

Fall 10-19-2012

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Recommended Citation

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https://opencommons.uconn.edu/nera_2012/13

**Characteristics of the Questioning Techniques Used by Effective Elementary
Teachers During Mathematics and Language Arts Lessons**

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**Paper presented at the Northeastern Educational Research Association,
October 19, 2012**

Characteristics of the Questioning Techniques Used by Effective Elementary Teachers During Mathematics and Language Arts Lessons

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Introduction

This presentation reports on one aspect of a larger qualitative study that examined the communicative interactions and instructional planning/reflection processes of six effective first and second grade mathematics and reading teachers, four in two schools in New Jersey and two in two schools in Israel. In both locations half of the teachers worked in a lower SES bilingual school and half worked in an affluent monolingual school. All teachers were interviewed and observed during two mathematics lessons and two reading lessons. The purpose of the larger study is to determine the extent to which the teachers use similar or different instructional methods within and across the subject areas and the extent to which these methods differ across cultural contexts.

The presentation focuses on two case studies of the New Jersey second grade teachers. One teacher works in a lower SES urban school with students who have limited English proficiency and the other works in an affluent suburban school with students with high English language proficiency. The data examined come from one lesson from each of the teachers. The urban teacher's data come from a mathematics lesson on strategies for doing addition with several addends and the suburban teacher's data come from a language arts lesson on authors' purposes. The analysis examines their use of questioning to enhance students' learning during each of these lessons. We are particularly interested in the impact that cultural context has on teachers' questioning styles and on the similarities or differences that may occur in the teaching

across two disciplines, regardless of cultural context. We chose to focus on questioning strategies based on the literature indicating that questioning techniques are a critical indicator of teacher effectiveness (e.g., Block, Hurt & Oakar, 2002; Sparks, 2012; Topping & Ferguson, 2005) and because our observations of the teachers' lessons revealed questioning to be the most salient characteristic of their instructional strategies.

Theoretical Framework

Our research is grounded in some important trends and policies in the field of teacher education and teacher assessment affecting educators and students in the United States and in Israel. Recently we have been hearing more and more in the public and political sectors about how important teachers are for the success of students and how important it is to have a national curriculum to establish standards for learning and achievement for all students throughout their school years in every state, school district, and school in the country. At the present time the US is in the process of implementing such a curriculum through the *Common Core State Standards for Literacy and Mathematics* which have been accepted by 47 of 50 states. A similar trend is going on in Israel.

Along with these standards, it is expected that students will be rigorously assessed on what they are supposed to be learning and most significantly for teacher educators, teachers will also be assessed with a national rating system for judging their effectiveness in producing student success. While this sounds like a good idea, there is at least one major flaw in the plan in regard to the assessment of teachers. This flaw is that the basis for judging effectiveness will be uniform across all schools and districts and will be based on external judgments of what is *supposed* to constitute effective teaching, independent of context and individual differences. Even more important is that the effectiveness of teachers will be based on their students' achievement on

these “one size fits all” national assessments and on snap-shots of teachers’ in-class performance rated through observational checklists using generic categories of instructional behaviors assumed to be “best practices” by “experts” in education. It is our contention that before we can assess teachers’ effectiveness, we need to better understand what it is that constitutes effective teaching and this needs to be done by studying effective teachers in a variety of schools and communities in the context of specific subject areas.

This perspective is consistent with the work of Shulman (1987) who more than 25 years ago wrote a seminal paper about the kinds of knowledge and behaviors that teachers needed to possess and use in order to be effective practitioners who approached teaching with “educational reform” values that emphasized comprehension, reasoning, and reflection. He called for research that was based on actual observations in the context of specific teaching and learning situations of novice and expert teachers.

This call was heeded by educational researchers in mathematics education, but the majority of studies on what makes teachers effective tended to focus on documenting the occurrence of commonly agreed upon but pre-determined best practices of teachers rather than on direct observation of effective teachers to determine what these processes were (*e.g.*, Beswick, Swabey, & Andrew 2008; D’Agostino & Powers 2009; Graeber 2005; Hill, et al. 2008; Jamar & Pitts 2005; Morris, Hiebert, & Spitzer 2009). While this approach is valid for collecting evidence to support existing assumptions about effective teaching, it does not lead to new knowledge about what actually makes teachers effective. As Deborah Ball pointed out in 2008, we still do not know exactly what distinguishes effective teachers from less effective teachers based on classroom-based investigations of teachers themselves.

A third perspective on which our research is based comes from an examination of the behaviors of highly effective literacy teachers (Bohn, Roehrig, Pressley, 2004; Pressley, 2002; Pressley, Allington, Wharton-McDonald, Block, & Morrow, 2001). This research suggested that the teachers identified as effective literacy educators often used a balanced approach to literacy instruction and that a critical factor in student achievement was the teacher's skill in delivery. Also noted in the literature were the commonalities in behaviors demonstrated by effective teachers that included the use of engaging activities, the use of questioning techniques to both construct and assess knowledge, an enthusiasm for reading and writing, high expectations for all students, and the encouragement of student self-regulation.

Thus, if we are to better understand and prepare teachers to be consistently effective practitioners **with all students** in these times of teacher accountability and evidenced-based practices (CCSS 2010), then we need to study the teachers who are most effective and study these effective teachers in a variety of schools and communities.

Our research seeks to address the following questions:

- 1)What instructional behaviors and communicative interactions are used by effective elementary teachers during reading/language arts and mathematics lessons?
- 2)What do effective elementary teachers do and think about in planning, implementing, and reflecting upon their teaching of reading/language arts and mathematics?
- 3)To what extent do community and school cultures and contexts impact on what these teachers do and think?

Methodology

In each research site we have selected teachers from an urban school and from a suburban school, who were identified by their principals as effective teachers of both mathematics and

reading. Each site is working with first and second grade teachers. In New Jersey, there are four participating teachers, two from an urban Spanish/English bilingual school and two from an affluent monolingual suburban school. In Israel, to date two teachers have been selected, one from an Arab-speaking school and one from a Hebrew speaking school. This mix provides us with insight into the similarities and differences across cultures and languages. For example, the second language acquisition issues involved in the urban NJ and Arab school in Israel have a lot in common and we are very interested to see to the extent to which practices vary cross-culturally.

The schools were selected because of the researchers' past associations with the principals and faculty of these settings and their links to the graduate programs and professional development networks in our institutions. Thus while the actual teacher selection was based on the principals' judgements, the selection of the schools was based on prior successful professional associations with the schools. The principals in each school selected one or two effective teachers by completing a survey the researchers designed based on the literature on effective teaching (Curby, Stuhlman, Grimm, Mashburn, Chomat-Mooney, Downer, Hamre, & Pianta, 2011; Danielson, 2007; Gallagher, 2004; Kilday, C.R. & Kinzie, M.B. (2009) and on the participating New Jersey principals' feedback on the survey **(see Figure 1-Principal' Survey)**.

After the teachers were selected, we arranged for each teacher to teach two lessons in language arts and two in mathematics. The two lessons in the same subject took place on two consecutive days so that we could see some follow-up. The teachers were interviewed right after each lesson about their planning and reactions to the lesson implementation. All lessons were videotaped and all interviews were audiotaped. One of the researchers was also present to take field notes during the lessons. A total of 8 videotaped lessons were completed in New Jersey and

to date four lessons have been completed in Israel where the data collection is still in progress. Following the completion of all lessons in New Jersey, the teachers and principals were invited to view their tapes and to reflect on their teaching processes. These sessions were also audiotaped.

The data for this presentation are based on the videotapes of two classroom lessons and the analysis of those lessons in terms of the teachers' questioning strategies. The questioning strategies were evaluated and coded using transcripts of the videotaped lessons. All verbal exchanges between the teachers and the students were transcribed and annotated with contextual information gleaned from the videotapes. From these transcripts, all of the teachers' questions were recorded and coded according to the following categories: **(see Figure 2 –Coding chart)**

- 1)type of question
- 2)pedagogical function of the question
- 3)students' responses to the question
- 4)teachers' follow-up to the original question and to the students' responses
- 5)pedagogical function of the follow-up

For this presentation, only comparisons of the frequency, type, and pedagogical functions of the questioning used by the two teachers were made. Students' responses and teachers' follow-up comments and questions will be reserved for another discussion.

Results and Interpretations

All questions were listed and coded according to the categories shown in Figure 2. After that, the total number of questions asked during the whole group parts of the lessons were tabulated and percentages of questions falling within each question type and question function were calculated. Results of this analysis of the types of questions used by the second grade urban

teacher during a mathematics lesson and those of a second grade suburban teacher during a language arts lesson indicated that, perhaps surprisingly, the results did not vary much as a function of location or subject matter (See Figures 3 and 4). The most salient feature of both teachers' questioning was that they asked a very large number of questions during each lesson (305 questions during 49 minutes of whole class instruction during the language arts lesson and 201 questions during the 46 minutes of whole class instruction during the mathematics lesson). The relative proportions of types of questions in both cases fell into similar categories. For example, the vast majority of both teachers' questions were close-ended requiring short verbal responses of students (63% for the urban math teacher and 69% for the suburban language arts teacher). Those questions included straightforward direct questions, as for example, "How many pencils do they have in all?" They also included what we called fill-in responses as for example, "Because 4 plus 4 is equal to.....?" and occasionally multiple-choice questions such as, "Which one do you think is easier to add? A)Ten plus five or B)Eight plus seven?"

Nevertheless, both teachers also used a substantial proportion of questions that were more open-ended and required students to formulate fuller responses based on their own thinking (20% for the math lesson and 26% for the language arts lesson). For example, the teachers used questions such as "Can you explain how you did that?"

Interestingly, the urban math teacher asked a larger proportion of rhetorical questions, almost one fifth or 17%, compared to only 5% of similar questions asked by the suburban language arts teachers. These questions required no answer from the students or were asked and answered by the teacher. Examples of rhetorical questions included utterances of "OK?" "Alright?" and "Right?" as well as "Remember when we talked about that?" or "Don't we want to do it an easier way?" The difference between how many rhetorical questions were used by the

two teachers may be a function of the subject matter and how the teachers feel about teaching the subject matter or a function of the cultural differences in the two classes and schools or a combination of all. Alternatively, it may be that the language arts teacher used a different kind of question to achieve the same purpose. More on this below.

In terms of the function of questions used by both teachers, somewhat different patterns emerged here as well. For the second grade teacher during mathematics (See Figure 4) we found that the majority of questions asked (54%) were for the purpose of eliciting short correct answers from students. This is consistent with our finding that most questions were close-ended. However, we also noted that 34% of this teacher's questions were intended to evoke prior knowledge or provide review without making the review process stand out as a separate part of the lesson. This suggests that the teacher knew what her students knew and had confidence in their ability to access and utilize that knowledge with just some slight prompting.

Our observation is further supported by the fact that the math teacher used questioning to scaffold, direct, guide, and just provide information 26% of the time, suggesting that her efforts were strongly directed toward getting the students to think for themselves in a safe and supportive environment. This interpretation is consistent with the observation that the teacher also did include open-ended questioning and especially used questioning to expand the students' thinking 14% of the time. By expansion of students thinking we mean questions that required students to make connections between ideas or to explain the reason for their answers. For example, "Why did you decide to add 4 and 6 together first?" It was noted, too, that the bulk of the open-ended questions and expansion of thinking questions occurred during the summing up and small group reporting out activities that took place at the end of the lesson. In addition, the questions requiring an extension of thinking tended to be reserved for the higher functioning

students. The teacher made it clear that these students were being challenged more by her statements such as, “Let’s see what they did (referring to students at Table #4). Wow, they have even a harder one.” So what we see here is another important interpretation of the teacher’s reasoning behind her questioning suggesting that she is differentiating instruction and providing varied questions to match what she knows about the functioning and capabilities of her students.

A somewhat different pattern for question functioning emerged during the suburban language arts teacher’s lesson (**See Figure 5**). During the suburban language arts lesson, the teacher tried to evoke correct answers only 25% of the time (compared to 54% of the time during the urban math lesson), but tended to repeat questions with rephrasing 30% of the time (compared to only 8% of rephrasing questions asked by the math teacher). In addition, elicitations of prior knowledge to answer questions were posed only 12% of the time (compared to 25% of the time during the urban math lesson) and questions used to obtain agreement or class consensus were used 10% of time. Interestingly, the use of questions to provoke critical thinking during the language arts lesson were found in only 2% of all questions. In the case of the language arts teaching as it was in the case of the math teaching, though, there seems to be a great emphasis on supporting students’ responses and providing very small challenges so that students feel safe and can be willing to participate (13% of questions were used to scaffold or guide instruction and another 12% evoked prior knowledge). In neither classroom did the teacher seem to rush her students nor did she put pressure on them to be correct. Rather both teachers provided time for students to think and stay on task by providing them with multiple opportunities to answer each question.

We also want to discuss the urban math teachers’ use of rhetorical questions. We believe that these questions are used for two purposes. First they are used to build consensus and

agreement within the class, to keep everyone on the same page, and to check to see if any students are not paying attention. The teacher is looking around and observing students' expressions while she asks for agreement. If she sees puzzled expressions, she has an opportunity to go back and repeat or at least not move forward. This interpretation is supported by the data indicating that 14% of the questioning by the urban math teacher was used to clarify and focus student attention. Taken in conjunction with the 15% of questioning used to repeat or rephrase an initial question, we can conclude that a lot of what goes on during questioning is intended to maintain student attention, a critical factor in student learning. A similar finding was obtained for the suburban language arts teacher for whom 32% of the questioning was also used to rephrase questions and, thus, to clarify meaning for students.

This leaves us with the second function of the rhetorical question. That function may be to signal to the students that "we are moving on so listen up." It is a readying question that the students are accustomed to and to which they know how to respond. For example, the teacher said, "OK," followed by "We're going to be working with partners now? OK? So I'm going to ask that you go back to your seats." This interpretation will be addressed more thoroughly when we examine the follow-up to questions codes as we continue to work through our data in the future.

Conclusions

These observations of questioning patterns would not necessarily be viewed intuitively as reflecting best practices and what we would expect of effective mathematics and language arts teachers. Both teachers asked a lot of questions with the majority calling for short closed-ended answers. However, because the premise of our study is that effective practices are those practices used by effective teachers, not necessarily those practices that are being recommended by

theorists of educational practice, we needed to examine the reasons behind the questioning to determine if there were perhaps underlying reasons that could not be discerned simply by looking at observable practices. Based on this examination, we have drawn the following conclusions.

1)The patterns of the types of questions used by these two teachers in different subject areas and in different cultural communities were largely parallel, with large numbers of questions being asked and with many of them calling for direct short answers to closed-ended questions.

2)Their questioning was focused to provide support, guidance, and success for students' participation.

3)The teachers used very large numbers of questions throughout the lessons and tended to repeat, rephrase, or use rhetorical questions before students responded suggesting that they were giving students time to think and adjusting questions to include all students before moving on. Therefore, it appears that the teachers knew their students well and modified their questions to meet the needs of a diverse set of students.

4)The teachers asked many questions to obtain consensus and maintain a sense of community in their classes.

5)The questioning served the purposes of assisting students in making connections between concepts and using their prior knowledge in the service of new learning.

Future Directions for Data Analysis

Our next step in the data analysis is to rework our coding of the students' responses to the teachers' questions and examine the teachers' responses to the students as well as their immediate follow-up of their own initial questions. This examination will parallel our structure reported on here using categories of responses and their pedagogical functions.

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Principals' Survey of Effective Teaching

Name of Teacher: _____

Please complete the rating scale below and return to Dr. Rochelle Kaplan
 William Paterson University
 1600 Valley Road
 Wayne, NJ 07470

5 Always **4** Often **3** Sometimes **2** Rarely **1** Never **Not Applicable**

The teacher:	<u>5</u>	<u>4</u>	<u>3</u>	<u>2</u>	<u>1</u>	<u>Not Applicable</u>
1. enables students to make gains on achievement tests	<input type="radio"/>					
2. is confident about being able to teach <u>all</u> students successfully and imbues students with sense of confidence that they can be successful learners	<input type="radio"/>					
3. uses effective pacing and allotment of classroom time for instruction and academic tasks	<input type="radio"/>					
4. effectively manages classroom behavior	<input type="radio"/>					
5. has comprehensive knowledge of subject matter	<input type="radio"/>					
6. designs and implements lessons that have a clear focused objective	<input type="radio"/>					
7. creates a warm and caring atmosphere while modeling appropriate and respectful behavior of others	<input type="radio"/>					
8. holds high, but realistic expectations for all students	<input type="radio"/>					
9. engages in self-reflection in order to improve professional performance and increase student learning	<input type="radio"/>					
10. is flexible and open to "teachable moments" that go beyond the original plan	<input type="radio"/>					
11. engages students in higher order thinking and provides students with cognitively challenging tasks	<input type="radio"/>					
12. provides clear directions and explanations	<input type="radio"/>					

The teacher:	<u>5</u>	<u>4</u>	<u>3</u>	<u>2</u>	<u>1</u>	<u>Not Applicable</u>
13.makes the class interesting by using a variety of techniques, activities, and materials	<input type="radio"/>					
14.differentiates instruction, homework, and assessment for diverse students in same class	<input type="radio"/>					
15.uses a variety of assessment methods and uses assessment to change daily instruction	<input type="radio"/>					
16.makes appropriate and effective use of technology in the teaching and learning process	<input type="radio"/>					
17.works effectively with parents and families of students to involve them in the educational process	<input type="radio"/>					
18. communicates effectively with colleagues and administrators	<input type="radio"/>					
19.improves performance by listening to constructive criticism and changing practices accordingly	<input type="radio"/>					
20.participates in professional study and professional development experiences and uses these to inform instructional practices	<input type="radio"/>					

Figure 1. Principals' Survey for Identifying Effective Mathematics and Literacy Teachers

Question	Type of Question	Function of Question	Response from Students	Teacher's Follow-up Response	Function of Follow-up Response
	1.Open 2.Closed 3.Rhetorical 4. Fill-in 5. Multiple-choice	1.Repetition-restatement without change 2.Rephrasing of original question 3.Clarification 4.Review 5.Evoking prior knowledge 6.Assessment 7.Re-focusing student attention 8. To obtain an answer 9. To obtain agreement or consensus 10. Really a command or direction 11. Criticism or correction 12. To scaffold 13. To provide information 14.Classroom management 15. To expand student thinking	1.Relevant 2.Irrelevant 3.Short answer 4.Long answer 5. None	1.Repetition of teacher's original question 2.Restatement of teacher's original question 3.Provide additional information by teacher 4.Short affirmation of student's response 5.Repetition or paraphrasing of student's response 6.Correction to student's response 7.Ignoring of student's response 8.Asking for someone else or another answer without feedback to original student response 9. A different question 10. Answers own question 11. Praise 12. Gives directions 13.Classroom management	1.Repetition-restatement without change 2.Rephrasing of original question 3.Clarification 4. Review 5.Evoking prior knowledge 6.Assessment 7.Re-focusing student attention 8. Reinforcement 9. Correction or criticism 10. To provide additional information 11. Classroom management 12. Praise 13. To expand students' thinking

Figure 2. In-Progress Scoring chart for coding questions used by teachers during mathematics or language arts lessons

Figure 3. Percentage of Types of Questions Asked During 46 Minutes of Whole-Group Mathematics Instruction of Second Grade Urban Teacher*

Open-ended (N = 41)	Closed-ended (N = 126)	Rhetorical (N = 34)	Total (N = 201)
20%	63%	17%	100%

*Total number of questions asked was 201 in 46 minutes of whole group instruction. Full lesson was 1 hour and 4 minutes long.

In addition, of the 126 close-ended questions asked, 34 or 17% were in fill-in format and < 1% were in multiple-choice format.

Figure 4: Percentage of Types of Questions Asked During 49 Minutes of Whole-Group Language Arts Instruction*

Open-ended (N = 78)	Closed-ended (N = 211)	Rhetorical (N = 16)	Total (N = 305)
26%	69%	5%	100%

*Total number of questions asked was 305 in 49 minutes of whole group instruction

In addition, of the 211 close-ended questions asked, 5 % were rhetorical that included 2% fill-in format and less than 1% multiple multiple-choice format.

Figure 5. Percentage of Functions of Questions Asked During Math Lesson of Second Grade Urban Teacher*

Code	Category	Number	Percent of Usage
1	Repetition – no change	15	7%
2	Repetition with rewording	17	8%
3 & 7	Clarification or focusing attention	23	14%
4 & 5	Review or evoking prior knowledge	68	34%
8	To obtain correct short answer	109	54%
9	To obtain agreement or consensus (e.g., OK?)	35	17%
10, 12, & 13	Scaffolding, directing, guiding, or providing information	26	13%
14	Classroom management	10	5%
15	To expand students' thinking	29	14%

*N = 201 questions with multiple purposes were attributed to single questions. Percentages refer to percentages of all questions asked, but because categories are not mutually exclusive, totals are greater than 100%.

Figure 6. Percentage of Functions of Questions Asked During Language Arts Lesson*

Code	Category	Number	Percent of Usage
1	Repetition – no change	8	3%
2	Repetition with rewording	90	30%
3 & 7	Clarification or focusing attention	7	2%
4 & 5	Review or evoking prior knowledge	36	12%
8	To obtain correct short answer	75	25%
6	Assessment	18	6%
9	To obtain agreement or consensus (e.g., OK?)	31	10%
10, 12, & 13	Scaffolding, directing, guiding, or providing information	28	9%
11& 14	Correction & Classroom management	14	5%
15	To expand students' thinking	7	2%

*N = 305 questions with multiple purposes were attributed to single questions. Percentages refer to percentages of all questions asked, but because categories are not mutually exclusive, totals are greater than 100%.