surfaces covered with paper or images, have items attached or placed within, and are redesigned to resemble pertinent objects. This novel presentation medium encourages students to explore and capitalize on their capabilities, and releases them from the uniformity of PowerPoint-based presentations. The MI strengths of the group become manifested through the planning and development of the C^4 and its presentation. Data collected from each student included required questionnaires and journal reflections. The majority of students stated that the project "made information more memorable." The students take ownership of their own learning, invest substantial time in developing a creative yet meaningful presentation, and take pride in their project outcome. Projects such as the C^4 motivate students to employ higher-level thinking and require them to apply their MI during the process. Students will gain genuine knowledge and have greater retention with the implementation of nontraditional teaching methods. Developing a more varied course with student-centered projects will allow students with a diverse range of MI to learn the material. The C^4 assignment can be adapted for most college courses.

In conclusion C^4 is a beneficial classroom project, which engages students possessing varied MI, allowing them to research, demonstrate, and learn about a specified topic. The C^4 allows students to utilize their MI(s), using ones that are at higher levels and improving or developing upon others that may not be as highly developed. Feedback from students via questionnaires and student reflections support the findings that students learn material better, possess a better understanding, and retain information longer with projects resembling the C^4.

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Senior Equine Management Course Uses ThinkSpace to Develop Business and Facility Management Project

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Most students struggle when faced with open ended tasks due to strategies taught by Universities that simply require finding and applying the correct strategy to answer the problem. Such problems often have multiple solutions and there is not necessarily one correct answer (CSPS, 2005). Students today perform better in the workplace when they have the ability to find solutions to authentic, real-world problems that are not well defined. To develop higher-order-thinking skills ThinkSpace was used to develop an equine business management project (Bender and Danielson, 2011)

For the *Equine Business Management* assignment students receive a scenario where they inherit land and money. Their charge is to develop the property into a cash flow positive equine business. The project is organized into 13 phases and the type of problem varied depending on the phase. The phase's included 1) assessing your equestrian business (questionnaire on type of business the student is designing); 2) business plan (short answers on vision, mission, goals and marketing strategy); 3) cover letter (letter to obtain a loan by writing to a bank owner audience); 4) facility plan (short answers and calculations on the type of horse operation, location, climate, prevailing winds, zoning regulations, manure management plan, and fencing plan including amount of fencing required; 5) facility design (drawings of the facility); 6) business worksheet with costs of goods (excel worksheet on annual income and expenses); 7) breakeven analysis (excel worksheet on the analysis if the business broke even); 8) marketing program (short answers on advertising and marketing strategies); 9) marketing checklist (questionnaire on marketing strategies); 10) marketing flyer (flyer on an advertisement); 11) health (checklist on an annual health care program including vaccination, deworming and farrier schedules); 12) nutrition (short answers on size of pastures, number of pasture/hay fields, stocking rate for each pasture, pasture maintenance program, and feeding programs) and 13) ration (development of a ration for the horses). Phases were developed utilizing material from Equestrian Professional (http://www.equestrianprofessional) and created concepts.

The Equine business project is an example of an ill-structured problem with multiple alternative solutions and evaluation strategies (CSPS, 2005). Preliminary results indicate improved learning gains in students. Unlike the students in this course from past academic years who wrote a formal paper on the equine business management project, the students who participated in the Equine business project in ThinkSpace, demonstrated deep and broad thinking about a genuine problem. Most interestingly, such students reported application of knowledge and skills gained during the Equine project, across academic courses, both internal and external to their majors.

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Using a Computer Simulation Model to Teach Dairy Farm Management

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Teaching Dairy Farm Management to undergraduate and graduate students requires the integration of: a) production physiology concepts (reproduction, feeding, health prevention,…) with economics; b) short term actions (insemination, drying-off, weaning,…) with medium-long term planning (reproduction and culling strategies, replacement policies, grouping,…); and c) animal activities with agricultural planning and environmental issues (crop production and rotations, manure spreading,…). While teaching individual concepts can be easily done in a traditional teaching environment, the integration of all these concepts is often difficult, mainly in a growing non-rural audience. The use of case studies is an excellent tool to develop and integrate these concepts, but it imposes a burden on the instructor to generate a large number of cases and to grade them.

A web-based computer simulation model was developed to simulate a dairy farm. Modeled events are based on physiological functions and work at random around predefined averages and ranges. The program has three levels of interaction: the administrator that coordinates the system; the instructor that controls all conditions within his class and can visualize each individual student activity; and the student that controls all actions in his farms. At the beginning of the course, the instructor defines all parameters of the farms that will be assigned to students (farm size, production level, population structure, dietary ingredients available, fertility, detection rate, incidence of diseases,…) and the program generates farms within these limits at random so that within a class, each student has their own and unique farm. Actions taken by students include: heat detection, insemination, dry off, diet specifications, formation of groups and transfer of animals between groups, colostrum and milk feeding, weaning, treatment of diseases, milk withdrawal if antibiotics are used, heat synchronization (hormonal), definition of milking routine and heat identification criteria, buying and culling of cows or heifers, among others. The daily output provides information on milk production and composition, economic performance and counters for errors incurred during the period as feedback for students and evaluation purposes. Instructors can evaluate students semi-automatically based on production, economic performance and/or error counters, and may also develop exercises based on their own farm (i.e., calculate required space for cows, land for forages production or manure spreading,…).

The simulation program can be used by the instructor as it is, but may also be used in parallel to formal classes to illustrate specific concepts (i.e., the instructor can cause a change in forage quality or modify fertility and make students identify the problem and discuss the consequences at the dairy farm level. The program has been used by undergraduate and Veterinary School students in three different universities with excellent evaluations of the learning process from student surveys. In a non-planned exam conducted 2 weeks prior to the final exam, students were 5 times more likely to respond correctly to the same type of questions about dairy cows than other species taught in the same semester. The program is written in Catalan, Spanish and English. For information, connect to www.dairyfarm.es (Calsamiglia, 2012). Information provided includes a Manual for Instructors, a Manual for Students, a Quick-start guide to managing the farm and two 12-minute videos (one for the instructor and another for students) that teaches how to use the program.

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North American Intercollegiate Dairy Challenge (NAIDC)

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The Mission Statement for the North American Intercollegiate Dairy Challenge (NAIDC, 2012) states, "*To facilitate education, communication and an exchange of ideas among students, agribusiness, dairy producers and universities that enhances the development of the dairy industry and its leaders.*" This initiative brings the entire dairy industry together for a common goal: to enhance the industry and promote development of new dairy leaders. As an innovative and effective method of teaching, mentoring and inspiring future dairy industry leaders, NAIDC uniquely includes all classroom elements, laboratory activities, communication and networking with individuals including potential employers. The NAIDC encompasses both competition and exposure to real-life career situations; all these elements are placed under one umbrella of friendly competition, which is adaptable to any business that is based on evaluation of management and resources for reaching monetary and life-style goals. The 2½-day NAIDC competitions enable individual students to apply classroom theory to a real-world situation while working as part of a team. Four Regional NAIDC events are structured to train students working in composite teams whereas competition among individual schools is reserved for a national contest; these competitions are spread across the country over the "NAIDC Year" or November through April. Composite teams are designed to teach team building skills and allow team members from various schools get to know each other. On day one of the contest, students arrive at contest site late Thursday afternoon and team building exercises are conducted in the evening; contest material including all dairy production data and other material such as financial, feed and regional benchmark information are distributed. At the end of the day, the students then get a 2.5-hour peak at the contest material. The second day (Friday) begins with the distribution of instructions for a working-dairy farm visit; after a brief inspection of the designated host dairy farm material, teams travel to their assigned farms. Both regional and national contest teams spend about 90 minutes walking the farm grounds; team members examine the entire operation and interview herd managers and/or farm owners. Each team is asked to develop a farm analysis identifying areas of strengths and opportunities, make a Power Point presentation to include appropriate recommendations for nutrition, reproduction, milking procedures, animal health, housing and financial management while taking into consideration the specific goals of the farm. The third and final day (Saturday) is set for presentations with each team making recommendations to a panel of industry judges; each student is expected to field questions from the judges. Presentations are evaluated based on the farm analysis and recommendations. Each panel of judges is made up of five experts, one judge from the areas of nutrition, diseases, reproduction, finance and production (dairy farmer). In the 10-year history of the contest, several testimonials have been observed on how NAIDC have positively impacted participants' career and how dairy science courses are now taught on many campuses. Finally, NAIDC has certainly provided an innovative way of tying real life goals, class room knowledge, monitoring systems, economics and the right people to produce a successful method that enhances learning and lifelong use of knowledge; in 10 years, more than 3,500 students have participated in NAIDC.

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Preparing Students for Careers in Effective International Agricultural Development

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The Department of Agriculture at Andrews University receives many requests to assist various parts of the developing world with improvement of their food security. In order to more effectively address these needs, we have developed a Bachelor of Technology degree in International Agriculture Development. The goal of the program is to prepare student to work with non-profit organizations, governmental agencies, and others to address the world's growing food needs in a sustainable manner. This program also allows students who meet the entrance requirements to be accepted into the Masters degree in Community and International Development that is offered at Andrews with advanced standing (Andrew University, 2012a).

The coursework required for this degree is comparable to that required for the Cornell University International Agriculture and Rural Development degree with a concentration in Agriculture Food Security (Cornell, 2012). The Agriculture portion of this interdisciplinary degree is built around courses in the animal and plant sciences relevant to production and post-harvest food storage to attain and preserve food safety and high nutrient content. The Business portion contains courses in accounting and economics. The Social Science content includes needs assessment, concepts in development, and social policy formulation. The capstone experience includes two Internships, one in the U.S. and one in the developing world (Andrew University, 2012b).

Direct assessment of the students will be made their using grades from chosen classes, and the evaluations of their supervisors and the faculty members during their Internships. They should be able to define and develop useful recommendations and sustainable projects during the Internships, and put them into practice. They will critique their projects and write an analysis similar in style to that of a professional development evaluator.

A number of students have expressed interest in this degree. Many of our students come with conservative Christian values including a strong ethic of service to others. They seek to put their education to practical use. Our Department is already involved in several development projects, so these students would be able to get their hands-on experience readily.

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Synergistic nexus between research-led teaching and inquiry-based student learning in Animal Sciences: Sharing the University of Tasmania experience

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In order to challenge old assumptions and break new grounds in teaching and learning in the Animal Sciences, a paradigm shift from the traditional '*teacher-focus*' to a modern '*student-centered*' learning approach is necessary. Establishing a synergy (systematic working together in concert) between '*research-led*' teaching and '*inquiry-based*' learning enhances students' understanding of both science content and scientific practices (Edelson et al., 1999). Understanding the scientific concepts of genetics by nutrition interactions in Australian pasture-based sheep, dairy and beef systems is a major dilemma faced by undergraduate students. This difficulty was reflected in the 2006 Animal Production Systems (KLA220) Unit's student evaluation of teaching and learning (SETL) at the University of Tasmania (UTAS). To address this problem, we implemented an innovative, inquiry-based learning and research-led teaching approach. The primary objective was to enhance students' critical thinking and target their learning needs through active participation in field experimental trials and hands-on activities.

Data from 104 students enrolled in the KLA220 Unit from 2006-2010 were utilized for this study. In addition to the theoretical concepts taught in class, students were exposed to hands-on genetics-nutrition experimental growth trials with sheep, laboratory experiments on intramuscular fat extraction, fat melting point, sensory evaluation of meat eating qualities, data analysis, livestock industry field visits, scientific journal article critiques and seminar presentations. Student learning experiences were evaluated through SETL surveys.

On the basis of 83% response rate and quantitative Unit Evaluation mean scores, results indicated a progressive improvement from 3.90 in 2006 to 4.40 in 2010 that exceeded the average Faculty threshold. Free-text student comments revealed that the research-led teaching approach had actively engaged and given them a rich learning experience. This finding is strongly supported by literature that "learning by doing" is an effective way for students to benefit from staff research (Gibbs 1998) and that students involved in research-based inquiries acquire a more sophisticated level of intellectual development (Blakemore and Cousin 2003) because the active learning process encourages students to adopt a deep approach to learning than the teacher-focused surface approach (Brew and Boud 1995).

In conclusion, this research-led teaching approach has undoubtedly made a significant contribution to the student learning experience in animal science through the development of students' critical thinking and scholarly values. Some student comments: *"Field trips were an excellent opportunity to meet & hear from producers and very useful in gaining a practical knowledge of animal production industries", "Lectures and field experiments were really inspiring, lab helped understand material"*

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Student Engagement in Animal Science Majors and Non-majors

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Student engagement (SE), especially the cognitive and social varieties, almost always equates to student success. The objectives of this study were to determine the level of SE in Animal Science (AS) majors at the University of Georgia (UGA) and to explore relevant factors that influenced SE. The National Survey of Student Engagement (NSSE, 2012) was administered after approval from the Institutional Review Board of UGA to 194 UGA students. Students were enrolled in either the Introduction to AS (n=48), Animal Nutrition (n= 79) or Leadership and Service (n=67) course. The NSSE used in this study was licensed to UGA and modified to include only the SE constructs of Integrative Learning (IL), Higher Order Thinking (HOT), Reflective Learning (RL), Total Deep Learning (TDL), Quality of Relationships (QoR), Educational and Personal Growth (EPG) and Satisfaction (S). An additional engagement question was added: "How would you rate your level of involvement in...clubs or organizations (Greek or otherwise)?" In addition, a series of descriptive demographic questions were posed to better understand the relationship between experiences and engagement. Data were analyzed using SPSS. Means and frequencies were calculated for demographics and test variables. Independent samples t-tests and Pearson correlations were calculated between SE constructs / variables and demographic information. Subjects averaged 20.8 years of age and were 64% female; 11% were freshmen, 23% were sophomores, 29% were juniors, and 34% were seniors. Although 67% entered UGA as freshmen, 30% entered as transfer students. Forty-eight percent were AS majors and 74% indicated involvement with a collegiate organization. AS majors had higher QoR ($t = 4.08$) at UGA, and they were more satisfied ($t = 4.08$) with their education. Additionally, the number of AS courses completed was positively related to the QoR ($r = .31$) and S ($r = .29$) engagement constructs. There was also a significant IL engagement construct difference among students of varying years in college ($F = 4.06$). Freshmen and sophomores were less engaged in IL activities than their junior and senior counterparts. Lastly, level of involvement in collegiate organizations (i.e. Block & Bridle, Sigma Alpha, etc.) was positively and significantly ($r \geq .20$) correlated to all of the engagement constructs, except Satisfaction. In particular, students who participated in leadership had higher ($P < .05$) TDL and QoR scores than students who were simply involved in the membership of the organization.

The AS department is to be commended for improving S and for fostering QoR among students and faculty when compared to non-AS majors. Perhaps greater effort could be expended to improve HOT and RL among students. Lastly, students should be encouraged to not only participate in collegiate clubs but to become actively involved in leadership to enhance engagement and student success.

NSSE (National Survey of Student Engagement). 2012. Accessed May 27, 2012: http://www.nsse.iub.edu/

Capitalizing on Millennials' interest in making a difference through international service learning with reflective journaling assignments

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The worldview of students dictates the type of learning environment they choose for their animal science elective courses. In their book, *Millennials Rising*, Neil Howe and William Strauss (2000) point out that millennials are optimistic team players that are highly-involved in school, community, and/or church activities and thus more dependent on peers and parents than previous generations. Undergraduate students today are highly motivated to make course commitments as groups and many prioritize study abroad options, which allow them to experience the practical, real world applications of what they are learning in the classroom. Martin (2009) stated that designing class projects that allow students to get out in the community will make a bigger impression upon Gen Y students than a research paper or test. They are more likely to learn and retain course material when they are actively engaged with that material, whether inside or outside the classroom. Since 2002 we have offered students 24-day Exploring International Animal Agriculture travel study tours (n=205). Students were asking for more engagement and asking the question, "Why aren't we working to make a difference in countries and villages visited instead of just learning"? So, how do we engage students more deeply?

In 2007, we began offering Animals & Food Security: International Service Learning course (in Haiti & Romania) as alternatives to traditional group study tour animal sciences classes. Partnering with local NGO's and agricultural universities has allowed us to directly engage students in two separate courses (Haiti winter-break and Romania Maymester) in which they work in bi-national teams with host university students and village leaders. Accepted students in both courses enrol in a one-credit preparatory class and then participate in the three-credit summer class in Romania or the one-credit winter-break class in Haiti. Following the Haiti winter break, students also take a required one-credit reflective follow-up class. Student learning outcome assessments include submitting daily journals reflecting on their work and then occasional guided reflective journals with sequential prompts about their expectations and behavioral changes. Learning outcomes include increasing the students': ability to effectively communicate with others across cultures; capacity to work effectively as part of a bi-national problem-solving team; and ability to think critically, and manage and solve real world problems.

Qualitative results of 54 U.S. students who attended the Haiti & Romania program and 18 Romanian students will be compared with the soft skills of new graduates prioritized by Crawford et. al. (2011). Student interest in these courses continues to increase as a result of the personal satisfaction and enhanced confidence of students from completed agricultural projects and on-going relationships with international hosts. This model seems to really appeal to the innate attributes of this generation of students.

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Virtual Microscopy: A New Paradigm for Teaching and Integrating Microanatomy

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Microanatomy is a visual science in which perception takes precedence over rote learning (Clarke et al., 1994). Traditional methods utilized for teaching microanatomy involve still images in a lecture format reinforced by laboratory hands-on exercises reviewing glass slides under a microscope. In today's demanding undergraduate animal science curriculum, students are expected to understand complex cellular physiology and organ functions ahead of any formal instruction and understanding of microanatomy. This can lead to poor integration, logic, retention and curb overall interest among students. Building on core morphological knowledge substantially enhances students' ability to perceive by his/her own senses, firmly comprehend, and accurately interpret functional relations when subsequently exposed to diverse fields in life sciences. Fitting new concepts into the morphological framework remains a primary interaction between morphological memory and cognitive processes (visual perception, organizing information and drawing conclusions). Therefore, in today's classroom, it becomes necessary to intricately integrate information at multiple interdisciplinary levels to effectively communicate concepts and enhance cohesive learning in life sciences (Heidger et al., 2002).

The term 'virtual microscopy' refers to viewing digitized glass slides at a sub-micron resolution to simulate browsing and change magnifications as done in a microscope. Although this technology has been recently used to replace microscopes with computers in laboratory settings for teaching histology (Blake et al., 2003, Krippendorf and Lough, 2005), its use in the lecture room for undergraduate education is largely unexplored. In my domestic animal biology lectures, I adapted an approach of demonstrating virtual slides; they formed an intermediate between still images and animations. It allowed me to precisely direct and exemplify morphological features by traversing different areas of a slide and from low to high magnification placing structural elements in a relational perspective. Compared to still images, it provided learners with a unique and realistic view of the tissue, simultaneously focusing on links between histology and physiology. It also opened up numerous opportunities for questions and interactions in the classroom strengthening cognition.

Based on student feedback, these demonstrations helped effective comprehension and assimilation of information. Annotated virtual slides for viewing outside the classroom could also help prepare students to think/learn independently. In summary, virtual microscopy in the classroom enhances learning experience among present-day students with a motivational and realism value – making fundamental factual knowledge more palatable. This method also ensures that morphological features of organ systems are effectively communicated preceding instruction in physiology.

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Clarke, J., G. Holsgrove, and D. Riches. 1994. Teaching and assessing microanatomy using closed circuit TV. Med Teach. 16: 213-219.

Heidger Jr, P.M., F. Dee, D. Consoer et al. 2002. Integrated approach to teaching and testing in histology with real and virtual imaging. Anat Rec. 269: 107-112.

Krippendorf, B.B. and J. Lough. 2005. Complete and rapid switch from light microscopy to virtual microscopy for teaching medical histology. Anat Rec. 285B: 19-25.

Wildlife Science and Applications: A Novel Course in the Animal Science Curriculum

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One simply has to look at the new graphics on the American Society of Animal Science's web page to see that the boundaries of 'animal science' have been extended beyond the traditional livestock species to include companion animals, laboratory animals and exotic species. Since 2000, the Journal of Animal Science has published at least 15 articles in which a wildlife species was the primary subject of investigation. The majority of students majoring in animal sciences at the University of Kentucky are preveterinary students from urban and suburban backgrounds. Their personal experience with animals is often limited to companion animals. Their knowledge base about animals is derived from their pets and from cable television shows. Thus, they have no strong connection to the traditional livestock species and a keen interest in wildlife. We viewed this as an opportunity to develop a course on wildlife biology and management based on the standard production animal course model. The objective was to show students how research in the traditional livestock species is being applied to the management of wildlife in three settings: 1) wildlife being kept for production purposes, 2) wildlife maintained in zoos and rescue shelters and 3) wildlife in their natural habitat.

As in the traditional livestock production courses, students study how the disciplines of nutrition, reproduction, genetics, behavior, etc. are applied to the specific species of interest. The first part of the course is devoted to mammalian phylogenetics with an emphasis on modern, molecular based methods for determining phylogeny. Next, we briefly review the disciplinary sciences from a comparative perspective. Laboratories during this part of the semester are devoted to comparative skeletal and soft tissue anatomy. Necropsy instruction is provided by the state wildlife veterinarian. Next, we focus on the three settings identified above, describing the scope of each, the problems encountered and how the disciplinary sciences are applied to address those problems. The laboratory sessions for the next six weeks are field trips that correspond to this block of material. We visit commercial bison and elk herds kept for meat and for trophy hunting purposes. We visit a primate sanctuary and discuss legal and ethical issues related to keeping wildlife as pets. We visit the Kentucky Department of Fish and Wildlife's Educational Center to discuss management of wildlife in the field. The last two field trips are to the nearby zoos in Louisville and Cincinnati. There we discuss zoo animal nutrition and breeding programs for endangered species. These trips and lectures provide the framework for the students to complete their term projects, a comprehensive description of a wildlife enterprise, the objectives and the strategies to meet the nutritional, reproductive, genetic and behavioral needs/issues of the animals in their care.

We have taught this course three times (2009, 2011, 2012). Anonymous student evaluations were obtained using the standard university form. Students rated the overall value of the course at 3.8, 0.5 above the college mean (1-4 scale). Students rated the course high for stimulating further reading (3.8, 0.5 above college mean) and that the laboratory clarified lecture material (3.8, 0.3 above college mean). Written comments were consistently positive, emphasizing the effectiveness of the course in demonstrating application of scientific principals learned in disciplinary courses and for revealing career opportunities in wildlife management.

Linking Animal Agriculture to Fine Art in an Introductory Course

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Animal Science is a natural science. It is a body of knowledge accumulated over centuries, derived logically and objectively through observation, experimentation and analysis. As is the case for any science based curriculum, ours has three emphases: 1) learning a substantial portion of this body of knowledge, 2) learning about the logical, objective, and analytical means by which this body of knowledge was obtained and 3) the application of this knowledge in the field. The emphasis is on knowledge, logic, objectivity, analysis and application (the rational) in deference to intuition, subjectivity and creativity (the emotional). Over the past 100 years, the trend in higher education has been to exaggerate this emphasis and, some would argue, to stifle creativity (Robinson, 2001, Taylor, 1960). And yet, intuition and creativity would certainly benefit scientists engaged in either expanding our knowledge or in applying current knowledge in the field. Increasing students' exposure to fine art may be a useful first step in developing the emotional skill set of students. The intent is that exposure may lead to appreciation/criticism and ultimately to expression/creativity. By starting with pieces within the student's recognized field of interest, students may be self-motivated to pursue this learning path.

One way that we have tried to do so is by integrating fine art into the introductory animal sciences course. This has been done in four ways. First, pieces of fine art and artifacts are used to describe the changes in man's relationship to animals over time. This includes artwork from the Neolithic period through the early Egyptian, Babylonian and Minoan civilizations that clearly trace the effects of domestication and early selection on the size, stature and color patterns of livestock. The practical and religious importance of livestock is evident in these early works of art. Art work has provided an important supplement to the written record in unraveling the development of modern stock. The scientific utility of fine art is demonstrated through this activity. Second, pieces of fine art are used as primary illustrations in PowerPoints where possible. Third, 5-10 minute mini-lectures are given before class tying animal agriculture to current events, culture and art. Fourth, students are given a homework assignment with pictures of four paintings. They have to find the title and artist of each. The fourth is a painting that belongs to the University of Kentucky and can be seen at its Art Museum. Students must visit the museum to obtain full credit.

These activities have been developed over the past seven years. Admittedly, this is a very small, first step in the development of a student's emotional skill set. We have made no attempt to evaluate the effectiveness of these activities in increasing the students' appreciation of art or in developing the student's creative thinking. As of this time, no comprehensive assessment of this aspect of the course has been solicited from the students. Students have commented positively when asked in casual conversation. No negative comments have been made. It has increased the visibility and image of our program in other parts of the university community.

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Classroom Debates as an Interactive Teaching Tool in a New Course on Companion Animal Hot Button Issues

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An article in Education World addressed teaching strategies that work well in the classroom (Education World, 1996-2011). It was noted that "using debates in the classroom can help students grasp essential critical thinking and presentation skills which included abstract thinking, citizenship and etiquette, clarity, organization, persuasion, public speaking, research, and teamwork and cooperation". In an Anthropology course taught at the University of Illinois, Dr. Sarah Wiseman (2010) introduced a debate format into an undergraduate course. She found that "classroom debates altered the course from its initial, unremarkable run as a lecture series into a stimulating learning experience for all concerned".

Over the past 10 years, there has been a shift in demographics of students in Departments of Animal Science. A large proportion of University Animal Science students are non-farm, urban students with an interest in companion animals and equine. Zawistowski (2008) stated that there are various circumstances where people differ in their opinions of how companion animals should be treated, type of care they should receive, and what type of animal can or should be kept as companions. He presented several examples of "hot button" issues that are debated among people, in the media, in the courts at both the federal level and in local communities.

A new course on "Companion Animal Hot Button Issues" is being introduced at the University of Minnesota this Fall, 2012 and will use a debate format to stimulate interactive learning. Issue statements have been developed for approximately 15 hot button issues and will be presented to students with a short list of points from each side of the issue. The most effective debate format and evaluations to use in this course will be derived from teachers with debate experience such as Snider and Schnurer (2006). A general approach will be to divide students into debate teams with each team taking a pro or con stance on each issue. Teams will be responsible for presenting their arguments based not only on opinion but using data and information derived from the literature. After presentations by each team, other students in the class will have the opportunity to ask questions of either team. A poll will be taken before and after the debate with a classroom response system using mobile devices such as cell phones, smartphones, tablets, iPods and laptops (Top Hat Monocle, 2010). In addition to the oral presentation, which will be recorded and posted onto the course web site, written statements by the debate teams will be posted on-line for students to review. Based on the debate and written statements, each student will submit a response indicating which stance they support and why. Main objectives of this course are to enhance oral and written communication skills and stimulate critical thinking.

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Equipping students to make ethical decisions in Animal Sciences: ANSC/FSHN 350

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As part of the general education core curriculum, University of Hawaii at Manoa undergraduates must have an upper division course focusing on contemporary ethical issues. The course, reviewed and approved by a faculty panel, uses specific hallmarks to qualify the course for "E" designation. Among them are: 1) Contemporary ethical issues will be presented and studied in a manner that is fully integrated into the main course content. 2) The disciplinary approaches used in the class will give students tools for the development of responsible deliberation and ethical judgment. 3) Students will achieve basic competency in analyzing and deliberation upon contemporary ethical issues to help them make ethically determined judgments.

ANSC/FSHN 350 Humans, Food and Animals: Ethics, Issues and Controversies is the "E"-designated course for Animal Science and Food Science and Human Nutrition majors. The primary objective of this course is to contribute to the development of informed and responsible citizens who are able to think critically and to analyze complicated science-related issues. By learning to apply ethical principles within a cohesive ethical framework, students will become more adept at dealing with moral dilemmas that ask "why, should, must and ought" of current scientific controversies. The course explores ethical issues and other controversies related to food science, nutrition science and animal science and the intersection(s) among the disciplines. Using small group work, students are presented with case studies, often based upon real or current events. Students discuss, answer questions, examining options, and expressing their own personal "comfort" level for each option. The ethics involved in the decision making is later reinforced using individual written journal assignments on the same case and whether their opinions changed after the discussion or after additional reading assignments. The intent is not just to present the case but to provide different, often conflicting viewpoints and ask the student to make a judgment. Guest speakers speak on a variety of contemporary issues contributing to the learning, with presentation topics tied to case studies, reading or web assignments. Textbooks used are: 1) Pence, GE (ed.) 2002, *The Ethics of Food: A Reader for the Twenty-First Century*. 2) Nestle, M and Dixon, LB, 2010, *Taking Sides: Clashing Views on Controversial Issues in Food and Nutrition* and 3) Rollin, BE, 2006 *Animal Rights & Human Morality*. Early assessment of this program and this class indicate that students feel better prepared to face these issues in their careers in animal sciences.

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Markkula Center for Applied Ethics. Accessed March 3, 2012: http://www.scu.edu/ethics/

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Using Research to Enhance the Undergraduate Animal Science Curriculum

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Undergraduate research opportunities enhance student learning experiences (Boyer, 1990; Zydney et al., 2002) and students engaged in research have a better understanding of scientific principles and are much more aware of graduate school opportunities, when compared to undergraduate students who have not done research (Russell et al., 2007). They have an advantage when applying to graduate programs, veterinary schools, and other employment positions since they have already performed techniques that they would learn as a first-year veterinary, medical, or graduate student. Undergraduate research fosters strong student-professor relationships that lead to increases in advanced degree program acceptance rates and enhance career opportunities for our students. The objective of this presentation is to describe course structure, teaching effectiveness, and benefits of involving undergraduates in research with *Research in Animal Science*, one of several hands-on courses that fulfill the 9-credit experience based education requirement for Animal Science majors at Rutgers University.

In this course, faculty opens their laboratories for students to learn firsthand about research theory and techniques and assist in conducting the research. Students gain experience in developing and testing hypotheses, handling research animals, working with cells in culture, taking research samples, and performing scientific and statistical analyses. Students often hear about faculty research projects in class and interested undergraduates can register for the research sections of this course offered by all 16 departmental faculty members. About 150 students register annually by-arrangement after faculty member agreed on the student's participation in the project. Along with the faculty mentor, a student may also work directly with postdoctoral fellows, graduate students, farm staff, and/or other undergraduate students. Some students enroll for additional semesters and have produced scientific abstracts, posters, and papers presented at conferences. In addition to laboratory-based projects, many students learn valuable field research techniques. For many students, *Research in Animal Science* prepares them for post-baccalaureate work.

In anonymous University course evaluations, students have consistently rated both "teaching effectiveness" and "overall course quality" of Research in Animal Science very highly. On a 5-point scale, where "5" is excellent, the department averaged 4.5 to 5.0. When asked what they liked most about the course, comments included the following: "I liked the hands-on experience I got. I especially enjoyed being able to do many of the procedures myself." "I got a lot of hands-on experience that I was able to put on my resume and am convinced was the reason I got hired at my current job." "I loved the research we did this semester (in spite of all the manure) because it tied together my environmental science major and horses..."

Boyer, E. L. 1990. Scholarship Reconsidered: Priorities of the Professoriate. Princeton University Press, Princeton, NJ. pp. 147.

Russell, S.H., M. P. Hancock, and J. McCullough. 2007. Benefits of undergraduate research experiences. Science 316:548-549.

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First Year Experience to Capstone Experience: Linking the Undergraduate Years in a Large Department

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Two major thrusts in higher education are first year experiences (Friedman and Marsh, 2009) and senior capstone experiences (Rhodes et al., 2012). Additionally there is recognition that helping students to prepare early for independent learning experiences can be beneficial (Wattiaux, 2006). The Department of Animal and Poultry Sciences at Virginia Tech has implemented a required 2-credit capstone experience that students must complete within 45 credits of graduation. Planning for the capstone experience begins in a freshman survey course (FR), continues in a sophomore seminar (SO) and culminates in an experience tailored to each student. In the FR course, students complete a four-year academic plan that includes the capstone experience. During the SO course, students prepare a resume, complete a mock interview, and draft a capstone experience proposal. Specific learning objectives include: 1) employing critical thinking skills to acquire, analyze, interpret, and integrate information from a variety of sources; 2) solving problems in authentic or realistic situations in the animal sciences; 3) planning and completing a project pertaining to each student's discipline and field; 4) demonstrating verbal, visual, and written communication skills; 5) contributing to a team effort; 6) assessing and describing potential contributions of the capstone to a larger whole; and 7) effectively competing for career and/or post-baccalaureate opportunities. Potential capstone experiences may include, but are not limited to, Study Abroad, Field Studies, Internships, Undergraduate Research, Independent Studies, and formal coursework at the Senior or Masters level. The capstone experience program is administered by a faculty committee that meets once a semester to evaluate proposals. In 2.5 years, more than 200 capstone proposals have been approved. Internships (35% of the total) are more popular in the summer whereas formal courses (27%) are chosen most often in the spring semester. Independent studies (13%), undergraduate research (14%), and study abroad (7%) make up most of the rest. About half of the students have presented posters at a Capstone Symposium held each semester. Students in the FR and SO classes are required to attend. Grades assigned by on-site supervisors are mostly A's but a few have assigned C's and D's. The overall course grade for most capstone experiences is pass-fail. Analysis of student perceptions (n=66 students) indicated that 97% of those completing an internship for their capstone achieved at least five of the seven learning objectives; 49% achieved all but one and 30% achieved all seven. With more than 450 majors in the department, the challenges presented by this new requirement are many and we continue to work on issues such as logistics and quality control but initial outcomes are positive for student learning.

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Rhodes, T. N., J. D. Miller and L. D. Edgar. 2012. Evaluating capstone courses: employing the five R's model to analyze an Agricultural Communications magazine class. NACTA J. 56(1):8-16.

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Notes: