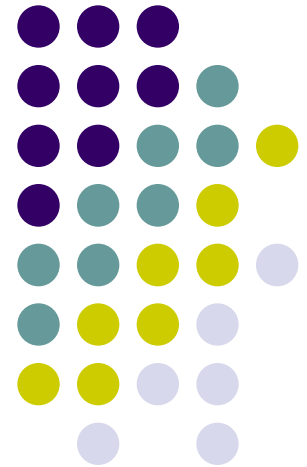


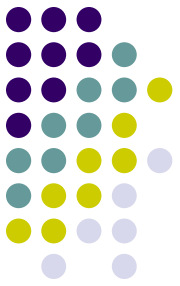
# **Working with Graduate Teaching Assistants (GTAs) and Undergraduate Peer Teachers (UPTs)**

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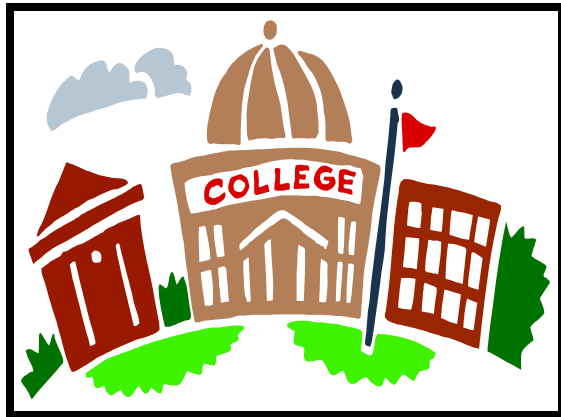
**Monica F. Cox, Ph.D.  
School of Engineering Education  
Purdue University**

**Christine Ehlig-Economides, Ph.D.  
Petroleum Engineering Department  
Texas A&M University**

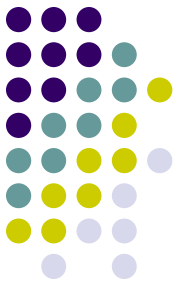




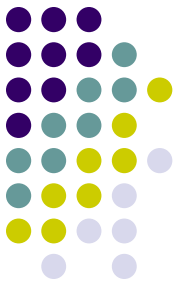
# Introductions



# Workshop Overview



- Presentation of UPT/GTA projects
- Advantages and disadvantages for engaging UPTs/GTAs
- Engaging UPTs/GTAs in student-centered learning
- UPT/GTA learning
- Supporting UPTs/GTAs and providing professional development opportunities
- Presentation of final “models” for incorporating UPTs/GTAs in courses



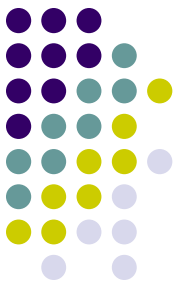
# **“Course Innovations as a Basis for Engineering Graduate Student Professional Development in Teaching”**

**NSF-Funded Project #0632879**

**PI, Monica F. Cox; Co-PI, Heidi Diefes-Dux  
Graduate Student Researcher, Rocio Chavela  
Undergraduate Student Researcher, Jeremi Hayes**

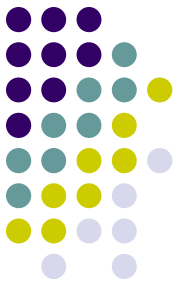
**Chavela, R., Cox, M.F., & Diefes-Dux, H. (2008). Development of a Pedagogically-Focused Course for Engineering Graduate Teaching Assistants. *2008 Proceedings of the American Society for Engineering Education.***

# Scope of Study and Research Questions

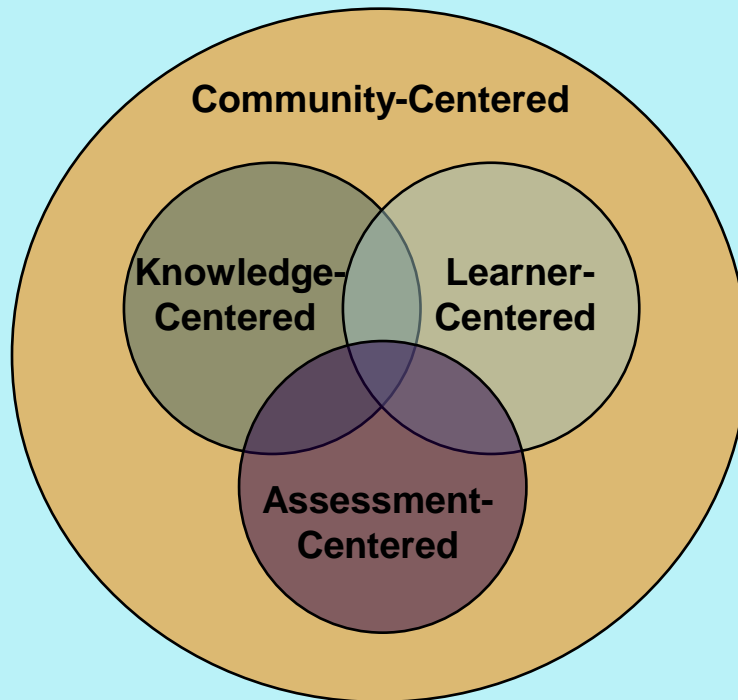


- **Creation of a pedagogically-focused graduate level engineering seminar for GTAs who have significant responsibilities for first-year problem solving and computer tools course**
  - Effective Teaching of Engineering: Linking Theory to Practice” (ENE 595G)- 1 credit hour
  - Based on elements of the “How People Learn” framework
  - Aligned with first-year engineering lecture and laboratory
    - GTA Responsibilities: supervise weekly 2-hour laboratory sessions, provide formative and summative feedback on students’ assignments, guide students through weekly tasks, design and grade quizzes
  
- **Use of qualitative and quantitative methods to explore engineering GTAs’ and first-year students’ perceptions about GTAs’ pedagogy within first-year courses**
  - To what extent does ENE 595G demonstrate principles of effective teaching and learning as described in the “How People Learn” framework?
  - How do feedback needs differ across engineering GTAs?

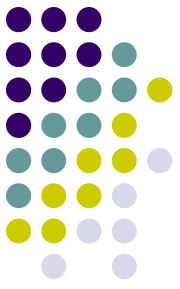
# Mapping of Seminar to HPL Framework



## HPL Framework



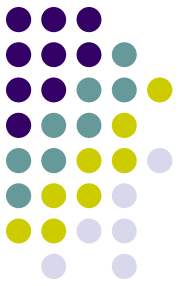
- **Community**- Achieved by building learning communities of graduate students and faculty interested in improving their engineering teaching using research-based strategies and innovations.
- **Learner**- Addressed by discovering what GTAs know about engineering teaching, curriculum development, undergraduate students, and drivers (e.g., ABET, resources, university and departmental goals and constraints).
- **Knowledge**- Achieved by applying course materials and ideas to GTAs' current and future teaching experiences.
- **Assessment**- Achieved by using formative and summative assessment tools to help GTAs reflect upon their applications of pedagogical innovations and strategies.



# Data Collection

- **Semi-structured One-on-One Interviews**
  - Purposeful Sampling (2 course enrollees, 4 additional GTAs)
  - Questions related to philosophies of teaching, experiences in the first-year course, and experiences in GTA seminar (if applicable)
- **Surveys**
  - Sent to approximately 400 students on-line (matched to interviewed GTAs)
  - Open-ended and closed-ended responses

# Preliminary Findings



## Metacognition

- “A lot of stuff... How hard it is to teach... I thought it is not that complex, but it has a lot of elements.”
- “The journal... I read back my journals ... I wonder why I did not start to write from the beginning that I started to teach ... that journal reflects a lot... put your thoughts just between you and your teaching and you can look back.”
- “This course made me to think seriously how to teach.”

## Sense of Community

- “There are so many good people out there who are teaching how to deliver effective teaching.”
- “It makes me happy that there are people who care. My other courses are so scientific and technical that these aspects are lost. I feel relief that you can express the things you believe are important apart from the research and structured work that you are doing every day. I look forward everyday to come to class.”
- “All the students enrolled in the course had this passion in teaching; they have the experience of teaching.”
- “You feel that you are not alone and these people are here to help me... that makes you feel like wow [...] You want these people to be around you to mentor you...”

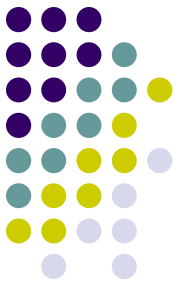


# **“Reading, Writing - Energy: An NSF CCLI Project to Enhance a Freshman Core Curriculum Natural Science Course”**

**NSF-Funded Project #0633321**

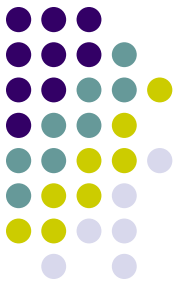
**PI, Christine Ehlig-Economides; Co-PI, Cathy Mariotti  
Ezrailson, Ramesh Talreja**

**Brooks, L., Yalvac, B., and Ehlig-Economides, C. (2008). Research on the Evolution of College Instructors' Perspectives of Teaching and Learning. *2008 Proceedings of the American Society for Engineering Education.***



# Reading, Writing - Energy

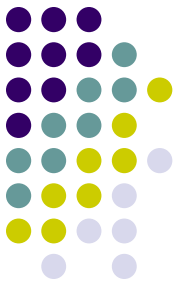
- ENGR 101: Energy: Resources, Utilization, and Importance to Society
- Core curriculum natural science elective for freshmen level and up
- Engineering outreach – course intended for both non-engineers and engineers



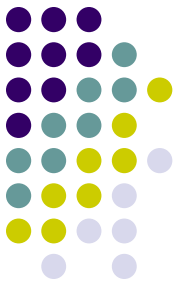
# Course Elements

- 3 lectures per week taught by professors and guest lecturers to all sections combined
- Weekly 2 hr recitation taught by UPTs and GTAs to small sections
- Quizzes on reading
- Current event and essay every week
- Semester long team project

# Course Pedagogy



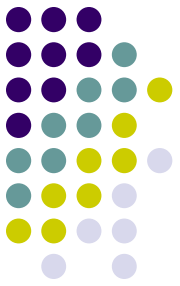
- Lecture dialog even with large class
- Student centered discussion during recitation
- Learning community at work
- Critical thinking skills development through discussion and writing



**What are your experiences working with UPTs and/or GTAs in your courses?**



# Advantages and Disadvantages for Engaging UPTs



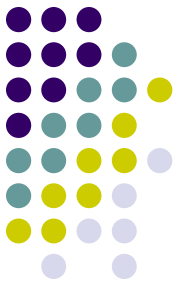
## ● Advantages

- UPTs cost less than GTAs, UPTs closer in age and have similar culture
- Students can gain better understanding of the content
- Can be paired with instructors
- Can work after hours to answer question
- Good mentors (comfort bet. Undergrads and UPTs)
- Motivated to be UPTs
- Using UPTs to modify curriculum

## ● Disadvantages

- Grading challenges- authority issues
- Could get burdened with grading
- Too close to the experience
- Vary in levels of content knowledge
- Upper level students might be more appropriate
- Scheduling conflicts and recruiting issues
- UPTs have unrealistic expectations about working in courses
- Misunderstanding by faculty about roles of UPTs
- Handling paperwork

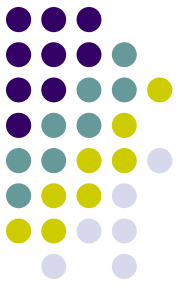
# Advantages and Disadvantages for Engaging GTAs



- Advantages

- Disadvantages

# Christine's Perspective (UPTs and GTAs)



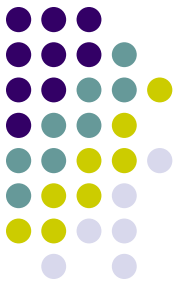
- Advantages

- UPTs have taken the course
- GTAs may be more mature
- Students are less inhibited by their peers

- Disadvantages

- UPTs and GTAs may have little teaching experience
- GTAs do not know the course content

# Monica's Perspective (GTAs)



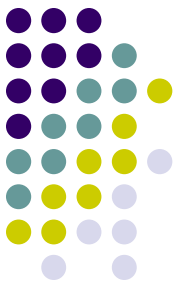
- Advantages

- Provide additional resources for students
- All parties have opportunities to learn from each other
- Workload within the course is distributed

- Disadvantages

- Teaching is often viewed to be less important than research.
- Most students have no prior experiences with pedagogy.
- It could be difficult for faculty to allow GTAs freedom within a course.

# Student-Centered Learning (Learner-Centeredness)



**Knowledge**

**Skills**

**Misconceptions**

**Learning  
Styles**

**Beliefs**

**Preconceptions**

*Problem-Oriented Question:* “Given what you know about muscle physiology, what two phenomena could explain her difficulty in running?”

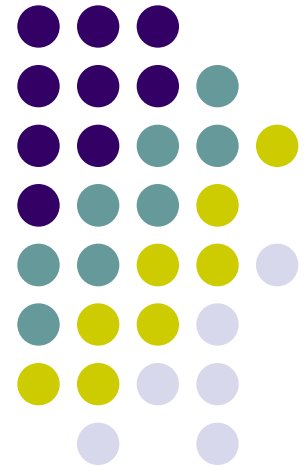
*Problem-Oriented Statement:* “Think about the muscles that you would use to pick up a child.”

*Prediction:* “What do you think would happen if we increased the amount of substrate in the model?”

# UPT/GTA Learning

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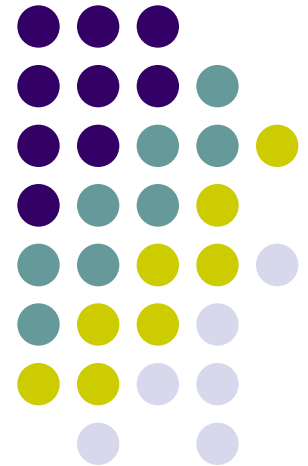
**How might we assess the content and/or pedagogical knowledge of GTAs and UPTs?**



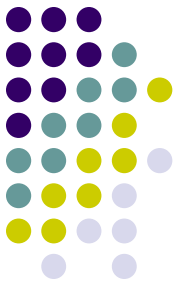
# Supporting UPTs/GTAs and Providing Professional Development Opportunities

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**Example**



# ENE 595G Objectives & Topics



## Course Objectives

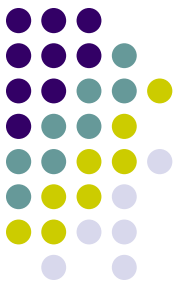
- Develop knowledge of effective teaching practices.
- Establish an engineering “community of teachers” during interactions with engineering faculty and peers.
- Produce personal deliverables that allow reflection upon relationships between pedagogy and engineering.
- Receive formative feedback about teaching within engineering courses.

Session	Topic
1	Course Overview and Discussion
2	Introduction to HPL Framework
3	Millennial Students Discussion
4	Formative Feedback Discussion
5	Introduction to Model-Eliciting Activities
6	Connections between HPL and MEAs
7	Curricular Discussion
8	Effective Teaching Session 1
9	Effective Teaching Session 2
10	Effective Teaching Session 3
11	Effective Teaching Session 4
12	Effective Teaching Session 5
13	Effective Teaching Session 6
14	Class Wrap-Up & Evaluation

# ENE 595G Course Assignments

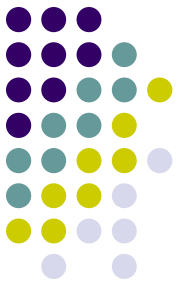


Assignment	Description	Purpose
<b>Weekly Journaling</b>	Brief reflection addressing a posed question.	Reflect on various aspects of GTAs' teaching experiences and interests and facilitate participation in class discussion.
<b>Teaching Philosophy</b>	Concept map and written statement concerning GTAs' teaching philosophy (beginning and end of the semester).	Articulate GTAs' beliefs about effective teaching practices in engineering.
<b>Reflection on Millennial Students</b>	Reflection addressing the following: Who are millennial students? How are you the same or different to millennial students? How do these similarities and differences affect teaching practices?	Develop awareness of how attitudes, beliefs, and behaviors of this particular generation affect their learning experience.
<b>HPL Analysis of Undergraduate Course</b>	Syllabus analysis using the dimensions of the HPL framework (beginning and end of the semester).	Recognize the importance of aligning curriculum design to a model of learning (HPL in this case).
<b>Faculty Interview</b>	Synopsis of a four question themed face-to-face interview with a faculty member within the about his/her teaching.	Create an opportunity for networking and answering questions that GTAs might have about teaching in general, teaching engineering content, faculty's preparation as teachers, etc.
<b>Journaling Synthesis</b>	Wrapping-up reflection addressing important aspects learned during the semester.	Foster metacognition and reinforce course objectives.



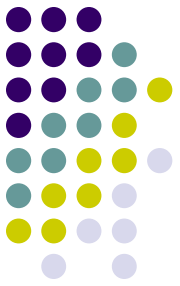
## Lessons Learned

- Course instructors had to ease students' apprehension about enrolling in such a course, since engineering students had not taken graduate level courses that required them to reflect upon their teaching and their views about teaching,
- The optional nature of the course meant that course enrollment was based upon students' intrinsic desires to reflect upon their pedagogical practices.
- This course was designed for a targeted group of GTAs, thereby reducing the generalizability of the course.
- Options for the course include the integration of current GTA training with course content.

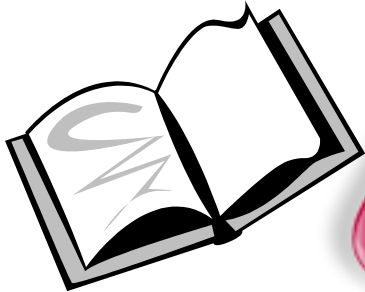
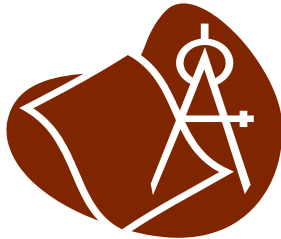


**How might you engage  
UPTs/GTAs in additional  
professional development  
activities?**



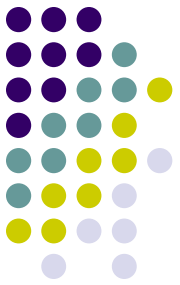


# Linkages



**UPTs/GTAs**





**What are you still  
wondering?**