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

Jeremy Zelkowski*
Jim Gleason
Stefanie Livers
The University of Alabama
Tuscaloosa, Alabama, U.S.A.
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
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
The MCOP²

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
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 MCOP²

• 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
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

• Long form
  – Each item background, literature, meaning
  – Scoring rubric
• Short form
  – Four scoring pages for formal observations
  – Room for short notes on each item
• Special thanks
  – John Abby Khalilian, Leah Cofer, John Dantzler, Tracy Weston