# *Impact of the Southwest Chicago Math Teachers' Circle on the Disposition of Teachers Toward Mathematics and Toward the Teaching and Learning of Mathematics*

Angela Antonou, University of St. Francis

# About the SW Chicago Math Teacher Circle

- Started as a collaboration of faculty members from five Chicago-land college and universities along with two middle school math teachers
- Location rotates among several colleges and universities (Lewis University-Romeoville, Saint Xavier University-Chicago, Trinity Christian College-Palos Heights)
- Started in spring 2016 with initial launch event on May 12 (Lewis), summer immersion workshop August 1-3 (Trinity)
- Participants: Middle (and elementary and high) school teachers in the southwest Chicago suburbs

# Study Purpose

To assess the effect of participation in a Math Teachers' Circle on:

- the perceived importance of, confidence of, and implementation of teachers to use inquiry-based learning in their classroom
- the dispositions of teachers toward mathematics
- the disposition of teachers toward the teaching of mathematics

# Three-Day Immersion Workshop (August 2016 at Trinity Christian College)

- Number of participants (excluding leadership team and guest leaders): August 1- 22, August 2- 17, August 3- 17
- Melissa Loe and Brenda Kroschell (University of St. Thomas in St.  Paul, Minnesota) served as national lead speakers

# Three-Day Immersion Workshop

- A total of 8 sessions (1.5 to 2 hours each) over 3 days, with meals, snacks, time to reflect, etc.
  - Day 1: Problem Solving, Liar's Bingo
  - Day 2: Twenty-five Point Affine Geometry, Fibonacci Fun, Coins in Two-Land, Exploding Dots
  - Day 3: Pascal's Triangle, Classroom Scenarios
- Study administration:
  - Survey administered after Session 1 (Day 1)
  - Survey administered after Session 8 (Day 3)
  - Prompted reflections after each session
  - 13 participants completed both the pre-workshop and post-workshop survey

# Participant Backgrounds

- Number of years taught
  - 1 year or less: 44.4%
  - 1 to 5 years: 22.2%
  - 5 to 10 years: 11.1%
  - more than ten years: 22.2%
- Grade levels
  - Fifth grade: 23%
  - Middle school: 54%
  - Middle and high school: 8%
  - High school: 15%
- Highest degree
  - Bachelors: 67%
  - Masters: 33%

# Survey Design

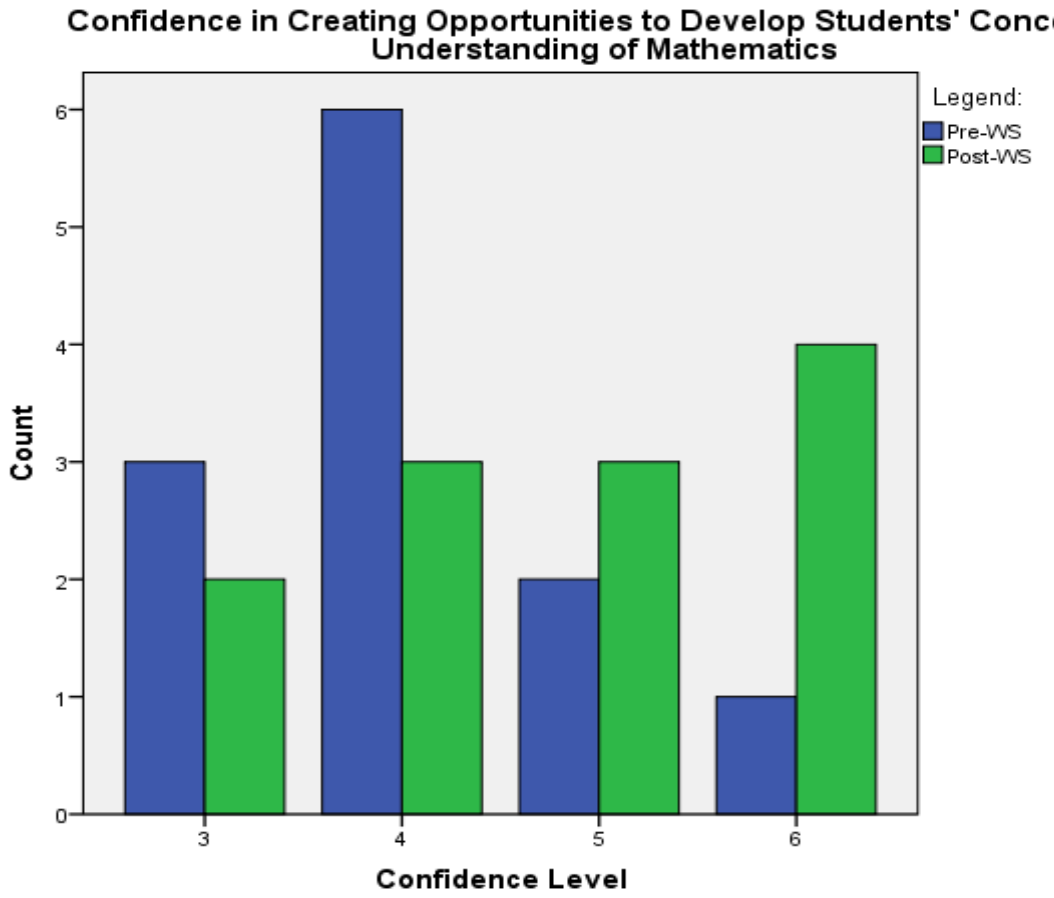
- First part:
  - 28 items:
    - Encourage social interaction as a means of learning
    - Provide hands-on experiences before introducing new concepts
    - Create open-ended problems
    - Engage students in inquiry-oriented activities
  - How important do you feel it is for effective mathematics instruction (1 being not important to 6 being very important),
  - How confident do you feel in applying it in the classroom (1 being not confident to 6 being very confident)
  - How frequently do you implement it (1 being not frequent to 6 being very frequent)

# Survey Design

- Second part (27 items):
  - A mathematician should be able to solve any mathematics problem or puzzle
  - Mathematics is an activity which is done alone, not with others
  - Solving mathematics problems requires patience
  - There are multiple means to discover a mathematical concept
- Third part (30 items):
  - I believe all students can understand mathematics through an investigative approach
  - Lecturing is the best way to teach mathematics
- Forced-choice 6-point Likert scale
  - 1 -Strongly Disagree, 2- Disagree, 3- Sometimes Disagree
    4 -Sometimes Agree, 5 –Agree, 6- Strongly Agree

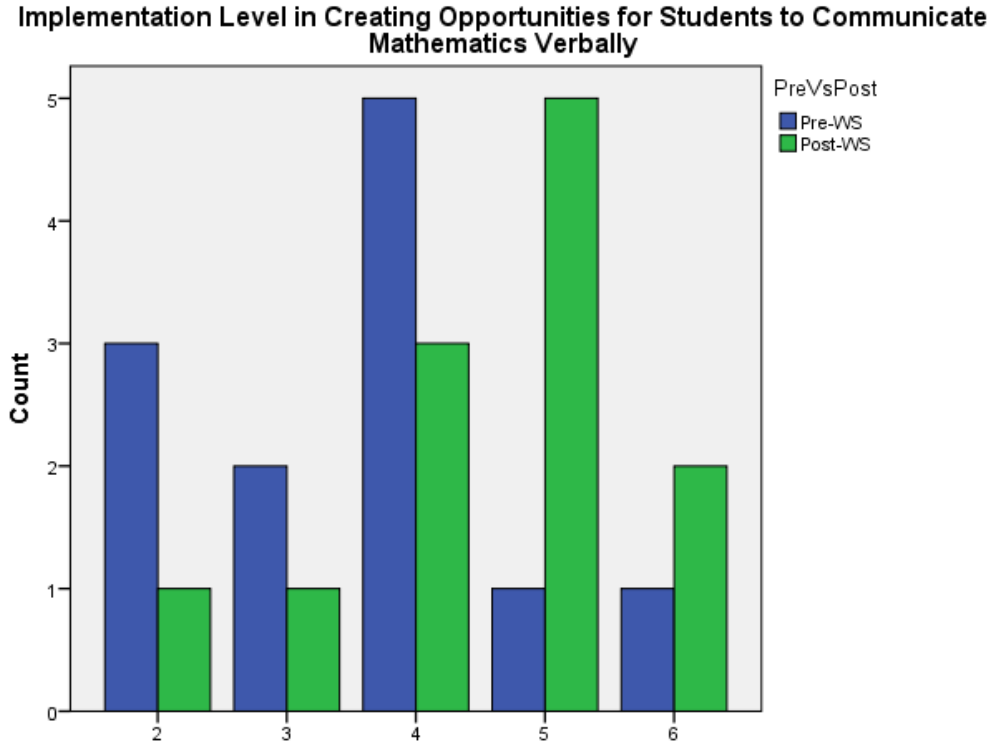
# Survey Results - **Confidence in Creating Opportunities to Develop Students' Conceptual Understanding of Mathematics**

- P-value: 0.023; 50% reported increased confidence with 50% reporting no change in confidence.



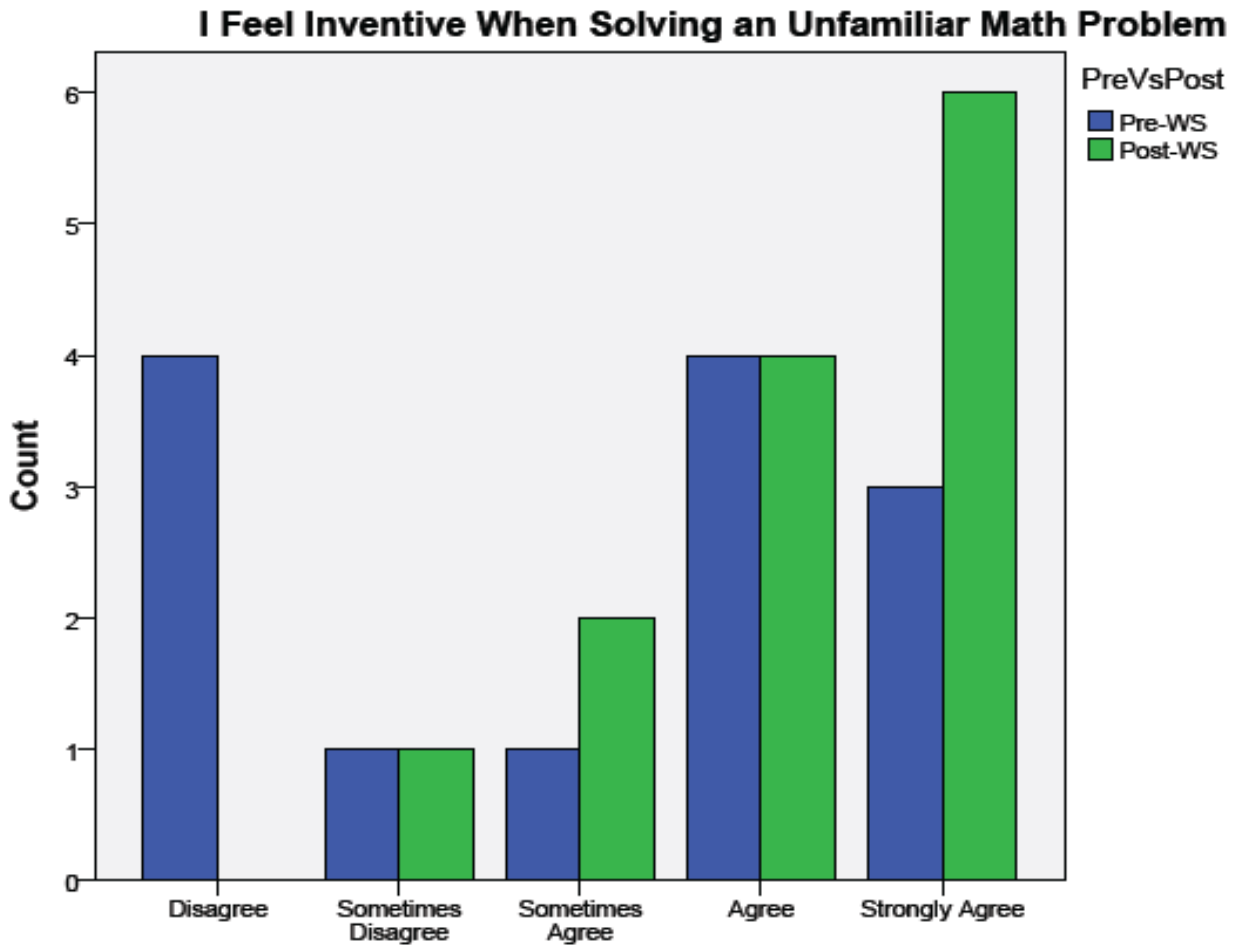
# Survey Results - **Creating Opportunities for Students to Communicate Mathematics Verbally**

- Confidence in applying it:
  - P-value: 0.008; 58% reported increased confidence with 42% reporting no change in confidence.
- Frequency of implementing it:
  - P-value: 0.009; 67% reported increased frequency of implementation with 33% reporting no change.



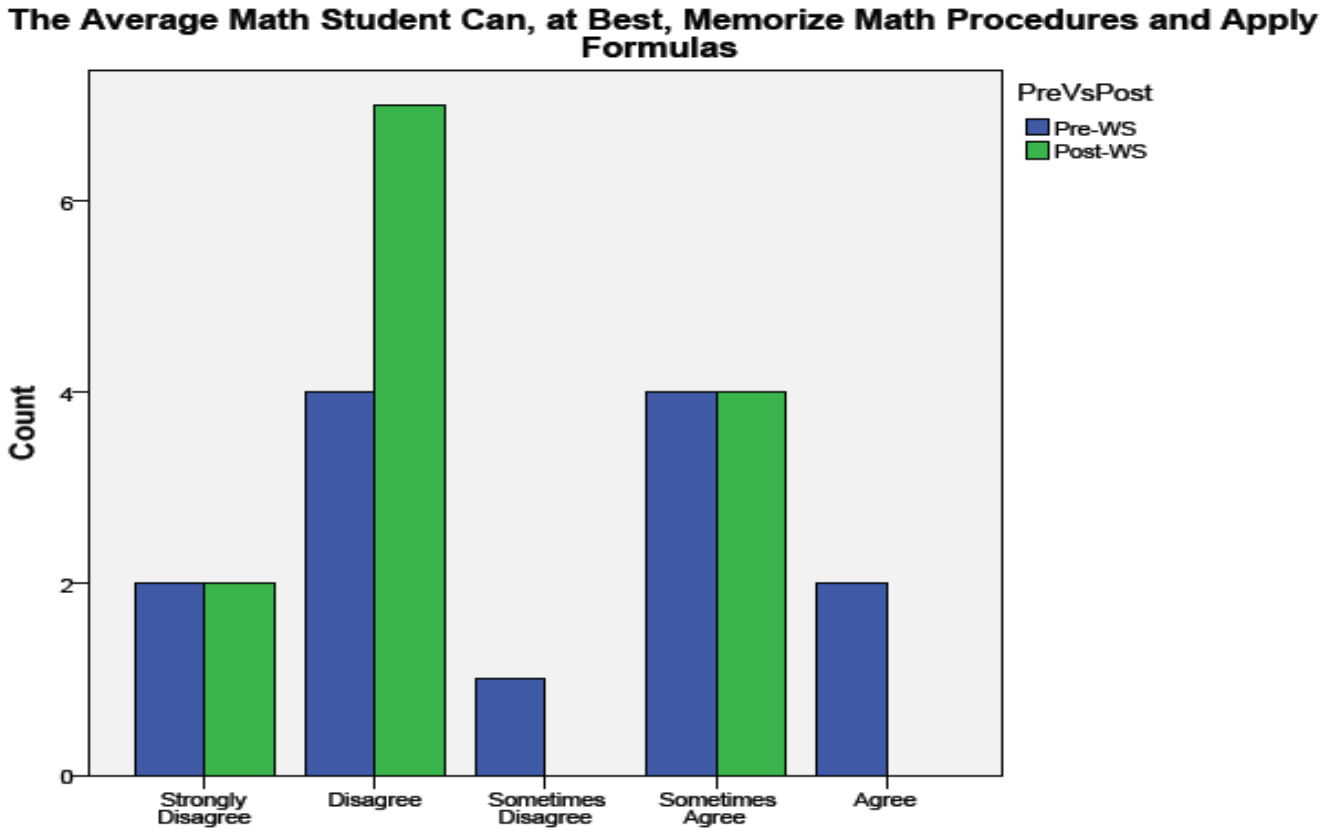
# Survey Results - **I Feel Inventive When Solving an Unfamiliar Math Problem**

› P-value: 0.026; 46% reporting stronger agreement, 54% reporting no change in agreement to this statement. Note that 2 out of 13 teachers changed their response from “Disagree” to “Strongly Agree”.



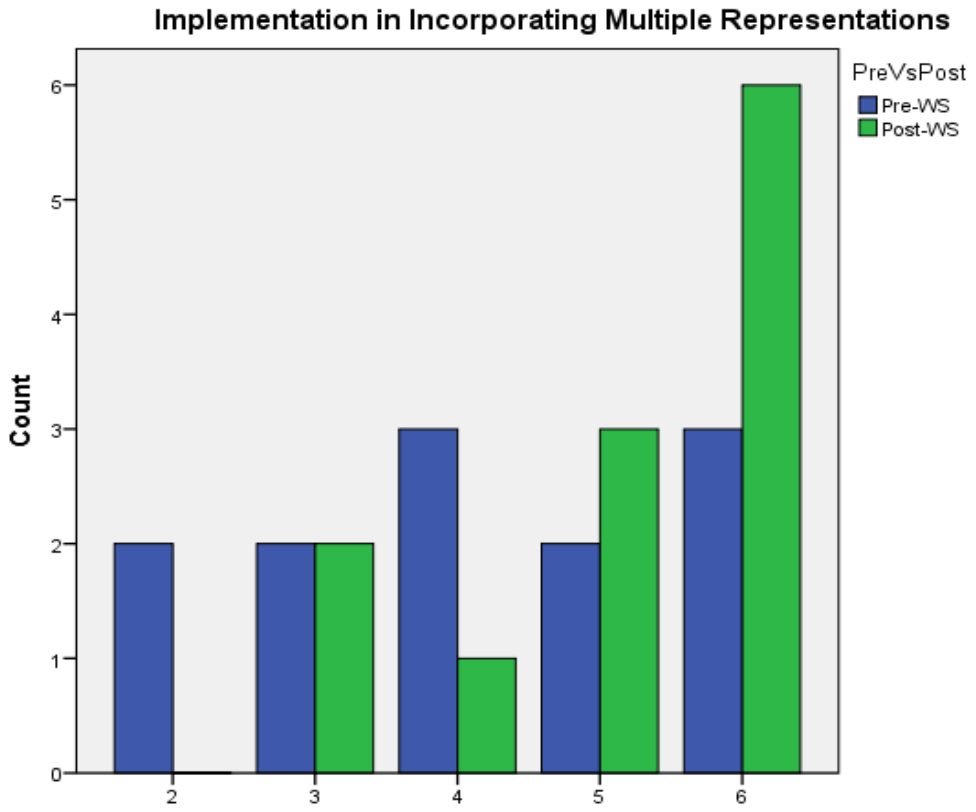
# Survey Results - **The Average Math Student Can, at Best, Memorize Math Procedures and Apply Formulas.**

- P-value: 0.053; 46% report weaker agreement.
- Pre-workshop:  46% disagree or strongly disagree
- Post-workshop: 67% disagree or strongly disagree



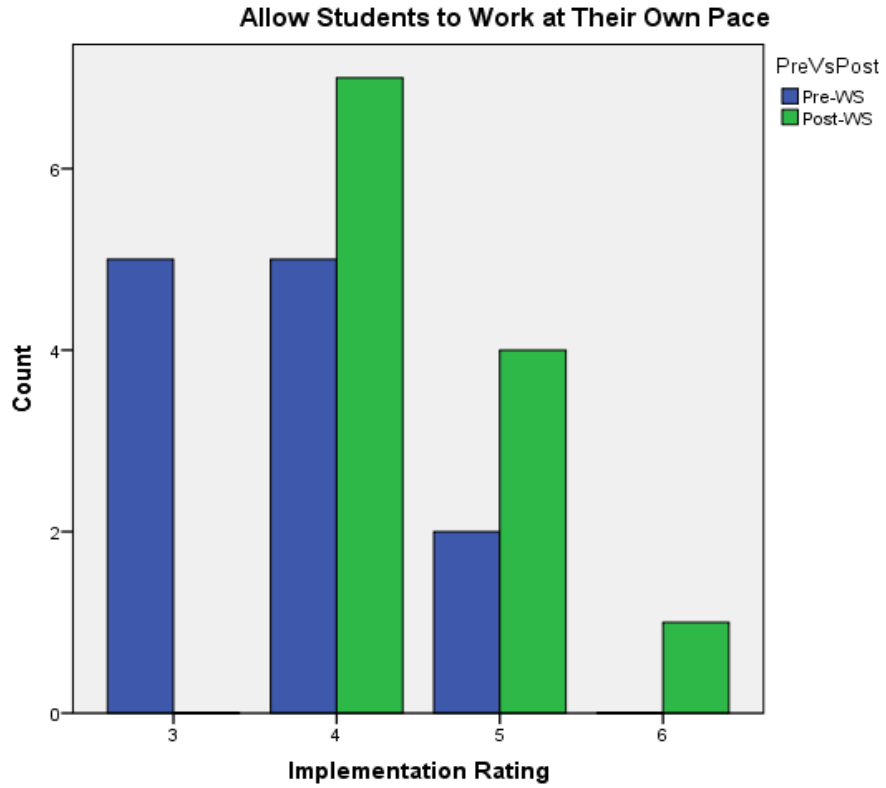
# Survey Results – **Incorporate Multiple Representations** (e.g., computational, graphical, geometric, algebraic, etc.) when introducing a concept.

- P-value: 0.009; 67% report increased implementation
- Pre-workshop median: 4
- Post-workshop median: 5.5



# Survey Results – **Allow Students to Work at Their Own Pace.**

- P-value: 0.007; 67% report increased implementation
- Pre-workshop median: 4
- Post-workshop median: 5



# Survey Results – Journal Reflections

- "Each activity continues to open possibilities I hadn't considered doing with my students." (Coins in Two-Land)
- "I've noticed that I'm becoming less afraid to try different things." (Pascal's Triangle)
- "I learned that you not only have to problem solve to get to the answer but also to get to a response to your students." (Classroom Scenarios)
- It made me understand the vast usefulness of productive struggle. My students need to engage in this type of problem weekly! It would help them learn to persevere!! (25-Point Affine Geometry)

# Future Considerations

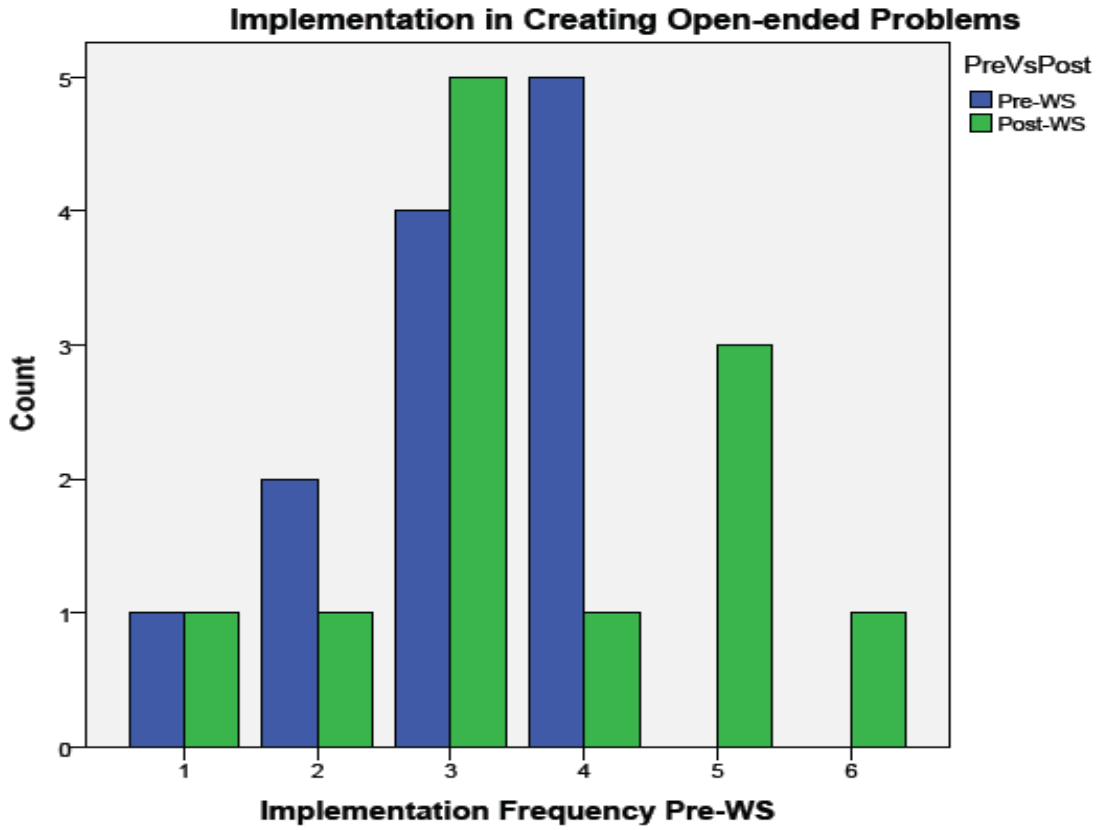
- Include other Math Teachers' Circles
- Data from one-day participants
- Investigate those items which did not show significant change:
  - It is important to immediately assist struggling students (5.5/5.5)
  - Confidence in incorporating student-led discussions (4/4)

# Thank you!

- Angela Antonou (University of St. Francis), co-principal investigator: aantonou@stfrancis.edu
- Rita Patel (College of DuPage), principal investigator ritapatelmath@gmail.com
- Southwest Chicago Teacher Circle Website: https://southwestchicagomathcircle.wordpress.com/
- National Math Teacher Circle Website (and resources): http://www.mathteacherscircle.org/

# Survey Results - **Creating Open-ended Problems**

- Confidence in applying it:
  - P-value: 0.053; 50% reported increased confidence with 42% reporting no change in confidence, 8% reporting slight decrease in confidence.
- Frequency of implementing it:
  - P-value: 0.034; 42% reported increased frequency of implementation with 58% reporting no change.



# Significant Changes

- Use multiple instructional strategies for one topic (implementation) – 0.034
- Create opportunities to develop students' conceptual understanding of mathematics: Confidence – 0.023; Implementation – 0.014
- Encourage students to discuss their reasoning with each other (implementation) – 0.014
- Incorporate activities which students find enjoyable (implementation) – 0.02
- Create problems so that students can practice routine computations. – 0.012
- Allow students to work at their own pace: Confidence – 0.038; Implementation – 0.007
- Create opportunities for students to communicate mathematics verbally: Confidence – 0.008; Implementation – 0.009
- Create open-ended problems (implementation) – 0.034

# Significant Changes

- Incorporate multiple representations (e.g., computational, graphical, geometric, algebraic, etc.) when introducing a concept: Confidence (0.035); Implementation (0.009)
- Help students see connections between mathematics and other disciplines (Importance) – 0.008
- Provide hands-on experiences before introducing new concepts (implementation) – 0.034
- I feel inventive when solving an unfamiliar math problem. – 0.026
- If I don't fully understand a mathematics concept, I avoid using it in the classroom. – 0.014
- I avoid using instructional techniques if I am unfamiliar with it – 0.035
- The average math student can, at best, memorize math procedures and apply formulas. – 0.053

# Survey Results – Confidence in Encouraging Students to Persevere in Solving Problems

- P-value: 0.059; 50% report stronger agreement.
- Journal Reflection on Perseverance:
  - Struggle is good even if you don't get there in the time provided.
  - It made me understand the vast usefulness of productive struggle. My students need to engage in this type of problem weekly! It would help them learn to persevere!!
  - I learned and was immersed in the example of a master teacher helping us when we needed a boost, but at the same time I was respected as a learner because she didn't show me a step-by-step procedure on how to solve the problem.

# Survey Results – Journal Reflections

- Response from the same individual during the workshop:
  - Day 1: “My problem solving strategies begin with a little “panic” trying to decide where to start. Then I usually do not finish.”
  - Day 2 : “I liked the challenges of looking at and working with a twist on my geometry. I learned that I can still (after many years removed from college) find success in an unfamiliar (setting).”
  - Day 3: “I’m feeling more confident about the importance of struggle and cooperation.”