

Incorporating On-line Dynamic Assessments for Measuring Teachers' Knowledge into Math Teachers' Learning Process

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Conceptual Framework

- Pedagogical Content Knowledge (Shulman, 1987)
- Mathematical Knowledge for Teaching (Ball, 2008)
- Studying and assessing teacher knowledge is difficult because we lack a single concept of the specialized knowledge for teaching “across a wide variety of domains within mathematics” (Orrill, 2015)

Purpose of Assessment

- To establish a teacher's competency in the content domain (e.g., for the purpose of certification exams),
- To determine the effectiveness of the Professional Development program;
- To guide the design of PD, in which case, “assessments must provide information at a finer grain size than instruments providing a summative measure” (Orrill & Cohen, 2016).

Methodological Design

Developed PCK Trapezoid Instrument

- Delphi study: Developed the initial PCK measures (Manizade, 2006; Manizade & Mason, 2011)
- Collected samples of students' challenges and conceptions with respect to the content focus (Manizade & Mason, 2014)

Collected Data

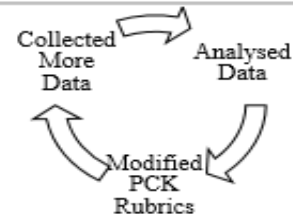
- Used 6 different instruments to collect and triangulate PCK data (van Hiele pre-test, Trapezoid Questionnaire, Trapezoid PCK instrument, Teacher reflections, Survey, and IQA instrument for follow-up observations) (Manizade & Martinovic, 2016; Martinovic & Manizade, 2017)

Analysed Data

- Used the available rubrics for the standardized instruments (Usiskin, 1982; IQA, Yunker et al., 2006)
- In order to analyse PCK data, created a first draft of the PCK rubrics based on available research, own knowledge, and by partially adapting IQA rubrics (IQA, Yunker et al., 2006)

Developed & Finalized PCK Trapezoid Rubrics

- Grounded Theory:



Modified & Finalized PCK Trapezoid Instrument

- Grounded Theory:
- Adjusted the graphics and descriptions based on the collected data
- Shortened the instrument, removed the items that duplicated results

1. van Hiele pre-test

- To gather information on teachers' developmental levels of geometry reasoning.



2. Trapezoid Questionnaire

- To assess teachers' knowledge of the area of a trapezoid and to gather self-reported data on the way they typically teach this content.



3. Trapezoid PCK Probe

- To measure teachers' PCK related to the area of a trapezoid.



4. Teacher reflections & survey

- To record and triangulate measures of PCK; to obtain demographic information.



5. Follow-up observations

- To assess quality of teachers' geometry instruction in the classroom

PCK Probe: Example of a Dynamic Measure

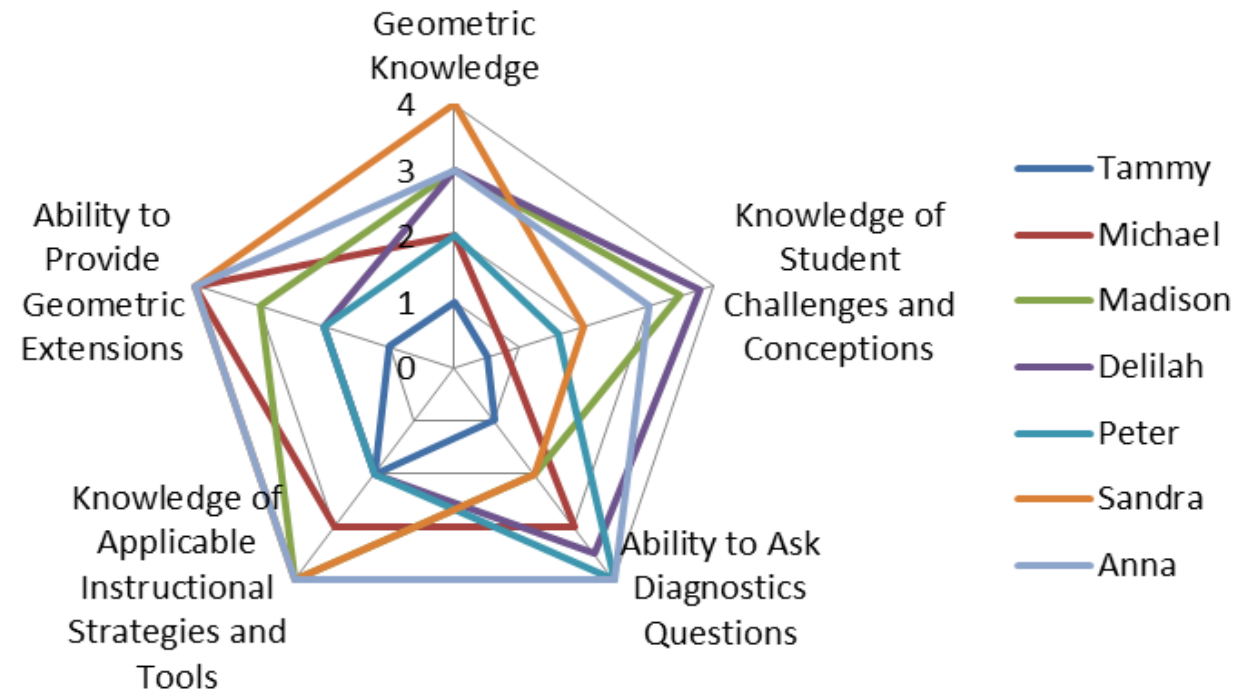
- See the GeoGebra Materials

Example of the Rubric

- **Knowledge of Applicable Instructional Strategies and Tools**

Level	Characteristics
4	<p>Did the instructional strategies and/or tasks have potential to engage students in rigorous thinking about challenging content?</p> <p>A. The instructional strategies and/or tasks proposed by the teacher have the potential to engage students in exploring and understanding:</p> <ul style="list-style-type: none">• the concept of trapezoid, OR different approaches for finding the area of a trapezoid,• generating a formal derivation of the formula for the area of a trapezoid <p>AND</p> <p>A. The task must explicitly prompt for evidence of students' reasoning and understanding.</p>

Teacher Profiles



Discussion

- Next Step; coding the possible responses, immediate feedback and scoring
- Use of Measures to inform professional development activities and programs
- Moving towards individualized PD programs/activities
- **Invitation to join the development** for each content area and to share measures and collected data with the math ed. community