# Measuring Mathematics Classroom Interactions: An Observation Protocol Reinforcing The Development of Conceptual Understanding

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# The MCOP$^2$

## Mathematics Classroom Observation Protocol for Practices

- Truly…we sought to move the field, not just for researchers, but all math educators most importantly, teachers themselves
- Steers us away from small scale, qualitative new results/ideas and individual research to…
- a field validated (consensus) product with process, replication, and reliability

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# The MCOP$^2$

## Mathematics Classroom Observation Protocol for Practices

- Developed initially as Evaluation and Research Protocol for a three-year grant project
  - IMPACT—Improving the Mathematical Practices for Alabama Classroom Teachers

- A tool that truly was to measure instructional change (if) from professional development
- No-to-low-cost use of teachers' time

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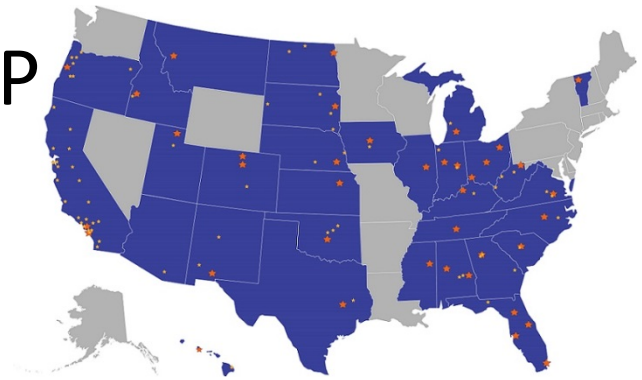
# The MCOP$^2$

## Mathematics Classroom Observation Protocol for Practices

- Factors of Measure
  - Measure teacher moves (practices of facilitation)
  - Measure student moves (engagements)
- Used in UA preservice teacher program
- Common measure for the MTE-P
  - http://bit.ly/MTE-P



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# Why "another observation protocol"?

- We acknowledge the U.S. instruments
- RTOP—Reformed Teaching Observation Protocol
  - Used more than a decade, lacked inherent mathematical-ness. Very few original math classroom observations, mostly science, not all grades
- MQI—Mathematical Quality of Instruction, Initially grades K-8 validation, later some high school. Very cumbersome to use as a school or district, extremely time consuming, requires high training. High research reliable and valid.

Continued

# Additional Protocols

- IQA—Instructional Quality Assessment, truly about analysis of student work and mathematical tasks in classrooms
- M-SCAN—New, only validated for two grades in development. Limited but has some access to teachers, schools, districts.
- **MCOP$^2$**—Field validated K-16, reliable, aims to give access to teachers, schools, districts. No training, just practice. Requires mathematical background and terminology understanding.

# Foundation towards MCOP$^2$

- Useful, not cumbersome, relatively easy to use with practice and familiarity with each item
- Mathematical practices of students
- Facilitation of teacher to provide students with opportunity for mathematical practices
- Classroom Culture for learning math conceptually

- Soundly looking at facilitation and engagement in the 8 Standards for Mathematical Practices in the U.S. Common Core State Standards

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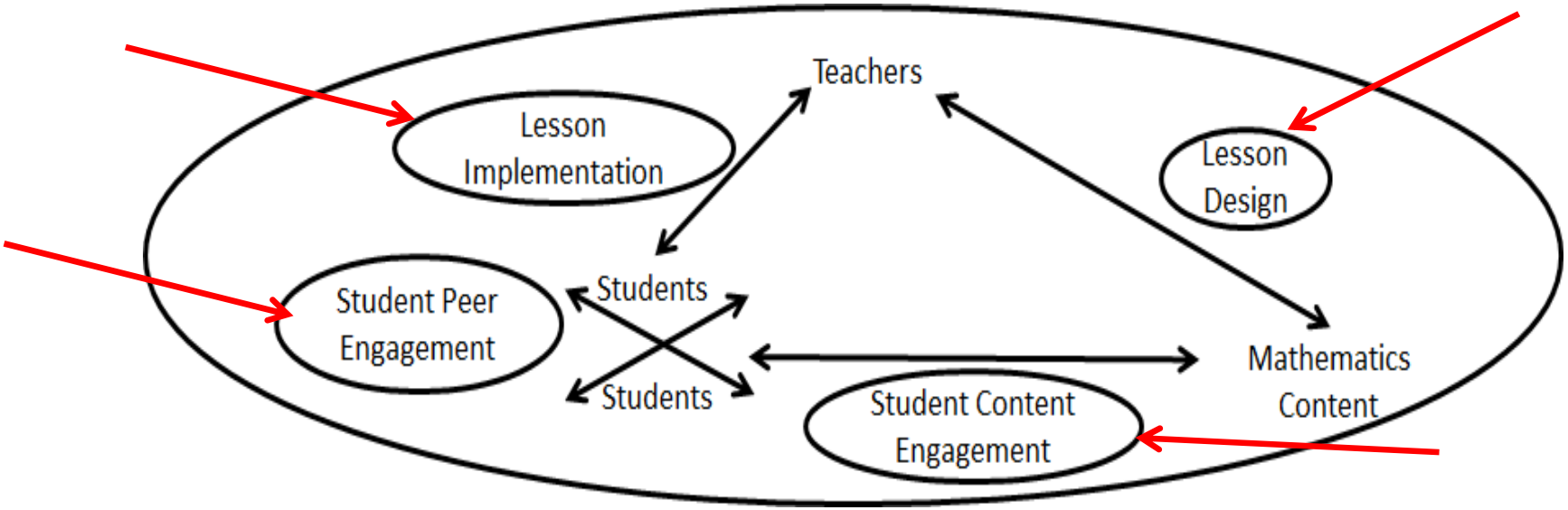
# 8 Standards for Mathematical Practices in the U.S. Common Core State Standards

- Derived from
  - the NCTM 5 process standards
    - Problem solving, communication, representations, connections, reasoning & proof
  - the NRC 5 competencies
    - Conceptual understanding, procedural fluency, strategic competence, adaptive reasoning, productive disposition

# Theoretical Framework

- MCOPP views the classroom through the lens of interactions within the classroom (Cohen, Raudenbush, & Ball, 2003)
- Focusing on conceptual understanding (Hiebert & Grouws, 2007) and agency and responsibilities within the community of learners (Rogoff, Matusov, & White, 1996)



# Strength, External Validation Studies

- Stage 1—Initial External Validation Study
- Sent to more than 900 mathematics educator professionals for review of items (164 = N)
  - **Essential, not essential but useful**, not essential **(94%)**
  - Departments of Faculty Positions
    - 37% mathematics, 49% education, and 14% joint/other
  - Ranks
    - Instructors (15%), assistant professors (35%), associate professors (22%), full professors (18%), other (10%)
    - Varying experiences but balanced in the field
    - 53% currently supervised teachers, 29% supervised teachers in the past, and 18% had never supervised teachers

# Stage 2

- Revised instrument & restudied
  - 26 of the 164 fully completed the re-validation
    - 46 of 164 said they'd agree to do it at stage 1
  - Rank:
    - instructor/lecturer, 7%; assistant professor, 19%; associate professor, 33%; full professor, 30%; other 11%
  - Years of experience in higher education:
    - 0-3 years, 7%; 4-6 years, 11%; 7-10 years, 11%; and 10+ years, 70%
  - years of experience teaching math in K-12:
    - 0-3, 22%; 4-6, 30%; 7-10, 22%; and 10+, 26%

# Observational Balance

- Initially, developed for grant baseline & eval.
  - Observations by five mathematics educators & a graduate student in mathematics (M.Sc.)
  - Two secondary experience and higher ed math, two elementary, one mathematician, grad student had clinical experience in high school
  - 40 Elementary classrooms observed (K-5)
  - 53 Secondary classrooms observed (6-12)
  - 36 Tertiary (post-secondary)

# Statistical Analysis Results

- Factor Analysis
  - Student Engagement factor 7 items +2 (0.897=α)
  - Teacher Facilitation factor 7 items +2 (0.850=α)
  - Two items loaded almost equally on each factor
- Interrater Reliability (Hallgren, 2012; Cicchetti, 1994)
  - Chose five videos: K-2, 3-5, 6-8, 9-12, Adv. Und.
  - No training, no initial debriefings
  - Watched independently during a two week period
    - SE scale score (ICC=0.669)
    - TF scale score (ICC=0.616)

# Other information

- Recommendations
- 3-6 observations per teacher as an evaluation
  - Lance, Butts, & Michels, 2006
- Group level, factors are strong enough for random samples, small N's, etc
  - Pre-post or pre-post-post
- Suffices to aggregate points or use of exact coefficients
  - Depends on your goal for use
- Practice 3-4 times to get used to instrument

# Thank you-Questions

- Home Page http://bit.ly/UA-MCOPP
- Long form
  - Each item background, literature, meaning
  - Scoring rubric
  - http://bit.ly/MCOPP-long
- Short form
  - Four scoring pages for formal observations
  - Room for short notes on each item
  - http://bit.ly/MCOPP-short
- Special thanks
  - John Abby Khalilian, Leah Cofer, John Dantzler, Tracy Weston

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