



Physics GTA Preparation

Integrating physics, pedagogy, and professional development

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New Graduate Teaching Assistants (GTAs) need preparation for teaching

- First-time physics GTAs are very often novice teachers
- Research shows* that training which includes practice and feedback improves GTAs' confidence and self-efficacy, enhances their pedagogical content knowledge, and can result in the adoption of learner-centered teaching strategies
- Students in intro physics ($\sim 5000/\text{yr}$) spend half of their in-class contact hours supervised by GTAs = GTAs can have a HUGE impact on student learning outcomes!



* Otero & Alicea-Muñoz. "Research on the Development of Faculty, Graduate Teaching Assistants, and Undergraduate Learning Assistants". In The International Handbook of Physics Education Research: Teaching Physics. AIP Publishing (2023)



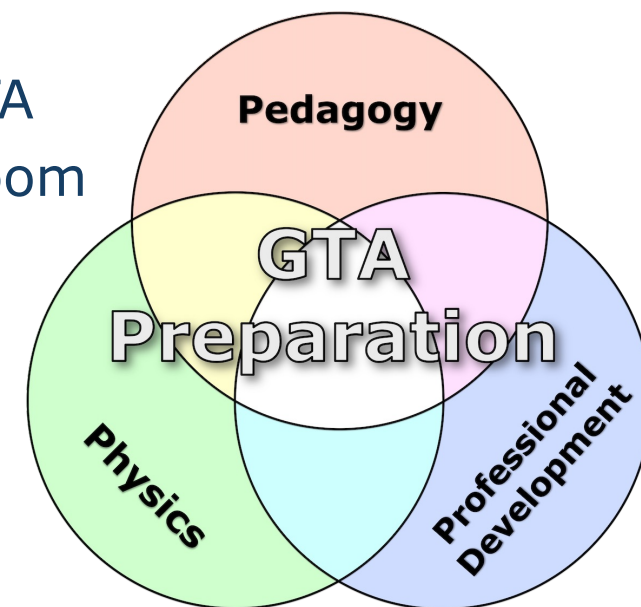
In the olden times, we had several problems with the physics GTA training

- “olden times” = before 2013
- Piecewise training, disconnect between pedagogy and content, lack of pedagogical reinforcement
- Lots of complaining, lack of motivation, especially since most of our PhD graduates leave academia
- **My goal:** to transform our old and ineffective ‘TA training’ into a robust and comprehensive professional development program for GTAs



The 3P Framework: A new perspective on Physics GTA Preparation

- We want GTAs who are **motivated** and **effective** teachers
- We also want to help GTAs develop **transferable professional skills** they can use outside the classroom
- **3P Framework** – to have a comprehensive program for GTA preparation that is useful and valuable for TAs in the classroom and beyond there must be full integration between:
 - **Pedagogy** – the methodology of teaching
 - **Physics** – content and PCK
 - **Professional Development** – transferable skills useful inside and outside academia



Orientation (before semester starts)

1. Introduction & GT Policies
2. Teaching Physics
3. Classroom Management
4. Lab Simulation
5. Microteaching

Follow-Up Meetings (during Fall semester)

1. Grading (3 sessions)
2. Midterm Evaluations & Time Management
3. Teaching Videos
4. Teaching and Research
5. Concluding Remarks

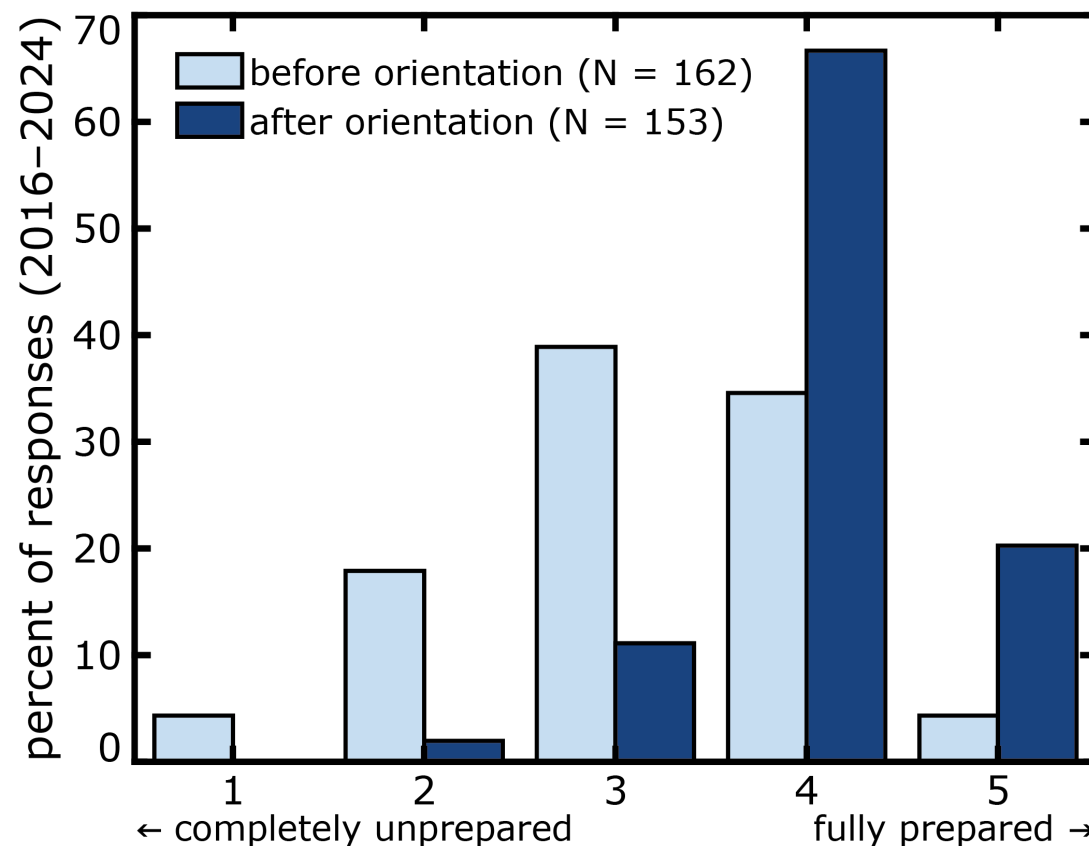
Out of class activities: Classroom Observations,
Workload Surveys, Mentoring Meetings



GTAs feel better prepared for teaching after going through the Orientation

“How prepared do you feel for your first GTA assignment at Georgia Tech?”

- Asked in an online survey before the Orientation, and again in a paper survey after the Orientation
- Very large effect size (Cohen's $d = 1.119$)

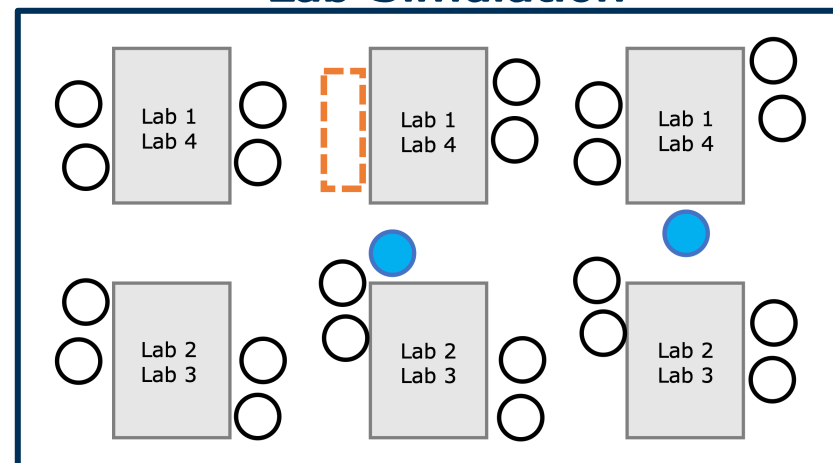


Alicea-Muñoz, et al, **under review** in Physical Review PER (2025)



GTAs appreciate hands-on activities, opportunities for practice and feedback, and developing PCK

Lab Simulation



Novice vs Expert

Categorization and Representation of Physics

Physics Education Research shows...

Intro Physics learning gains using Force Concept Inventory (FCI)
14 courses, 2084 students

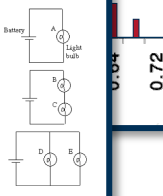
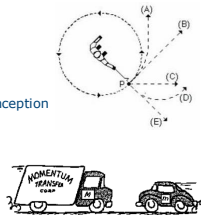
Hake, AmJPhys, 66, 64 (1998)

Addressing Misconceptions

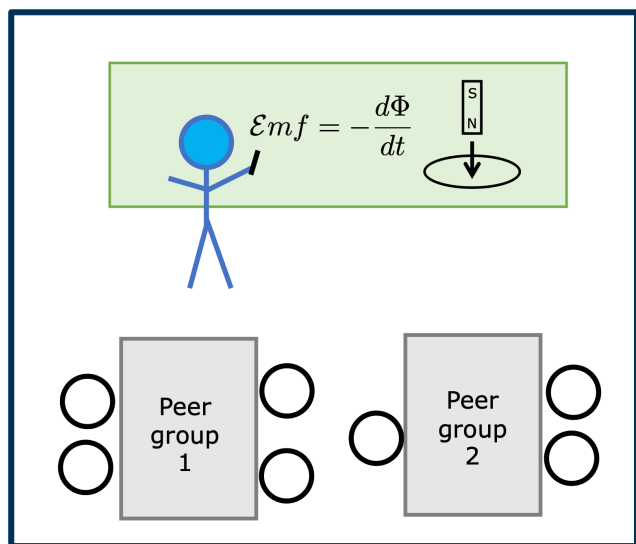
- Split up into three groups to work on these examples (for 10 minutes):
 - Example 1 (FCI)
 - Example 2 (FMCE)
 - Example 3 (BEMA)

- Think of **reasons** why students would pick the incorrect answers (what misconception do they have?)

- Come up with ways to **address** the misconceptions



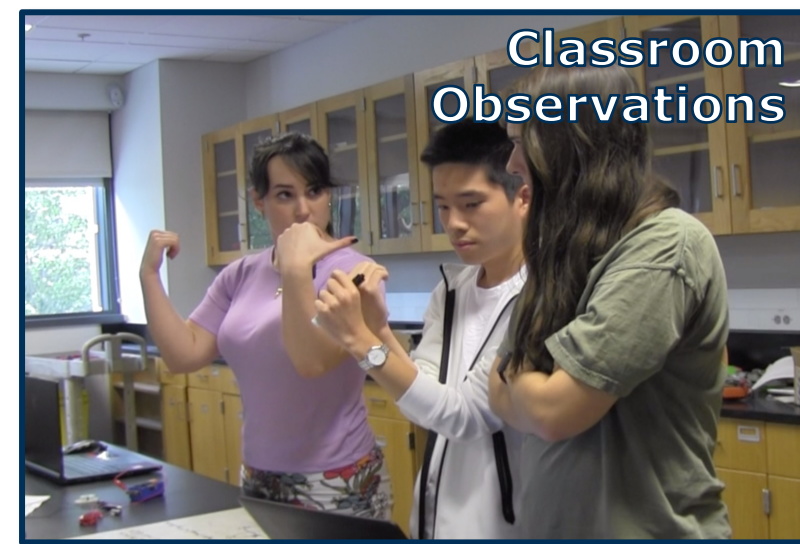
Georgia Tech



Microteaching

Teaching Physics

Classroom Observations



Alicea-Muñoz, et al, Physical Review PER 17, 020125 (2021)
Alicea-Muñoz, et al, **under review** in Physical Review PER (2025)



Additional takeaways (not enough time to give you the details!)

- Over 270 physics PhD students have gone through this program since 2013
- First-time GTAs consider teaching to be an **important** part of their professional development, and are **concerned** about **content mastery** and **time management**, among other things
- GTAs **feel better prepared** for teaching after participating in GTA preparation, adopt more **learner-centered** teaching approaches, and their students consider them **effective teachers**

Scan here for my **GTA prep research** (papers, posters, presentations; current as of early 2025),
and all my **GTA prep materials** (slightly outdated, pre-pandemic)



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