



# Graduate Teaching Assistant Development via the MAA Instructional Practices Guide

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# Outline

- Motivation: GTA training
- Structure of the course
- Calendar, activities, reflections



# Motivation

- 7 characteristics of successful calculus programs: *Effective training of graduate teaching assistants.*
  - “The most successful universities have developed extensive programs for training, monitoring, and supporting these instructors. Running a successful training program is not a task that can be handed off to a single person. ***While there is always one coordinator, their effectiveness requires a core of faculty who are willing to participate in the graduate students’ training that takes place before the start of the fall term and to assist in visiting classes and providing feedback.***” (Bressoud & Rasmussen, 2015, p.145)
- Prior research: Speer et al. (2005), Hauk et al. (2009), Gutmann (2009), Kung & Speer (2009), Kung (2010), Raychaudhuri & Hsu, 2012, etc.



# Structure of the Course

- One credit, required course in Ph.D. program
- First year graduate students to graduating ones
- Met once a week for 50 minutes over 15-weeks
- Requirements: Reading (IP Guide and TRU Framework) assignments; Writing Assignments (5 reflections and teaching statement and equity statement); Two observations and follow up meetings



# Course Goals

- Graduate students will:
  - Understand and discuss issues related to teaching mathematics at the post-secondary level reading through policy documents and research studies offered by certain agencies.
  - Compare and contrast how we might resolve issues in the post-secondary level mathematics classroom.
  - Reflect on our own teaching through a teaching philosophy statement.



- **Required Reading:**

- The Mathematical Association of America (M.A.A.): The Instructional Practices (IP) Guide (2017):

<https://www.maa.org/programs-and-communities/curriculum%20resources/instructional-practices-guide>

- Mathematics Assessment Project (MARS)- TRU Framework:

<http://map.mathshell.org/trumath.php>

- ***Additional Resources***

- The Conference Board of Mathematical Sciences (CBMS): <https://www.cbmsweb.org/the-mathematical-education-of-teachers/>

- Video Cases for College Mathematics Instruction:

<http://www.collegemathvideocases.org/home/index.php>

- Academy of Inquiry-Based Learning: <http://www.inquirybasedlearning.org/>

- AMS Blogs

- Inclusion/Exclusion: <https://blogs.ams.org/inclusionexclusion/>

- On Teaching and Learning Mathematics:

<https://blogs.ams.org/matheducation/>



# Topics

- **Week 1**-First week of the classes, setting norms
- **Week 2**- (pages 4-18) Intro: Manifesto, Wait Time, Student Engagement and Office Hour(added)
- **Weeks 3-6**: Classroom Practices cont'd
- **Weeks 7-9**: Assessment (Formative & Summative Assessment)
- **Weeks 10-13**: Design Practices and TRU Framework
- **Week 14**: Equity
- **Week 15**: Reflections



## Before semester started

- Read the ideas on the following blogs for your Week 1 teaching and try to implement an idea from these blogs. It doesn't have to be exactly the same idea, you may modify it as you wish and as it fits in your course level and coordination requirements. (FYI-there are many ideas listed and I know there exists at least one that you can modify and do in your class during the first week)

(a)

<https://www.artofmathematics.org/blogs/vecke/the-first-class-of-the-semester-setting-the-stage>

(b) <http://danaernst.com/setting-the-stage/>





# Week 1 Reflection Assignment

1. What are **your** objectives for your students in the course you teach this semester? (Please note that these objectives might be the additional ones than the course content goals and might be different from course coordinators/textbooks.)
2. What teaching ideas/practices do **you** want to work on this semester? (I.e., what do you want to try or implement or improve, etc. in your teaching?)
3. Which idea or ideas did you implement from blog posts in your class during first week? (Make sure to explicitly state which idea and from which blog. Also, you may have taken an idea and modified it to your class, so explicit explain what you changed and why.)
4. How did this implementation go? How will you change it for future teaching?



# Reflection #1

3. From [Discovering] the Art of Mathematics [website] I took the idea of “jump right into activities” and had the students work on some mathematics on the first day. From Dana C. Ernst [blog] I took the idea of having students discuss the following questions:

- What are the goals of a university education?
- How does a person learn something new?
- What do you reasonably expect to remember from your courses in 20 years?
- What is the value of making mistakes in the learning process?

I followed the suggest directions of having students think of an answer on their own, then discuss with their group, then share a summary with the class.



## Every week: Reflect

- Weekly
- Submit or bring to class (one or the other version)
- Not a technical writing! Weekly Journaling for yourself.



# **WEEK 4: Bring a task to class and read IP Guide pages 40-51 and bring your answers to**

- What did you notice/wonder?
  - What are some vocabulary/phrases you noticed in the reading? (E.g., “low-floor high-ceiling” task)
- How does your task fit in the various categories described in this reading?
- How can you “improve” your task?



## Every week: “MEET”...

Most visitors to the program thought that the heart of our project was group learning. They were impressed by the enthusiasm of the students and the intensity of their interactions as they collectively attacked challenging problems. But the real core was the problem sets which drove the group interaction. One of the greatest challenges that we faced and still face today was figuring out suitable mathematical tasks for the students that not only would help them to crystallize their emerging understanding of the calculus, but that also would show them the beauty of the subject.

(Triesman: **Emerging Scholars Program**)

Treisman, U. (1992). Studying students studying calculus: A look at the lives of minority mathematics students in college. *The College Mathematics Journal*, 23(5), 362-372.



# Every week: "MEET" ...

## Meet Dr. Uri Triesman

- <http://www.utdanacenter.org/about-us/staff/p-uri-treisman/>

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### The Charles A. Dana Center

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### Philip Uri Treisman, Ph.D., Executive Director

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Philip Uri Treisman is a University Distinguished Teaching Professor, professor of mathematics, and professor of public affairs at The University of Texas at Austin. He is the founder and executive director of the University's Charles A. Dana Center, an organized research unit of the College of Natural Sciences.

Uri is active in the leadership of organizations working to improve American mathematics education. He is a founding member of Transforming Post-Secondary Education in Mathematics ([transformmath.org](http://transformmath.org)) and serves as the representative of



### News

**Introducing MathCuts: Quick, engaging strategies for classroom teachers**

"As a math teacher, taking time to engage in meaningful professional learning wasn't always possible," said Michael Greenlee, MathCuts author...

**Teacher Advisor With Watson adds Inside Mathematics resources**

Inside Mathematics continues to gain recognition as one of the leading producers of quality free mathematics instructional resources for teachers. Teacher...

**Mathematics Launch Years Toolkit**

The Mathematics Launch Years Toolkit consists of briefs intended to support districts and higher education systems in streamlining students' transition...



# How to Select an Appropriate Mathematical Task

- Do I have clearly-stated and concrete learning objectives defined for the lesson in which the task is going to appear, and do students have access to those objectives?
- Does the task align with my learning objectives?
- Do I have actionable information, based on formative assessment or surveys, about my students' motivations, attitudes, and mathematical readiness for the task?
- Based on that information, does the task meet students at their level of expertise (not too easy, not too hard) and at their level of readiness (they are prepared to do the task apart from having the right level of expertise) and motivation (students have a reason to perform the task apart from extrinsic rewards and punishments)?
- Is the task well-constructed in terms of building students' intellectual development, competence, and autonomy? Does it leverage the social context of the class to promote relatedness?
- Is the task suitable for the physical environment of the class meeting?
- Is the task suitable for the mode of instruction (face-to-face vs. online)?



## Choosing Meaningful Group-worthy Tasks

Characteristics for academically challenging, intellectual, and rigorous tasks

- (1) Open-ended, productively uncertain, and require complex problem solving;
- (2) Provide opportunities for students to use multiple intellectual abilities to access the task and to determine intellectual competence;
- (3) Address discipline-based, intellectually important content; and
- (4) Require positive interdependence and individual accountability.





# What do you think about this task?

- <https://bookwalk.app.box.com/s/jh6usftggxytjnyhqde2>

## Calculus 1 Worksheet 15

1. Suppose  $f'(x) = 3x^2$ . What could  $f(x)$  be? Check your answer. Are there other possible answers?
2. Suppose  $g(x) = x^5$  and  $f'(x) = g(x)$ . What could  $f(x)$  be?
3. When  $f'(x) = g(x)$  for all  $x$  in an interval  $I$ , we say  $f$  is the *antiderivative* of  $g$ . Find antiderivatives for the following functions.  
(a)  $x^5 - 3x^2 + 1$       (b)  $2 - \frac{5}{x^2}$       (c)  $\frac{1}{2\sqrt[3]{x}}$       (d)  $\frac{2}{x}$



# Additional Resources

- <http://www.collegemathvideocases.org/>

The screenshot shows the homepage of the website 'Video Cases for College Mathematics Instruction'. The header features the title and a navigation menu with links for HOME, CASES, ESSAYS, RESOURCES, and INFORMATION. Below the navigation, there is a main content area with a description of CASES and a list of video cases. On the right side, there is a sidebar titled 'Video Cases' with a note about viewing the start page.

Video Cases for College Mathematics Instruction

HOME CASES ESSAYS RESOURCES INFORMATION

CASES are 40-60 minute activities rooted in video vignettes from college math classes or office hours; case materials include Facilitator Guide for the person leading the case activity.

**The First Day of Class**  
Establishing classroom norms and setting the tone for learning in class using various first-class-meetings of instructors from calculus, college algebra, liberal arts mathematics.

**Facilitating Group Work**  
Unpacking the communication as instructors work with student groups in calculus.

**Inside the Group**  
Exploring student thinking through a look at one student group working on a newly introduced calculus concept: anti-derivative.

Video Cases

Video case start page can be viewed by clicking the picture to the left of each title.

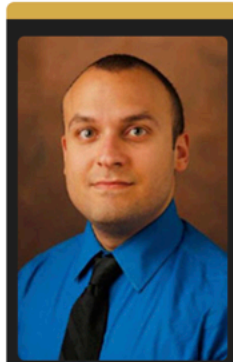


# Every week: “MEET”...



## Meet Dr. Luis Leyva

- <https://peabody.vanderbilt.edu/bio/luis-leyva>



### Contact Information

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## Luis A. Leyva

Assistant Professor, Mathematics  
Education, Dept. of Teaching & Learning



### Research



## Week 2- Extra Topic-Office Hours

- Time to greet and get to know your students more in an "safer" environment,
- Make sure that you announce it as a time that you specially reserve for them to get to know them (rather than time for to get help).
- When they visit you in your office hour, make an effort to know them, at least their mathematical background.



# Assessment

- Where does your exam question fit? p.86 of IP Guide

		Cognitive Process Dimension					
		Remember	Understand	Apply	Analyze	Evaluate	Create
Knowledge Dimension	Factual						
	Conceptual						
	Procedural						
	Metacognitive						



# Exit Ticket

- One thing I learned today is...
- One idea that I will try in my course is...
- One idea I would like to learn more about is...



# Observations

- Before week 5:
  - I would like it if you could tell me if you think that I am conducting my classroom in an equitable manner and if I am giving appropriate wait time to students.
- Meet after and discuss notes



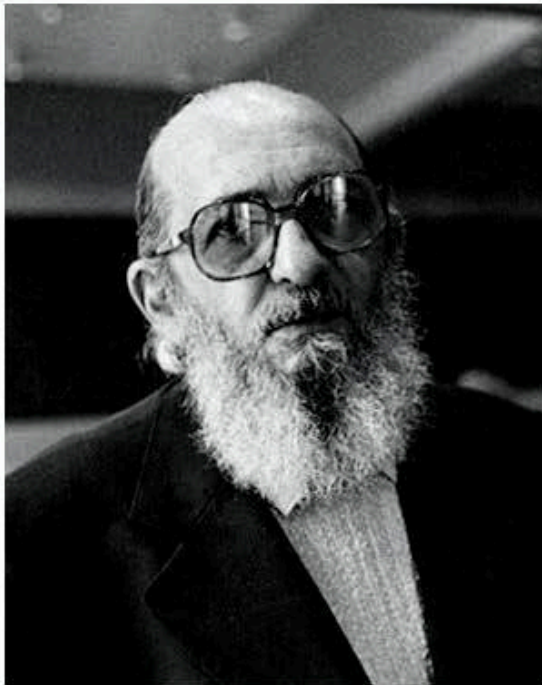
## ***End of Semester: Reflection/ Feedback***

- “Reflection without action is sheer verbalism or armchair revolution and action without reflection is pure activism or action for action’s sake” (Freire, 1970, p. 149).





## Meet *Prof. Paulo Freire*



No one educates anyone else  
nor do we educate ourselves,  
we educate one another in  
communion in the context of  
living in this world.

~ Paulo Freire



# From Students

“Throughout the semester, I have had my ups and downs when teaching statistics this semester. It was my second time teaching statistics, but the first time I tried to utilize group work with the students... First, the students’ buy into the course structure and style did well for the 12:20 class, while the 11:15 class had some buy-in, but not much. I tried over the next couple of weeks to improve the buy-in, but missing the Wednesday and Friday of the first week hindered that. This has shown me I need to better build the norms for the class on the first day of class. I need to allow students to share how they want to learn, but also let them know that I want them to also work on some group work throughout the semester. “



- “The IP Guide taught me that equity is a process not an end goal. I would like to continue to work on fostering a safe environment for my students, so they feel comfortable sharing their partial understanding, communicating openly with their peers, and building on each other’s knowledge. The IP Guide taught me that participation in my classroom is swayed by the allocation of authority, status, and power in the classroom. So, one thing that I have been working on is purposefully giving student’s credit for their mathematical ideas. For example, I always refer to a mathematical step by the person who suggested it (i.e. Molly’s step or Karl’s idea). By doing this I am hopefully distributing the mathematical power to the students.”



# Future Reflection for IP Guide

- “Moving forward I want to think more deeply about how I structure my class. I am planning on implementing some of the ideas from the Design Practices section of the IP guide. This section has many questions that I find thought provoking and useful. Over the course of this last semester I did not often engage in the type of thought full planning that the IP guide recommends. In part this is due to teaching a coordinated course. This meant that much of the design thinking had already been done by someone else.”



**THANK YOU!**

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