On-the-Job Teacher Training[6]

The training of teaching assistants is something most of us have taken part in during our early career. As graduate students we did this first as participants, and then perhaps as mentors. Later, as faculty members, we may help run or even design such programs in our departments. Teacher training activities in universities are not static, but evolve over time, and are influenced by similar programs in other departments or schools.

In this article, Doris Gluck and Herman Gluck talk about teacher training programs from kindergarten through college, and compare their methods. Besides the fact that these types of programs have common goals, some of the students we train for university-level teaching may later become involved in teacher education and training at the K–12 level.

Doris Gluck has been a math coordinator in several private schools in the Philadelphia area and has run workshops on elementary math teaching in local schools, as well as at state, regional, and national conferences for teachers. She is a winner of the Mathematical Association of America's Edyth May Sliffe Award for Distinguished Mathematics Teaching. Herman Gluck is a professor in the math department at the University of Pennsylvania and for the past 15 years has helped to organize and run the annual teacher training program there.

Who participates in your programs?

Herman: Our participants are mostly first- and second-year math grad students who will then serve as TAs. There are also advanced undergrads and grad students from other departments, and very recently, incoming math lecturers/postdocs, who are teaching for the first time since their graduate student days.

Besides myself, our trainers include another faculty member and five Master Teaching Assistants, experienced math graduate students selected for their outstanding performance as teachers and for personality traits which lead us to believe that they will be good mentors for our beginning teachers.

Doris: The teachers I work with, who have already been on the job for a number of years, usually teach all core subjects. They go into teaching for a variety of reasons, such as love of children or love of reading, but rarely for a love of math. Unlike Herman's group, I am usually the only trainer and organizer.

How are your training programs structured?

Herman: There are two parts to the teacher training program at Penn: a two-day total immersion just before classes begin and follow-up throughout the fall semester, involving classroom visits, filming of our teachers in action, and discussion afterwards.

The intensive two-day training period begins with demonstrations by our Master TAs of various ways to run a calculus recitation, and then continues with practice teaching in small groups. The training ends with a large group meeting where the Master TAs discuss many practical aspects of teaching, such as coordinating with the professor in charge of the course, keeping records, holding office hours, handling student concerns, and helping students in distress. For difficult issues, new teaching assistants are advised to "dump it on the professor."

The follow-up portion begins a couple of weeks later with visits by the Master TAs to the first-time teachers in their classrooms, and with discussions later that same day. Shortly thereafter, these teachers are filmed while teaching, and each then watches the film with one of the Master TAs. Seeing oneself in action is a powerful learning tool, especially after pausing many times for discussion.

Later in the semester, the math department holds a luncheon for all the program participants and many faculty, with wide-ranging unstructured discussion of various issues in the classroom. The faculty often jump-start this discussion by saying aloud what problems they are facing in their own teaching, and, with a little encouragement, the new teachers follow suit.

We often suggest to new teachers that they visit some of our most successful experienced teachers in their classrooms, with an eye to seeing what they do, and what may be worth trying to incorporate into their own teaching style.

Doris: The professional development I do depends on the needs of the school district or school at that particular time. It could focus on specific mathematics topics for all teachers, and is sometimes triggered by the adoption of a new curriculum.

As follow-up, I schedule individual or small group meetings with teachers monthly or more often. This is a time when we can discuss implementation of new programs or ideas, as well as problems that the teachers may be having in the classroom. We also discuss what's going to be happening in their math instruction the following few weeks. This can be as explicit as working through individual mathematics problems, or as general as discussing the overall goals of the next unit.

I aim to have teachers feel that they are in a risk-free environment when they are working with me, so that they are comfortable sharing mistakes and questions about

[6]*Doris Gluck is a former classroom teacher and math coordinator for elementary grades in the Radnor Township School District. Her email address is* dgluck@math.upenn.edu.

[6]*Herman Gluck, a professor at the University of Pennsylvania, works on geometry and topology with applications to molecular biology, hydrodynamics, and plasma physics. His email address is* gluck@math.upenn.edu.

DOI: https://dx.doi.org/10.1090/noti1918

content and delivery. At the same time, I am modeling the kind of environment I hope the teachers will carry over to their own classrooms.

How do you address teacher attitude and classroom atmosphere?

Herman: At the beginning of our training program, we say to the participants, "Have fun teaching and let it show! Genuinely care for your students, and let it show! If you don't yet have fun teaching, figure out how to. If you can't figure out how to, then fake it. The attitude you bring to the classroom and the atmosphere you create there is half the job of teaching."

And we continue by saying, "Be respectful of your students and their insecurities, and work very hard to create a risk-free environment for them. Do this by encouraging questions, and follow up by saying something positive about every question and every answer."

Doris: The math requirements for an Elementary Education Certificate are minimal in most universities. Many teachers feel unprepared and lack confidence in their ability to teach mathematics as a meaningful and thought-provoking subject.

I agree with everything Herman said, but rather than stating these things to my participants, I model them. I ask these teachers to do the activities and games as if they were a first grader or a fourth grader, and later we discuss how they felt, what they learned, and how they could adapt these activities for use in their own classrooms.

What are the anxieties and pressures felt by students and teachers?

Doris: The term "math anxiety" is used so often by math educators that it is easy to lose sight of just how awful it feels to those who have it: a kind of mental congestion which impedes thought and expression, and which involves tension, apprehension, nervousness, and worry.

Math anxiety can be thought of as a diffuse fear of math-related problems, impacting both children and adults, teachers, and parents.

When a person has math anxiety, working memory comes to a halt. Adults with math anxiety often transmit this fear and aversion to the children they work with. Children can develop math anxiety after having a bad experience, such as freezing when asked a question, or while taking a timed test in a math class. These experiences can lead to a more general fear of all mathematics.

No other subject is taught where every child is expected to learn the exact same thing in the exact same time. Reading is taught in small groups and children can often choose their own books; in writing, students write their own papers and no two students are expected to write in the exact same way. However, we often teach math to the entire class and expect every student to do the same problems and to memorize the same facts in the same time frame. Why wouldn't students who are struggling become anxious?

Herman: I can see two kinds of math anxiety among the students at Penn.

The first seems to me a continuation of what Doris described.

The second kind of anxiety hits strong math students when, for the first time, there is a creative, discovery-oriented component to the course. The students have to figure out why things are true, and back this up with well-reasoned arguments. Deeper thought is required. But there is a randomness to getting good ideas, and students who were best in their high school classes, who were the first to answer almost any question, may find themselves mute and trying to think, while other students are already answering the question. This is a humbling experience, which can lead to self-doubt.

I think we do not pay nearly enough attention to math anxiety at the college level. At Penn, we could do a better job in our teacher training program by candidly discussing math anxiety and ways to respond to it.

I am also aware of some of the pressures that our teachers, especially the beginning ones, feel. There is the pressure to do a good job in the classroom because you will be observed and judged by older faculty, who will later write a teaching recommendation for you when you go on the job market. There is the pressure to keep up with the pace of the curriculum, so that the students in your section are well equipped to deal with a common final exam. There is also the pressure to deal well with difficult students, but without the background experience to help you do this. With all these pressures, it's not so easy to relax and let your best self shine through, and create the kind of classroom atmosphere that puts students at ease and helps them to perform at their best.

Doris: Although some of the pressures felt by elementary school teachers, such as pacing of the curriculum or dealing with difficult students, may be similar to those mentioned by Herman, there are a number of other pressures we encounter.

Classroom teachers are answering to many other people: administrators, teachers at the next grade level or next school, and also parents. The expectations from each group are often very different, and can be mutually contradictory.

These are topics that should be brought up in training sessions, but often are not.

How do teachers and students share the responsibility for learning?

Doris: I sometimes think of the elementary school environment as a petri dish, and it is the responsibility of the classroom teacher to provide the nutrients for student growth. Students come to school curious about everything.

It is up to us, as teachers, to provide the activities and the problems that help them explore, discover, and construct their own understanding and learning.

When we present concepts and skills too slowly or too quickly, students lose that curiosity. If we go too slowly, they become bored and uninterested. If we go too quickly, they become confused and begin to lose confidence. Neither atmosphere provides for optimal intellectual growth.

It is the responsibility of teachers of young students to present material "just right": not too slowly and not too quickly. When this is done well, students become more confident and more independent. They are able to make appropriate choices to help themselves continue to learn.

This is made possible by teachers who understand the varying academic and developmental levels of their students, and have the flexibility to adapt the curriculum to meet their needs. Questions can be asked in such a way that students can answer correctly at many different levels of sophistication. This is sometimes called "differentiated teaching," and one way it can be achieved is by adapting lessons so that the students are given a variety of assignments with a range of degrees of difficulty.

Given that elementary math teachers, just as their students, are at many different academic and developmental levels, I must create an atmosphere in my workshops much as I would hope to create in a classroom of my own: risk-free, differentiated, and with choices.

Herman: As students get older, they naturally take on more and more responsibility for their own learning.

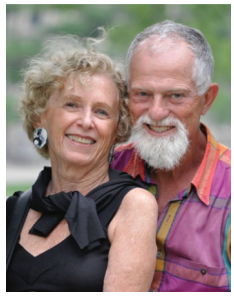
For math students at Penn, we get one view of how the division of responsibility evolves by simply counting hours that students spend on courses outside the classroom: perhaps 6 to 10 hours per week in freshman calculus, going up to 10 to 15 hours per week in more advanced classes.

As the mathematical level of the courses goes up, there is an increased emphasis on helping the students grow in mathematical power: the ability to successfully tackle problems of increasing complexity for which there may be no prescribed algorithm or strategy to lead to a solution. This mathematical power means the ability to purposefully hunt for and discover new mathematics, the ability to communicate this new understanding both in writing and in speech, and the ability to persevere through confusion and frustration to reach a solution. There is no possibility of going on in mathematics without these strengths.

For those math students who then do go on to graduate school, the division of responsibility for their learning changes once again. After a prescribed number of courses, they are on the hunt for a thesis advisor and a thesis problem, and while working on a thesis, even with the guidance of a caring and supportive advisor, they are on their own more than ever before. In some cases, this does not work out well, and so it becomes a time to reassess priorities and goals. But in the best of cases, this is the most exhilarating time of their lives, as they blossom forth to the attention of the world.

Conclusions

- For our youngest students, more time and concentration needs to be focused on problem-solving and critical thinking, less time on algorithms and computation.
- Attention to independent thinking in the early stages, including the development and nurturing of patience and perseverance, paves the way to creativity.
- Math anxiety and insecurity can continue from elementary school through college, and we must alert our beginning teachers to this, and encourage them to tell their students that these feelings are quite common, and can lessen with experience.
- Good teacher support should include regular contact between trainer and teacher.



Doris and Herman Gluck

Credits

Photo of authors is courtesy of Doris and Herman Gluck.