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To Be or Not to Be---Is That a Good Question??

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Elementary Preservice Teachers and Questioning Strategies in Mathematics: Round 2

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Questioning and classroom discourse help teachers determine the depth of children’s thinking by incorporating effective questions addressing higher levels of Bloom’s (1956) cognitive domain:

- Kamii & DeVries, 1978; Kamii & Warrington, 1999; Schwartz, 1996; Stone, 1993; Sousa, 2000; Wassermann, 1991

Increased interest in the relationship between teachers’ questioning strategies and children’s ability to reason:

- Baroody & Ginsburg, 1990; Buschman, 2001; Carpenter, Fennema, Peterson, Chiang & Loef, 1989; Fennema, Carpenter, Franke, & Carey, 1993; Fennema, Franke, Carpenter & Carey, 1993; Sousa, 2000
The study

Methods students inexperienced at questioning
First methods class for many
Lesson plan questions very low level

Purpose: This session describes a pilot exploration designed to determine how well EC-6 preservice teachers can (a) recognize effective questioning strategies when observing inservice teachers and (b) analyze the effectiveness of their own questioning strategies after field experiences.

Began in fall 2012 (Round 1)
The study: Round 1

Analyzed videos

Structure of field experiences for math methods classes
  Five field experiences:
    One virtual experience (Annenberg-choice of four videos),
    Two field observations of mentor,
    Two experiences to teach mini-lesson

Structure of teaching experience
  Groups of three assigned to a mentor
  Teach 1/3 of class for 30 minutes
  Rotate students twice
  Allows students to teach same lesson three times and adjust each time

Audio recorded the two mentor observations and the two mini-lessons and analyzed
# NCTM Role of Classroom Discourse

## form used in 2011

<table>
<thead>
<tr>
<th>Teacher’s Role in Orchestrating Discourse: Questioning to Strengthen Discourse</th>
<th>Evidence – Questions/Statements</th>
<th>Level of Bloom’s</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>What questions/actions did the teacher ask/do to illustrate these characteristics?</strong></td>
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<td></td>
</tr>
<tr>
<td>1. Poses questions and tasks that elicit, engage, and challenge each student’s thinking.</td>
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<tr>
<td>2. Listens carefully to students ideas.</td>
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<tr>
<td>3. Asks questions to clarify and justify their ideas orally and in writing.</td>
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<tr>
<td>4. Decides what to pursue in depth from among the ideas that students bring up during a discussion.</td>
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<tr>
<td>5. Decides when and how to attach mathematical notation and language to students’ ideas.</td>
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<tr>
<td>6. Decides when to provide information, when to clarify an issue, when to model, when to lead, and when to let a student struggle with a difficulty.</td>
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<tr>
<td>7. Monitor’s students’ participation in discussions and decides when and how to encourage each student to participate.</td>
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</tbody>
</table>

### Student’s Role in Orchestrating Discourse

- **Not successful in analysis**
- **Students commented that not helpful when writing lesson plans or teaching**
- **Time to reevaluate study 😊**
Described and discussed Webb’s Depth of Knowledge levels

Described and discussed Hess’s Cognitive Rigor Matrix (CRM)
Different states/schools/teachers use different models to describe cognitive rigor. Each addresses something different.

- **Bloom** – What **type of thinking** (verbs) is needed to complete a task?

- **Webb** – How **deeply** do you have to understand the content to successfully interact with it? **How complex** is the content?
Webb’s Depth-of-Knowledge Level Shared with Students

- **DoK-1 – Recall & Reproduction**
  - Recall of a fact, term, principle, concept, or perform a routine procedure

- **DoK-2 - Basic Application of Skills/Concepts**
  - Use of information, conceptual knowledge, select appropriate procedures for a task, two or more steps with decision points along the way, routine problems, organize/display data, interpret/use simple graphs

- **DoK-3 - Strategic Thinking**
  - Requires reasoning, developing a plan or sequence of steps to approach problem; requires some decision making and justification; abstract, complex, or non-routine; often more than one possible answer or way to find answer

- **DoK-4 - Extended Thinking**
  - An investigation or application to real world; requires time to research, problem solve, and process multiple conditions of the problem or task; non-routine manipulations, across disciplines/content areas/multiple sources
The intended student learning outcome determines the DoK level. What mental processing must occur?

While verbs may appear to point to a DoK level, it is what comes after the verb that is the best indicator of the rigor/DoK level.

- **Describe** the physical features of a plant.
- **Describe** how squares and trapezoids are alike and different.
- **Describe** the most significant effect of WWII on the nations of Europe.
If there is only one correct answer, it is probably level DoK 1 or DoK 2

- DoK 1: you either know it (can recall it, locate it, do it) or you don’t
- DoK 2 (conceptual): apply one concept, then make a decision before going on applying a second concept

If more than one solution/approach, requiring evidence, it is DoK 3 or 4

- DoK 3: Must provide supporting evidence and reasoning (not just HOW solved, but WHY – explain reasoning)
- DoK 4: all of “3” + use of multiple sources or texts
Assessing only at the highest DoK level will cause missed opportunities to know what students do & do not know – go for a range; end “high” in selected/prioritized content

Performance assessments can offer varying levels of DoK embedded in a larger, more complex task

Planned formative assessment strategies and tools can focus on differing DoK levels

<table>
<thead>
<tr>
<th>Depth + thinking</th>
<th>Level 1 Recall &amp; Reproduction</th>
<th>Level 2 Skills &amp; Concepts</th>
<th>Level 3 Strategic Thinking/Reasoning</th>
<th>Level 4 Extended Thinking</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Remember</strong></td>
<td>-Recall, locate basic facts, details, events</td>
<td>Not appropriate at this level</td>
<td></td>
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<tr>
<td><strong>Understand</strong></td>
<td>-Select appropriate words to use when intended meaning is clearly evident</td>
<td>-Specify or explain relationships - summarize - identify central idea</td>
<td>-Explain, generalize, or connect ideas using supporting evidence (quote, example…)</td>
<td>-Explain how concepts or ideas specifically relate to other content domains or concepts</td>
</tr>
<tr>
<td><strong>Apply</strong></td>
<td>-Use language structure (pre/suffix) or word relationships (synonym/antonym) to determine meaning</td>
<td>-Use context to identify meaning of word - Obtain and interpret information using text features</td>
<td>-Use concepts to solve non-routine problems</td>
<td>-Devise an approach among many alternatives to research a novel problem</td>
</tr>
<tr>
<td><strong>Analyze</strong></td>
<td>-Identify whether information is contained in a graph, table, etc.</td>
<td>-Compare literary elements, terms, facts, events - analyze format, organization, &amp; text structures</td>
<td>-Analyze or interpret author’s craft (literary devices, viewpoint, or potential bias) to critique a text</td>
<td>-Analyze multiple sources - Analyze complex/abstract themes</td>
</tr>
<tr>
<td><strong>Evaluate</strong></td>
<td></td>
<td>-Cite evidence and develop a logical argument for conjectures</td>
<td>-Evaluate relevancy, accuracy, &amp; completeness of information</td>
<td></td>
</tr>
<tr>
<td><strong>Create</strong></td>
<td>-Brainstorm ideas about a topic</td>
<td>-Generate conjectures based on observations or prior knowledge</td>
<td>-Synthesize information within one source or text</td>
<td>-Synthesize information across multiple sources or texts</td>
</tr>
</tbody>
</table>
Using the CRM

- Provided samples of questions for students to analyze in groups (A-M)
  - Rich discussion prompted when groups disagreed
- Students in groups then took level 1 questions and rewrote for level 3 or 4
  - Shared with class
- Analyzed questions in videos including virtual field experience
- Wrote lesson plan 1 in groups of three
  - Exchanged lesson plans in class
  - Analyzed questions using Hess’s cognitive rigor matrix
  - Discussed how to improve
Continued analysis

- Audio recorded mentors during initial observation
  - In groups, analyzed questions using Hess’s CRM
  - Discussed analysis in class

- Audio recorded their lesson during field experiences
  - In groups, analyzed questions using Hess’s CRM
  - Discussed analysis in class
Student comments

- Students asked 8 questions
- Not a grade
- Students asked to be thoughtful and in-depth
1. Did you have any experience or training in writing and analyzing effective higher level questions prior to this class, perhaps in other methods classes?

- I used the chart you gave us in social studies methods but [the professor] did not train us on the chart or use the chart.
- I had never been asked to write higher level questions prior to this class.
- I have written many other lesson plans but did not pay attention to the levels of my questions.
- I have used Bloom’s in my ESL courses.
- This class really opened my eyes and helped me see how important higher level questions are.
2. Was using the Hess chart helpful when writing questions?

- Definitely helpful! I knew what to look for in each question. I knew that if I ask as yes/no question it is level 1.
- I like “at a glance guides” and plan to use this one in the future.
- It is already in my “Teacher Tool Binder”. 😊
- I often used the same type questions but now I am aware and can use other forms of questioning.
3. Was the chart helpful in analyzing the videos, your mentor, and your lesson plan?

- Yes because it provided me with real world examples of proper questioning.
- Analyzing and reflecting is important when creating your own understanding of questioning techniques.
- It allowed me to view the mistakes I was making in my own questioning strategies—like saying “can you”.
4. Which was easier to analyze: your questions, your mentors questions, or questions from the videos and transcripts?

- The easiest to analyze were my questions because I really paid attention to them.
- My own questions. I was a lot harder on myself than on others.
- The mentors and the videos were easier because they were more authentic than the transcripts or my lesson plans.
5. Have your questioning strategies changed to analyzing questions with the Hess chart?

- Yes because I found that I could write questions that fell within the higher levels.
- My question strategies have definitely changed because I am constantly trying to come up with higher level questions.
- Now I hardly ever ask yes or no questions and “one answer” questions.
- I now use more question during instruction instead of just giving examples.
6. Will you use the Hess chart when in Intern I and/or Intern II?

- I enjoyed using the chart and use able to build from recall to extended thinking by just changing a few words.
- I am in Intern I right now and have used the chart every single time I wrote lesson plans!
- Yes, it helped me come up with better questions and helped me realize that I was not asking very good questions.
- I used the chart to make a science lesson over magnetism.
7. Did having lesson plan group discuss the questions being asked help or hinder your learning to write effective higher level questions?

- Having lesson plan group analyze my lesson plan helped because I got feedback from two other people besides myself.
- This helped me realize that I need to ask better questions.
- It hindered my thinking since we all had different expectations. I like to analyze my own questions.
8. What did you learn about yourself and your questioning strategies from analyzing questions from multiple sources?

- I learned how to write better questions by analyzing my questions, my mentors questions, and the master teachers in videos questions.
- I learned that I like using questions where the students have to justify their answers.
- I realized, as hard as it is, that it is a trained habit and will become easier with time. (Referring to writing better questions)
Extending study

- Survey candidates for background in mathematics
  - Perhaps efficacy

- No quantitative data yet
  - Ideas??

- No follow up in Intern I or II
  - Ideas??