The Relationship Between Dialogic Teacher Feedback and Student Outcomes on Standardized Science Assessment.

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Need for the Dialogic Feedback Observation Tool (DFOT)

- The act of science is a practice grounded in argumentation (Anderson, 2002).
- Science and Engineering Practices of the NGSS
  - 1. Asking questions (for science) and defining problems (for engineering)
  - 2. Developing and using models
  - 3. Planning and carrying out investigations
  - 4. Analyzing and interpreting data
  - 5. Using mathematics and computational thinking
  - 6. Constructing explanations (for science) and designing solutions (for engineering)
  - 7. Engaging in argument from evidence
  - 8. Obtaining, evaluating, and communicating information

- Most teachers are not practicing instructional strategies that promote dialogic discourse (Duschl et al., 2007; Flup, 2002; Osborne et al., 2003; Pianta et al., 2007)
- Potential dual purpose:
  - Diagnostic tool to determine if the teacher creates potential opportunities for dialogic interactions to occur.
  - In-service professional development - self-assess practice.
- This study used the DFOT as a diagnostic tool to quantify teachers’ dialogic feedback.
Development of the DFOT

- Headings and subheadings created after extensive literature review of Argumentation in science education
  - **Epistemic Cognition**
    - Development of the views shared by the scientific community. Shifting from an everyday view to a scientific view.
  - **Construction**
    - Establishing a *communal* environment where teachers and children address learning tasks together
  - **Critique**
    - Facilitating joint Dialogue where children listen to each other and consider alternative viewpoints
  - **Elaboration**
    - Provides opportunity for students to elaborate about their claim
  - **Reflection**
    - Provides opportunity for students to reflect on their claims and the claims of peers
<table>
<thead>
<tr>
<th>Focus</th>
<th>Example(s)</th>
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| Epistemic Cognition | “How do your ideas align with the ideas of the experts?”  
“What do you think about your classmate’s source for their claim?” |
| Construction     | “What evidence do you have for your claim?”  
“Before we discuss this together have a conversation with your small group about the topic.” |
| Critique         | “Your classmate has presented the idea that ______; can anyone offer a different idea?”  
“Does anyone want to negotiate with your classmate’s idea?” |
| Elaboration      | “Do you remember when your classmate said____.” Can you add anything to those thoughts now?” |
| Reflection       | “Can you explain what we discussed in your own words?” |
Field Trial

- Six 3rd grade teachers recorded a 45 minute science lesson.
  - **Prompt:** “Record a typical lesson where you are discussing the meaning of data collected after an investigation.”
- Three teachers who were awarded the Presidential Award for Excellence in Science and Math Teaching (PAEMST).
  - PAEMST is the highest award bestowed to science and math teachers in the United States
- Three 3rd grade teachers with no Argument-based inquiry professional development
Results of the Field Trial

Dialogic Feedback Observation Tool

- Epistemic Cognition
- Construction
- Critique
- Elaboration
- Reflection
- Total

PAEMST 1, PAEMST 2, PAEMST 3, Teacher 1, Teacher 2, Teacher 3
Details of the Study

• Three-Year Professional Development project with a mid-sized school district.
  ○ State of Iowa had recently adopted the NGSS as their science curriculum.
  ○ PD focused on the Science Writing Heuristic approach.

• Five-day summer workshop with ongoing professional development through Professional Learning Community (PLC).

• Summer workshop focused on Argument-Based Inquiry theory, cognitive learning theory, and argumentation.
  ○ NOT training on how to “follow” a curriculum or learning a “Bag of Tricks”
Argument-based Inquiry - The SWH Approach

- **Big Questions** (What are our questions? What can we research? What can we test? What can we develop?)
- **Testing & Observations** (How should we set up our tests? How should we collect and record our observations?)
- **Claims & Evidence** (What are the strengths and weaknesses of our claims based on our evidence?)
- **Consultation with Experts** (How do our claims relate to accepted scientific ideas?)
- **Math Infusion** (What is the best mathematical process to use? Why is a certain mathematical process relevant?)
- **Technology Infusion** (How can technology help the processes above? What is appropriate technological integration?)
- **Application** (How can I apply my understanding to developing a product or a process?)
- **Communication** (How can I communicate my understanding to an outside audience?)
Participants
- 33 Teachers
- Experience 2-30 years of experience
- Grade Level 3rd - 8th
- Years attended the workshop: 1-3 years

Students District Information
- District 2,203 students
  - 32.6% qualify for Free and Reduced Lunch and 17.7% below the poverty line. 15.6% are considered in a minority group, and 2.9% are labeled English Language learners.
  - Mostly middle-class caucasian families
  - Pre-PD: Students scores lower on the science section of the Iowa Assessments than math and reading.
Descriptive Statistics

- the National Percentile Rank (NPR) was converted to Normal Curve Equivalent (NCE) score.
- “At Risk” Variable created
  - Number of students with an IEP, ELL, or qualify for Free-and-Reduced Lunch
  - If a student had more than one label they were counted two or three times.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Mean</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Dependant-NCE Science Score</strong></td>
<td>55.64 (SD = 4.12).</td>
<td>Max. 65 Min. 44 (range = 21).</td>
</tr>
<tr>
<td>At Risk</td>
<td>10.75 % (SD=10.49).</td>
<td>Max 24%, Min. 3% (Range = 21)</td>
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<tr>
<td>DFOT</td>
<td>29.21 (SD = 10.54)</td>
<td>Max 50 Min 8 (range = 42).</td>
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Data Collection

- Teachers recorded a 45-minute video of a science lesson.
- Teachers were given a prompt
  - “Record a typical lesson where you are discussing the meaning of data collected after an investigation.”
- Interrater reliability: $r = 0.92$
Research Question

1. Does the ability to utilize dialogic teaching practices, as measured by the Dialogic Feedback Observation Tool (DFOT), predict student outcomes on standardized science Assessments?
## Results

<table>
<thead>
<tr>
<th>Variable</th>
<th>$B$</th>
<th>$SE\ B$</th>
<th>$t$</th>
<th>$P$</th>
<th>$R^2_{\text{Adjusted Change}}$</th>
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<tbody>
<tr>
<td><strong>Step 1</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>At Risk</td>
<td>-0.09</td>
<td>0.12</td>
<td>-0.83</td>
<td>.413</td>
<td>0.02</td>
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<td><strong>Step 2</strong></td>
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<td></td>
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<tr>
<td>At Risk</td>
<td>0.26</td>
<td>0.06</td>
<td>4.40</td>
<td>&lt; 0.001</td>
<td>0.385</td>
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<tr>
<td>DFOT</td>
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<tr>
<td>Total $R^2_{\text{Adjusted}}$ = 0.365</td>
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Contributions

- **Teaching and Learning of Science**
  - Captures actual teacher interactions instead of value judgments
  - Potential Teacher self-evaluation tool

- **NARST Members/Science Education Field**
  - Quantitative Tool that measures teachers’ ability to create potential opportunities for dialogic interaction.
Limitations

- Small Sample size
- Non-diverse student population
- Multiple-grade levels
- Only evaluated one video sample
Future Research

- The ASSIST Approach
- Correlations between dialogic feedback and teacher epistemic cognition
- Educative Curriculum Materials (ECM)
  - Video Based Coaching