Development and Validation of an Instrument to Measure Teacher Knowledge of Inquiry

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Background

• Instrument developed as part of national survey of elementary teacher professional development
  – Professional development characteristics, teacher knowledge, teacher practice
• 19-item multiple-choice measuring teacher knowledge of:
  – Scientific inquiry
  – Classroom inquiry
  – Pedagogical content knowledge
Development Process

• Review of existing instruments
• Drew questions from:
  – Assessing PCK on Inquiry Science Teaching (Schuster, Cobern, Schwarts, Velom, & Applegate)
  – Evolving Inquiry (Doll, Bruning, Horn, & PytlikZillig)
• Developed new items
• Table of specifications developed
<table>
<thead>
<tr>
<th>Reference Source</th>
<th>No. of Questions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scientific inquiry</td>
<td>6</td>
</tr>
<tr>
<td>The diverse ways in which scientists study the natural world and propose explanations based on the evidence derived from their work (NSES, pg. 23:)</td>
<td></td>
</tr>
<tr>
<td>Inquiry pedagogy</td>
<td>8</td>
</tr>
<tr>
<td>[Schuster, et al.]</td>
<td></td>
</tr>
<tr>
<td>Classroom Inquiry</td>
<td>Source</td>
</tr>
<tr>
<td>-------------------</td>
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</tr>
<tr>
<td>K-4 NSES Standards</td>
<td>Essential features of classroom inquiry</td>
</tr>
<tr>
<td>Ask questions about objects, organisms, and events</td>
<td>Engage in scientifically oriented questions</td>
</tr>
<tr>
<td>Plan and conduct an investigation</td>
<td>Propose preliminary explanations</td>
</tr>
<tr>
<td>Gather data</td>
<td>Give priority to evidence</td>
</tr>
<tr>
<td>Use data to construct explanation</td>
<td>Formulate explanation from evidence</td>
</tr>
<tr>
<td></td>
<td>Connect explanation to knowledge</td>
</tr>
</tbody>
</table>
Development Process

• Focus group sessions with pre-service teachers to identify confusing questions and wording
• Resulting pilot assessment had 29 questions
• Pilot test with 164 teachers from two Midwestern states in early 2010 (convenience sample)
Pilot Test Results: Classical Test Theory

- Item difficulty .09 - .99;
- Discrimination .00 - .43
- Item-total correlations -.05 to .34
- Alpha = .54;
Final Instrument

• Had to balance content coverage, length, and psychometric properties

• Final version had 5 scientific inquiry; 7 classroom inquiry; and 7 PCK questions

• Some retained items were revised based on pilot results.
## Psychometrics Comparison: Classical Test Theory

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<tr>
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</table>
Psychometric Comparison: IRT
Procedures for Final Survey Administration

• National survey was stratified random sample
• Mail survey conducted spring, 2010 through early spring, 2011
• Participants received mailed survey introduction, scan-form survey, and post card reminder
• Each teacher randomly assigned math, reading, or science version in equal numbers
Final Results from National Survey

• Overall return for all subject areas was n = 595
• Teachers taking science measure (n = 142) scored 56% correct overall
  – Scientific inquiry 48% correct
  – Classroom inquiry 63%
  – Pedagogical content knowledge 55%
## CTT Comparison

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<td>Discrimination</td>
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<td>.01 - .36</td>
<td>.12 - .41</td>
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<tr>
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<td>-.06 - .32</td>
<td>-.03 - .34</td>
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IRT Comparison

![Graph showing IRT comparison between Revised and Pilot versions, with Information and Standard Error plotted against Ability (Science Inquiry Knowledge). The graph illustrates the differences in performance between the two versions.]
Future Directions: Data Analytic Model

Contact hr.
Collaborative Participation
Practice/feedback (workshop)
Practice/feedback (classroom)

Perceived Utility
Perceived Knowledge
Reported Practice Gain
Knowledge
Future Directions

Knowledge measure will be one of the dependent variables for randomized control trial examining impacts of guided inquiry professional development, including coaching.
Final Results from National Survey

Presentation Wednesday, March 6 at 2:45 in Curacao 8
Contacts

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