

## CoMInDS Program Profile: Duke University

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**Program Snapshot:** A one-semester seminar program for first-year mathematics graduate students prepares them for teaching at Duke and beyond. The seminar is supported by practice teaching and faculty observations in the subsequent term, so that participants are well prepared when they begin teaching as instructors of record.

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### How did the program originate?

The program is long-established, founded in 1987 in order to increase teaching quality in mathematics and reduce the frequency of complaints about instruction by graduate teaching assistants (GTAs).<sup>\*</sup> For many years, the seminar was a non-credit course but was later formalized as a graduate credit-bearing course to provide GTAs with transcript evidence of their teaching preparation and to encourage them to take the course seriously. Graduate students perceive that their post-graduate job prospects are aided by Duke's reputation for strong GTA preparation, and by their own learning from the course and their graduate teaching experience.

TA preparation began at Duke about the same time as the department was also embarking on Project CALC, a major reform of its calculus courses in the late 1980s (Bookman & Blake, 1996). The project sought to develop students' skills in using mathematics to understand and investigate questions in the world around them; use calculus to formulate and solve problems and communicate their solutions, using technologies appropriate for the task; and work cooperatively with peers. While some aspects of the reform have been scaled back or modified since the early days, small class sections and project-based laboratory sessions continue to be staples of Duke's calculus program. In the lab sessions, undergraduates do activities or analyze information on real-world phenomena, develop ideas and model them mathematically, then explain their work in writing. The special demands of this student-centered format mean that preparing graduate students for their teaching roles is important for the calculus program's success.

### What is the scope of the program?

- All first-year graduate students take the course, about 10 doctoral students per year.
- Most first-year TAs lead or assist with a calculus lab in the fall term and do not have a teaching role in the spring. Most second-year students teach their own calculus section as instructor of record.

<sup>\*</sup>Here the term graduate teaching assistant (GTA) includes all graduate students holding or preparing for teaching roles. Local terminology may differ.

### **How is the program staffed and funded?**

- The seminar course is taught by one teaching-focused faculty member who holds an appointment as professor of the practice (PoP). The seminar is part of the PoP's regular 4:4 teaching load. A teaching-focused colleague or senior graduate student may co-teach.
- Each of the four PoPs also teaches calculus sections and serves as course coordinator for the specific course he or she is teaching, for example running weekly meetings with both calculus instructors and lab TAs. In this way, coordinating and observing GTAs is part of their teaching load for that course, and is not regarded as an extra burden.

### **What are the main components of the program?**

The seminar course counts the same as other math graduate courses and is offered annually in the fall term. Meeting two or three times per week for 50 minutes, the course includes a mix of formal presentations, GTA presentations, and group activities. Topics include lesson planning, calculus course content and calculus lab expectations, writing and grading tests, and practice teaching. For example, instructors share information about Duke students and national trends in student background and diversity, and a guest expert provides training on implicit bias.

Students practice a variety of teaching tasks, and class time is spent giving and getting feedback on them: developing a lesson plan; preparing a grading rubric and then applying it to sample student work; writing assessment items; presenting a concept to students. Out-of-class assignments include reflections and readings. The course introduces GTAs to active learning but does not directly espouse a preference for active learning approaches. The GTAs are working in calculus labs at the same time, thus they are having experiences with students and course content that help to make the seminar content relevant and immediately useful. One popular session includes a panel of experienced GTAs who offer reflections on how the seminar material connected to their own later teaching experiences.

The seminar course is supported by several components that together form an integrated program of support:

- *Training week.* All GTAs participate in this orientation at the start of the school year. New graduate students are provided an orientation to the job that most will have initially, leading calculus labs and working in the calculus help room. Other sessions briefly address classroom interactions, grading, and expectations for the TA role, and introduce TAs to the specific course and instructors where they are assigned.
- *Practice teaching.* In the spring term, first-year graduate students plan and teach two lessons as guest instructors in calculus. Faculty observers provide feedback on the practice lessons, using a succinct but structured evaluation form with open-ended items on the lesson plan, the classroom atmosphere, and students' behavior, and sliding scales

for rating fundamentals such as eye contact and public speaking. If problems are perceived, another observation and feedback loop follows before the GTA is assigned as an instructor of record. Some second-year students may be assigned to support calculus labs again; for example, international GTAs who are still gaining English fluency.

- *Faculty observation.* Once GTAs start teaching their own calculus sections, they are each observed by a PoP faculty member and provided feedback. Additional coaching and feedback may be provided if the observer has concerns.
- *End-of-course evaluations.* At the end of their first semester as instructor of record, GTAs review their end-of-course evaluations from students, then write a self-evaluation of their strengths and weaknesses and ways to improve. These evaluations together are discussed by the GTA and the supervising PoP. If there are no major problems, their training is complete.

### **What aspects of this program make it work in the local institutional context?**

- *Autonomy:* The PoPs have high autonomy over GTA development and teaching assignments, and this is linked to their work in the undergraduate calculus sequence. With four people in this role, the PoPs form a “critical mass” who can consult with each other and work as a team.
- *Modest numbers* of graduate students mean it is possible for the PoPs to provide individualized, hands-on support and “keep tabs” on GTAs.
- *Departmental culture:* The department is viewed as culturally supportive of good teaching. Positive faculty attitudes and messaging from faculty who serve as ‘mentors’ of first-year graduate students are felt to encourage GTAs to take teaching seriously.

### **Leaders’ advice about this program model**

- Interacting with new GTAs over a full semester course allows the seminar instructor to learn about GTAs’ attitudes, skills, values, and beliefs about students. This knowledge helps the PoP team to make assignments for the GTAs’ initial teaching experience: for example, GTAs who are observed to be particularly patient may be a good fit for the half-paced calculus course targeted to undergraduates without prior calculus background.
- The current program benefited from a strong base of experience from its founding developer, Jack Bookman, who shared his materials and experiences freely but also supported later PoPs to adapt the program to their own ideas and changing circumstances.

**Where can I learn more?**

Duke Department of Mathematics (2017). Training for Teaching Assistants.

<https://math.duke.edu/graduate/teaching-assistant-training>

Resources from this program are available on the CoMInDS Instructional Resource site, <http://cominds.maa.org/instructional-resources> Search by contributor (Bookman, Braley, Schott) to find them. Some items of interest:

Syllabus for “Teaching College Mathematics” at Duke University. Emily Braley & Sarah Schott. <http://cominds.maa.org/instructional-resources/browse-instructional-resources/syllabus-%E2%80%9Cteaching-college-mathematics%E2%80%9D-duke>

Writing Exams, In Class, Discussion Guide. Jack Bookman. <http://cominds.maa.org/instructional-resources/browse-instructional-resources/writing-exams-class-discussion-guide>

Class Observation Evaluation Form. Jack Bookman. <http://cominds.maa.org/instructional-resources/browse-instructional-resources/class-obervation-evaluation-form>

**Sources cited**

Bookman, J., & Blake, L. (1996). Seven years of Project CALC at Duke University - Approaching steady state? *PRIMUS*, 6(3), 221-234.

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