THE ROLE OF DISCOURSE IN TEACHING SCIENTIFIC INQUIRY: A DESCRIPTIVE STUDY OF TWO STUDENT TEACHERS

Background – Inquiry-based instruction & discourse

- *National Science Education Standards* (NRC, 1996): science as inquiry
- *Inquiry and the national science education standards* (NRC, 2000)

Essential Features of Classroom Inquiry

1. Learner engages in scientifically oriented questions
2. Learner gives priority to evidence in responding to questions
3. Learner formulate explanations from evidence
4. Learner connects explanations to scientific knowledge
5. Learner communicates and justifies explanations

Background – Inquiry-based instruction & discourse

- "fluent speaker of science" (Lemke, 1990)
- A productive marriage of science and language as key to scientific literacy (Mercer et al., 2004; Lewis et al., 2008; Hackling et al., 2010)
- Classroom discourse is mostly controlled by teachers and little of it is used for reasoning or developing ideas (Blanchard et al., 2008; Hackling et al., 2010)
- The practice of inquiry-based instruction often takes on different forms (Crawford, 2007)

Research Questions

1. What does inquiry-based science instruction mean to preservice science teachers (PTSs) ?
2. How do PTSs view the role of discourse in inquiry-based science instruction ?
3. How do PTSs structure a classroom discourse that supports teaching scientific inquiry ?

Methodology

- Participants

Mary, 8th grade biology

Jane, 12th grade anatomy & 10th grade biology, block

- Data collection

- EQUIP instrument (Marshall, Smart & Horton, 2010)
- Class video (45 min)
- Semi-structured interview (45-60 min) with each participant

Theme 1: Teaching scientific inquiry

- "Doing science" through hands-on activities
- Understanding the nature of science (NOS)

  - Scientific knowledge is tentative

  - Scientific inquiry is a collaborative process

    * Students communicate about scientific concepts (Mary)
- Acquiring the scientific language, e.g. vocabulary, writing (Jane)

Theme 2: Limited role of classroom discourse in supporting scientific inquiry

Table 2. Video lesson descriptions				
PST & Topic	**Class activities**	**Discourse type**	**Instructional purpose**	**Duration (minute)**
Mary: Arthropod	Graphic organizer	Small group	Review	7
	Arthropod quiz game	Whole class	Concepts/application	20
	Graphic organizer/drawing	Individual	Summary/review	10
Jane: Skeletal system	Board game	Small group	Prior knowledge	5
	Sharing questions	Whole class	Prior knowledge	10
	Mini-lecture	Whole class	Explanation	20
	Labeling the manikin	Small group	Concepts/review	10

Theme 2: Limited role of classroom discourse (cont.)

Table 3. Questions captured from the video lessons			
Teacher-generated questions: Type, count and examples			
	Mary	Jane	
Short-answer	16	11	Where is the zygomatic bone? What type of arthropod is this?
Explanation	2	3	Why does it (sternum) has 3 parts? How did you know it's a centipede?
Open-ended	0	0*	
Student-generated questions: Type, count and examples			
Clarification	2	4	Is sacrum the tailbone? Do we need to draw all the legs of the centipede?

- “You have to be careful not to get sidetracked with some of those questions because they are, it's like, you want to gets into this whole area of medicine that really wasn't what we were talking about today. But it's a really good question, so you try to answer it, try to answer it but kind of not completely get off track... Sometimes we can get good discussions go on. ” (Jane, interview)

- “Kids have a lot to bring to the class…. to some extent, you have to limit that so that you have time to finish your lesson because they could sit and talk about their personal experience. So there's a real balancing act I'm trying to figure out between encouraging that on one hand but also using it to steer the ship in the direction that it needs to go at the same time.” (Mary, interview)

Theme 3: Factors affecting inquiry-based science education

Table 4. Factors identified by PTSs		
Factors	**Mary**	**Jane**
Cooperating teacher	Much involvement	Little involvement
Time	No time for inquiry	Adequate time for inquiry
Student (age)	Younger students easier to engage	Older students with higher level of maturity
Tests	Test questions do not test students' ability to conduct scientific inquiry	

Discussion

- **IRE model**

  "guessing game" vs. authentic dialogue (Deneroff et al., 2002)

- **Argumentation**

  a monolith of facts, an automotive discourse vs. an attempt to establish truth with a claim supported by data, warrants, backings, qualifiers (Osborne, 2010)

- **Cooperating teacher**

Limitations

- video

- data size

- written ?

Conclusion

This study finds that the meaning and the practice of teaching scientific inquiry could have a different emphasis due to PTSs' own experience with inquiry and the nature of the class they teach. The two PTSs confirmed that discourse plays an important role in inquiry-based science classrooms, however, the degree to which they would like to have students talk about scientific ideas varies. Based on their video lessons, it is not difficult to conclude that teachers still do most of the classroom talking and oftentimes the talking is not supported by authentic inquiry experiences.

Questions and comments?

Thank you!

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