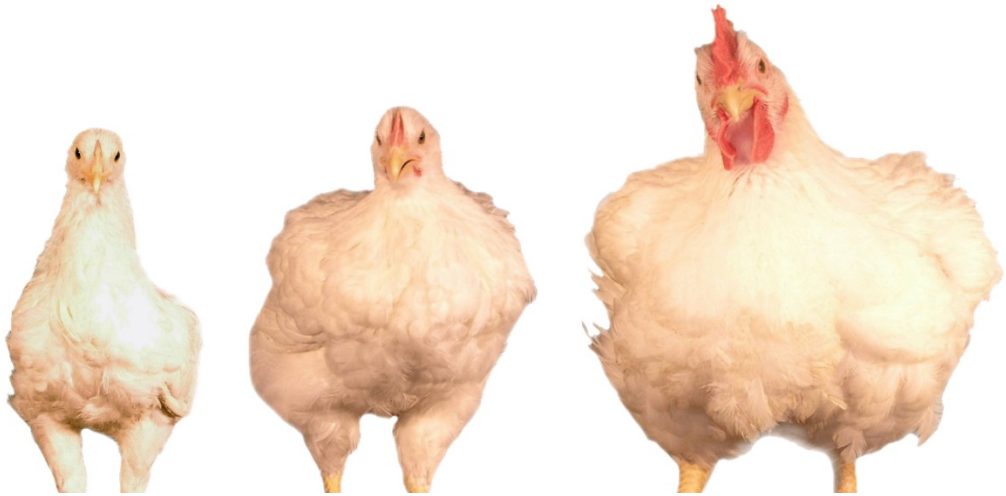
Knowledge Generation Builds Confidence in an Advanced Production Class



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The Problem

Undergrads normally assimilate knowledge passively

- Lectures
- Textbooks
- Regurgitation of facts

Can *knowledge generation* by students foster

- Engagement
- Mastery
- Confidence
- Synthesis of knowledge

Opportunity

Engaging students actively in research (knowledge creation) may have some benefits

- Immerse students in systematic investigation
- Deepen appreciation for empirically derived knowledge
- Increase interest in and mastery of subject matter, e.g.
  - Broiler flock management
  - Impact of genetic change on broiler growth and efficiency
- Build confidence
- Exposure to process of synthesizing new and existing knowledge, e.g.
  - Role of genetic change in socially responsible food production system

Pedagogical Questions

Can students benefit from the knowledge generation process?

Can this *High Impact Experience*

- Foster student engagement?
- Improve subject matter mastery?
- Build student confidence?

Assessment

- Evaluation over 4 cohorts (2013 to 2016)
  - Student comments from course evaluations
  - Comments from industry participants
  - Debrief with students after presentation

The Class

Animal Science 471: Applied Poultry Research

Level: 4th year production course

- Objective (overarching): “to become fluent in poultry”
- Undergraduate students: 11 to 26 per term
- Graduate students: 2 to 5 per term
- Course content (layers, turkeys, broilers, and broiler breeders)
  - Animal care and biosecurity
  - Anatomy and physiology
  - Nutrition and feeding
  - Reproduction
  - Incubation
  - Growth and development (modeling)
  - Management
  - Health and welfare
  - Processing
  - Industry issues

The Knowledge Generation Project

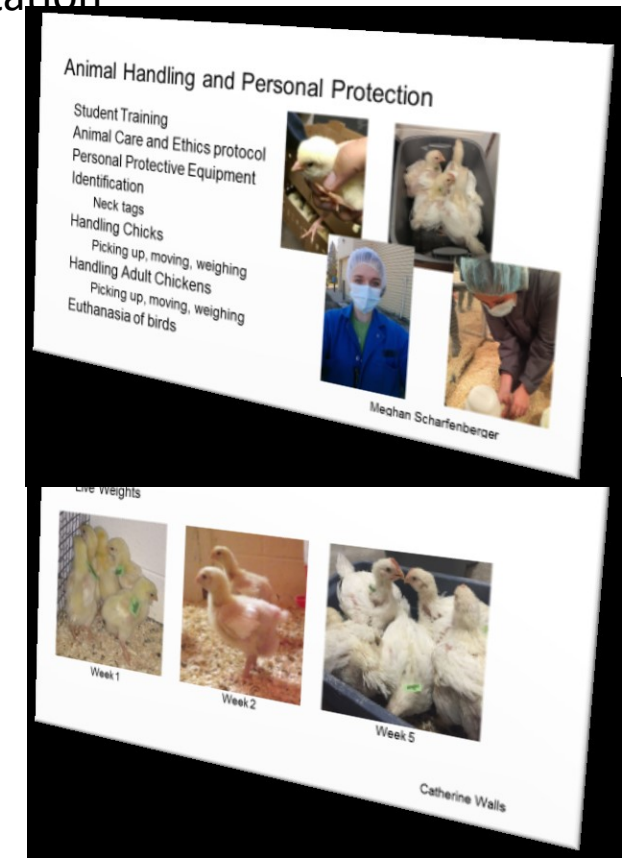
Rigorous experiment of publishable quality

- Research theme varied
  - Nutrition themes
  - Evaluation of genetic change over 60 years
- Learning outcomes:
  - Achieve fluency in industry issues
  - Understand key elements of poultry management
  - Understand the science behind production efficiency
  - Evaluate the economic relevance of the research for end user
  - Master communication skills

Knowledge Generation Project Scope

Broiler experiment during lab (6 week project)

- Week 1: Practical animal care training, project orientation
- Weeks 2-8: Run research project
  - Brooding
  - Measure feed intake
  - Weighing birds
  - Dissection
- Week 9: analysis and reporting
  - Nonlinear modeling of growth and development
  - Economic analysis
- Week 10: Presentation planning (*Google slides*)
- Week 11: Practice presentation
- Week 12: Presentation to industry



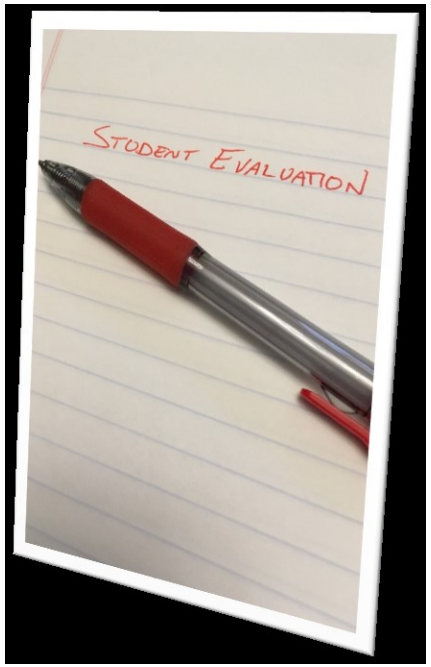
Student Evaluation (40% of Course)

Undergraduate students

- 3-4 page report (6,000 characters)
- Science journalism format

Graduate students

- Poultry Science manuscript



All Students: Presentation to industry

- A single 40 minute presentation

Impact

Key messages from student presentations

- The first meal matters
- Compensatory growth is complex and nuanced
- Genetic change over 60 years has made chicken production more socially responsible

The effect of quantitative feed restriction on allometric growth in broilers

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ABSTRACT Feed restriction in broilers is aimed at preventing metabolic disorders, increasing feed efficiency, or manipulating carcass conformation. The purpose of the current study was to investigate the effects of modest graded levels feed restriction during the second and third wk of life. Mixed-sex chickens were raised in pens with 4 replications per treatment to 35 d of age. Chickens were fed ad libitum throughout the trial, or 90, 80, or 70% of expected ad libitum feed intake during the second wk of life, or 95, 90, 85, or 80% of expected ad libitum feed intake during the third wk of life. Feed intake, BW, ADG, and feed conversion ratio (FCR) were measured and weekly dissections were conducted to characterize allometric growth of the breast muscle, legs, abdominal fat pad, liver, gastro-intestinal tract (GIT), and heart. Feeding 70% of ad libitum during wk 2 and 80% during wk 3 reduced ADG during the restriction period and reduced BW at the end of the restriction period, but chickens exhibited complete compensatory growth within one wk after the restriction period. No significant effects of restriction treatment were found on BW, FCR, fat pad, empty GIT, breast muscle, heart, legs, and liver weight at d 35, but allometric growth curve for breast muscle was lower in birds fed 80 and 85% of ad libitum during wk 3, and for birds fed 70% of ad libitum in wk 2. Allometric growth curves for all body parts were different between males and females, except for the liver. Females had higher relative fat pad, breast muscle, and liver weight and a lower GIT and heart and leg weight compared with males at d 35. Feed restriction could differentially affect males and females. This study showed that feeding 70% of ad libitum in wk 2 might be beneficial to reduce fat pad, but later feed restriction in wk 3 may reduce breast muscle weight at broiler processing age.

Key words: compensatory gain, yield, fat pad, development, breast muscle

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INTRODUCTION

Feed restriction in broilers has aimed in the past at preventing metabolic disorders, such as sudden death syndrome and ascites (Yu and Robinson, 1992; Buys et al., 1998). Rising feed costs drive the interest in interventions such as feed restriction to improve feed efficiency and reduce abdominal fat accretion. There are 2 main methods to apply feed restriction, each with their own effect on production performance (Lee and Leeson, 2001; Butzen et al., 2015). Qualitative feed restriction is defined as limiting (specific) nutrient intake through dilution of the diet. Quantitative feed restriction is defined as reducing nutrient intake through reducing the amount of feed consumed. Precise quantitative restriction can be achieved by directly controlling feed intake. This does not confound the effects of feed restriction with effects of diluting components. Following a period of feed restriction, broilers normally experience a period of rapid growth, called compensatory growth (Hornick et al., 2000). The extent to which broilers show compensatory growth depends on many factors such as environment, period and method of the applied restriction, strain, and sex (Lippens et al., 2000; Lee and Leeson, 2001; Khetani et al., 2009). Most research on feed restriction and compensatory growth was done 2 decades ago, but genetic companies continue to increase broiler growth potential (Zuidhof et al., 2014). Therefore, some of the outcomes of older literature may not be applicable today. Recent literature shows that 20% feed restriction during the first wk after hatch can increase fat deposition in the breast muscle (Velleman et al., 2014b), but restriction of 20% during the second wk did not result in a difference in intramuscular fat or abdominal fat (Jalal and Zakaria, 2012; Velleman et al., 2014b). In addition, Butzen et al. (2013) showed that chickens provided 80% of ad libitum intake from 8 to 16 d of age do not differ in BW, feed efficiency, breast muscle weight, or fat content at 35 d of age compared to ad libitum fed chickens. They also showed that sex of the chickens was an important factor, as only feed restricted females had a significantly increased fat

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Student Evaluations of their Experience

- Approximately 50% of students reported high level of engagement
  - Lab provided great hands-on poultry experience
- 10% of students expressed disapproval of the project
  - Critical of unstructured learning
  - Unaccustomed to self-directed work

Industry Audience Reaction

"It's really great to see what the University is doing to train our future leaders"

"You never see that… during the question period after their presentation not one of them was distracted"

"To the person, everyone contributed impressively to the presentation"

Required Resources and Support

Project funding

Human resources

1. Graduate teaching assistant
   - Department standard: 1 per 20 students
2. Volunteer learning coach(es)
   - Undergrads who have taken the class before and ‘got it’

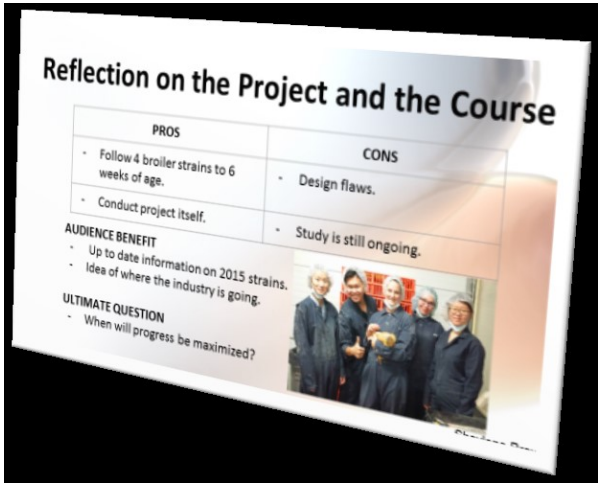
Teaching team role

- Data quality control
- Support, engage, coach, inspire students

Was it Worthwhile?

Pros

- Many students appreciated the hands-on learning
  - Rigorous systematic study
  - Practical poultry management
- Students worked together on all aspects of the project
- Students ‘owned’ the project, and audience noted their confidence and engagement



Cons

- Lab content scope narrows to a single research project
- Planning requirement
  - Funding
  - Ethics approval
  - Training
- Challenge to engage a larger class

Reflections

- Students self-reported their surprise and pride in what they accomplished
  - High impact story told fluidly by 13 to 29 people
- Smaller class (11 + 2) worked better

Next step

- Objectively quantify
  - Engagement
  - Confidence
  - Retention