

# Mathematical Discourse and Questioning: Connecting Research to Practice

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# Setting the stage

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- We were both members of a graduate course within the mathematics education program at Auburn University; the course was taught by Dr. W. Gary Martin.
- Graduate students worked in pairs
  - Christopher - classroom teacher at Auburn High School
  - Ruby – full-time graduate student
- Examined six of the eight Mathematics Teaching Practices within *Principles to Actions: Ensuring Mathematical Success for All* (NCTM, 2014).
  - For each specified practice, each pair completed,
    - An initial review of the practice,
    - A plan for exploring the practice within the classroom
    - A reflective summary regarding the plan for exploration



# Why discourse and questioning?

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- The discourse in the mathematics classroom **gives students opportunities to share ideas and clarify understandings, construct convincing arguments regarding why and how things work**, develop a language for expressing mathematical ideas, and learn to see things from other perspectives (NCTM 1991, 2000).



# Analyzing Discourse and Questioning through Action Research

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Discourse was explored using 3 different analysis methods:

1. Visualizing student participation
2. Teacher-student discourse analysis
3. Teacher questions



# Visualizing Student Participation

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- We monitored student participation in mathematics dialogue.
- This was completed by marking on a classroom seating chart each time a student participated in classroom discussion.
- The purpose was to gain an overview of which students were participating in classroom discussion.



# Visualizing Student Participation

FRONT

0*	2*
	4*
	1*

7*	4*
3*	1*
	1*

0*	2*
3*	

	1*

	0*
	3*

3	Co-Teacher
1	

# - How many times the student participated in whole class discussion.

\* - Teacher interacted with individual student while working in small groups.

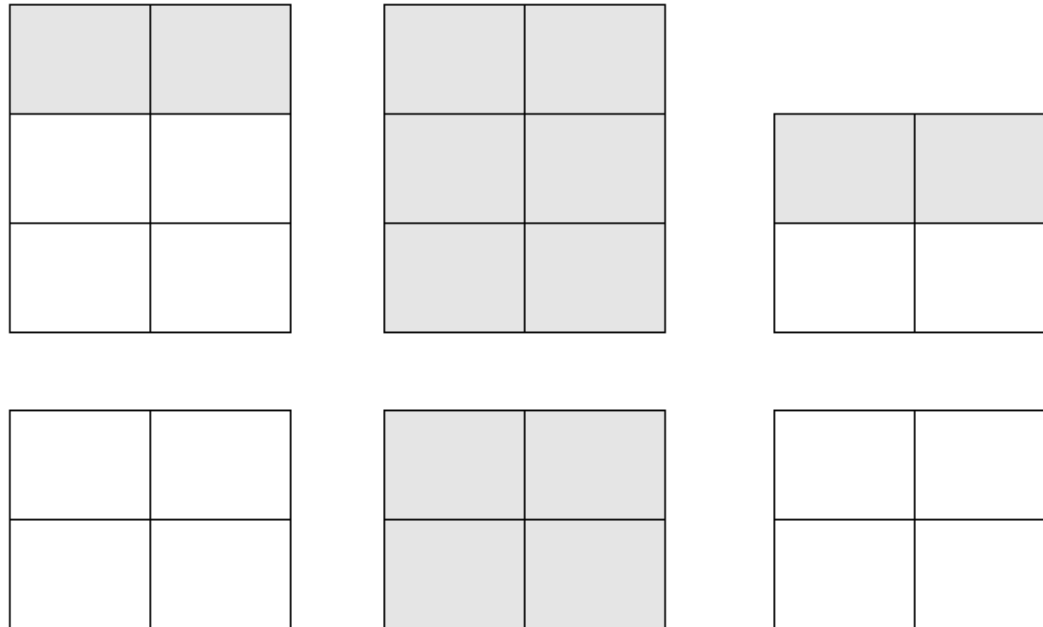


# Strategies for Improvement

- Moving students who are consistent in their participation outside of the “Action Zone” (Walsh & Sattes, 2005).

## ACTION ZONE

### FRONT



# Strategies for Improvement

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- Student Participation
  - Equity sticks/cards are one way to gain student participations.
  - Class Dojo
  - Marking seating chart





# Teacher-Student Discourse Analysis

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- We conducted a teacher-student analysis of classroom discourse.
- This was completed in 5-minute increments.
- The purpose was to examine the frequency of teacher-student and student-student discourse.



# Teacher-Student Discourse Analysis

T: for teacher

S: for student presenting

I: for co-teacher

S: student not presenting  
but engaging in discourse

s: student (group work)

t: teacher (when talking  
to a small group)

1. T**S**T**S**T**S**S**I**S**T**S**S**T**S**T
2. T**S**T**S**S**T**I**S**T**S**S**I**T**S**T
3. TT -----TSTSTSTTTST-----ST-----
4. T---TST---TSTST--TSTSTSSTTSTS---ststst
5. TSTST -----
6. T--stsssts -----
7. T -----TIT ---T -T
8. T ---- Ttstsssts
9. TSTSTSTSTSTSTSTST—T**S**S**S**T**S**S**S**T**S**S**S**TSTSTSTST**S**
10. TT—T-----
11. TT
12. T**S**TSTT
13. T**S**TTSTT



# Strategies for Improvement

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- To ensure students are provided with opportunities to follow their peers' contributions, implement Wait Time 2.
  - A 3 to 5 second pause following - not prior to - a student's contribution



# Teacher Questions Analysis

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- We conducted a question analysis, using the question sequences asked by Christopher Parrish during the course of a lesson.
- The question sequences were categorized as either focusing or funneling.
  - Funneling: a pattern of questioning that involves using a set of questions to lead students to a desired procedure or conclusion
  - Focusing: a pattern of questioning that involves attending to what the students are thinking, pressing them to communicate their thoughts clearly, and expecting them to reflect on their thoughts and the thoughts of their classmates.



# Teacher Question Analysis

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## 12:30 – 12:35

- T: Ok. Is there another angle on here that I could use?
- S: 45? I don't know.
- T: Ok. So if this one is 40, what happened here?
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- T: What's happening at the top?
- S: It decreased by 5
- T: So, Sidney what angle did you have?
- S: 50.
- T: So Sidney, where would I stop?
- S: You gotta find 70. (Not Sidney)
- S: No right there. (Not Sidney)
- T: Ok. So, she's going to use this and she will still move it to "a"



# Strategies for Improvement

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- Focusing - Plan questions in advance
  - Pair with teacher to write down questions
  - Video/audio record lessons



# Overall Strategies for Improvement

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- Task Selection
  - Discourse that focuses on tasks that promote reasoning and problem solving is a primary mechanism for developing conceptual understanding and meaningful learning of mathematics (NCTM, 2014).
- To accomplish productive questioning patterns:
  - Self-awareness
  - Pair with a teacher
  - Develop questioning norms



# Questions

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- Thank you!





# References

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