Addressing Major Challenges of (Mathematics) Teaching

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Dr. Randolph A. Philipp
San Diego State University

Abstract
What are the fundamental challenges of teaching? Do teachers master any of these challenges early in their careers? Which challenges are never mastered, and what approaches might help one meet these enduring challenges? I address these questions as they apply to secondary school mathematics teaching.

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Plan for the Session

- Major Challenges Teachers Face
- One Approach to Overcoming Challenges
- Considering Students’ Productive Dispositions
- Questions (About Graduate School) or Anything Else
On a sheet of paper, list a few major challenges you face as a (mathematics) teacher.

1. X
2. X
3. X
4. X
5. X
6. X
Two Major Challenges

1) Managing a classroom of students
   (disciplining students, assigning and collecting homework, assessing and evaluating students)

2) Addressing the needs of individual students
Addressing the Needs of Individual Students

Do you care about your students?
Which of your students would answer the question as you did?
Do you have any students who would answer the question differently? Can you explain the disconnect?
Caring

The 3 elements of a caring relationship

• The one caring
• The cared for
• The relationship between the two

“Does this mean that I cannot be said to care for X if X does not recognize my caring?

In the fullest sense, I think we have to accept this result.”

How can teachers develop a stance of caring?

- *Showing Your Students You Care* Assignment
- Example (handout)
My showing my students I care actually was initiated because I had a student who was distracted and rarely turned in his homework, so on a day that he had not done anything, and had not done his homework I called him after class to figure out what was going on. In just my noticing that something was wrong, he began to cry. I gave him a tissue and after giving him a few minutes, I asked him what was going on that was distracting him from class and causing his non-turned in homework. From just asking, I learned more about this student than I think most teachers know. He explained how his mom and dad had gotten a divorce in the last month and that as a result of this split, they had split him away from his brother. So he was living with his dad and his brother with his mom. He told me that he missed his brother and this was why he was not focusing. Not only did this help me understand his situation but it taught me that there is always something else going on. We all know this, but I think that sometimes as a teacher we forget that life happens and school is not the only thing that affects these kids’ lives .... From this talk, I took the opportunity to lighten the mood as I walked him to (his next) class (since he was late) and ask him about other things that he likes to do. (He likes fishing with his dad.) I know that I am not all-knowing, but I shared the outlook I had on his situation. I explained that we don’t have much control of the things that go on in our lives but that school, especially at his age, is something that he does have control of and maybe this could be the place where he did not have to think about the sadness but focus on himself. The following three weeks, this student raised his grade from a D- to a B. He began turning in his work and from that he saw results on his next test .... When I first went to talk with Ethan, I was not expecting tears and they came as a surprise to me. He was a little apprehensive to talk to me during class up to this point, but when we talked one to one, he really seemed comfortable. This helped me feel comfortable. The talk went great and the results I saw from this were also great. I have since then tried talking to most of my other students and have been pretty successful. I have one that really just doesn’t like me, or so it seems, and talking to him has not been too helpful. I think my students can see that I genuinely care about them.

– All names are pseudonyms.
Themes

1. Seeing One Group of People Versus Seeing Individuals Within the Group
2. Talking to Individual Students Is Threatening to Some Teachers
3. One Conversation Can Initiate Significant Positive Change
1. Seeing One Group of People Versus Seeing Individuals Within the Group

When teachers spend time talking with students individually, they often change their perceptions of the students.

“I definitely look at him with a new lens since I got to witness a more positive side of him.” (a student teacher)

“Mark is great; he’s become one of my favorite students in the class (I know we’re not supposed to say we have favorites but I just can’t help it) despite the problems he has posed. He is one of the students who so far has helped me grow the most as a student teacher.” (Another student teacher)
Themes

2. Talking to Individual Students Is Threatening to Some Teachers

“When I sat down next to this student, she barely looked up at me and acknowledged that I was there. I immediately felt the wall that she was putting up, and immediately I felt my wall go up too. ... My thoughts raced a mile a second in that instant, but I fought against them and opened up the conversation by asking how she was doing.” (A student teacher)
Themes

3. One Conversation Can Initiate Significant Positive Change

“He started doing his homework on a regular basis. Better yet, he has even been proud of the fact that he has been doing his homework. He came up to me the other day after class and showed me all of his homework stamps that he had received that week for completing his homework. He was so excited and so was I.” (A student teacher.)
Moving From the General to the Content: Assessing Students’ Mathematical Understanding

• Assigning Mathematical-Content Interviews
• 1-minute interviews
Talking Briefly to Students Can Help Us Understand Their Thinking

Donna and Megan

Circle the larger or write $\equiv$.

$4.7 \quad 4.70$

What might you conclude now about their reasoning?

0:00–0:21 (Searchable Set of CDs, Clip #388; Select CD, Clip #9)

What might you conclude now about their reasoning?

0:20–0:46
Talking Briefly to Students Can Help Us Understand Their Thinking

Felisha, end of 4th grade

This is a cookie that four children at a party want to share. Show how the four children might share the cookie. How much does each person get?

What might you conclude now about her reasoning?

One child leaves without eating or taking her piece. How could the three share what is left?

Searchable Clip #325: 0:35–1:37
“Each person would get one fourth and they would get one twelfth, and added together they would each get one third.”

What might you conclude now about her reasoning?
Define Mathematical Proficiency

- Concepts
- Procedures
- Problem Solving
- Reasoning and Justifying
- Positive Outlook
Define Mathematical Proficiency

• Concepts (Conceptual Understanding)
• Procedures (Procedural Fluency)
• Problem Solving (Strategic Competence)
• Reasoning and Justifying (Adaptive Reasoning)
• Positive Outlook (Productive Disposition)

The Strands of Mathematical Proficiency

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The tendency to see sense in mathematics, to perceive it as both useful and worthwhile, to believe that steady effort in learning mathematics pays off, and to see oneself as an effective learner and doer of mathematics.

The capacity to think logically about the relationships among concepts and situations, including the ability to justify one’s reasoning both formally and informally.

The ability to formulate mathematical problems, represent them, and solve them.

Knowledge of procedures, knowledge of when and how to use them appropriately, and skill in performing them flexibly, accurately, and efficiently.

Integrated and functional grasp of mathematical ideas

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- Integrated and functional grasp of mathematical ideas

- Conceptual Understanding

- Strategic Competence

- Productive Disposition

- Procedural Fluency

- Adaptive Reasoning
Which Strands Do Your Students Develop?
Two Teachers Studying Their Students’ Productive Dispositions*

Paying attention to what students say and think helps us by enabling us to

• better know our students,
• tailor how we teach mathematics, and
• tailor how we teach about mathematics.

*Productive Disposition—the tendency to see sense in mathematics, to perceive it as both useful and worthwhile, to believe that steady effort in learning mathematics pays off, and to see oneself as an effective learner and doer of mathematics.
Relationship Among Traits/Beliefs

- confidence
- teacher as holder of knowledge
- success determined by self
- hard work leads to success
- math understanding takes time or focus
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- confidence
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83% 100%
Relationship Among Traits/Beliefs

- Teacher as holder of knowledge
- Success determined by self
- Hard work leads to success
- Math understanding takes time or focus
- Mistakes as a site for learning
- Confidence

Connections:
- 83% from mistakes as a site for learning to confidence
- 83% from teacher as holder of knowledge to confidence
- 100% from math understanding takes time or focus to confidence
- 100% from math understanding takes time or focus to confidence
- 83% from success determined by self to confidence
Mistakes (or incorrect reasoning)

1) Mistakes are bad. Once students start reasoning incorrectly, they will learn wrong and it will take longer to fix.

What instructional implications follow for a teacher who believes this? For example, would a teacher who held this belief encourage students to try solving problems their own ways?

2) Mistakes are unavoidable, darn it. But bad.

3) Mistakes are natural, and we learn from them.

4) We should encourage thinking, even if it may lead to mistakes!
Developing Students’ Productive Dispositions
(End-of-Class Reflection)

Reflections help students be more aware.

Today in math, I…

learned   noticed
realized heard
understood didn’t understand
discovered thought
said felt

____________
Questions, Comments, Discussion

But first…
End-of-Talk Reflection

During this colloquium, I...

learned
realized
understood
discovered
said
disagreed with
noticed
heard
didn’t understand
thought
felt
wondered about
Questions, Comments, Discussion