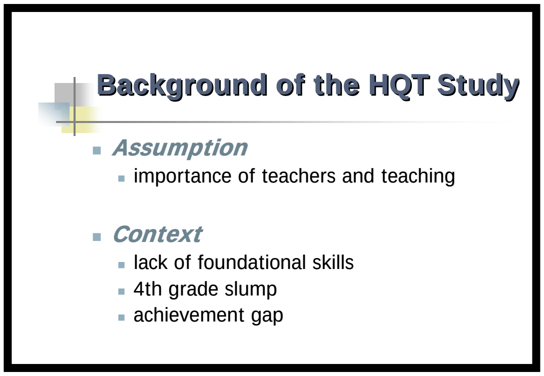
High Quality Teaching of Foundational Skills in Mathematics and Reading

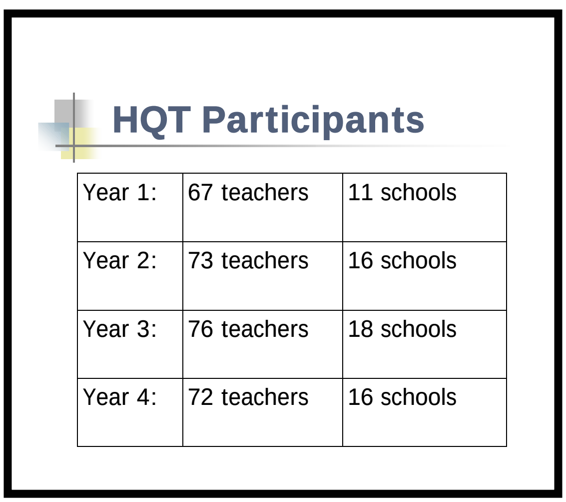
Interim Report, July 1, 2005

UMCP / MCPS Partnership Study of
High Quality Teaching in Mathematics & Reading
Supported by a grant from
Interagency Education Research Initiative

The High Quality Teaching Study[1] is based on the assumption that teachers and teaching are key factors in the quality of student learning. We focused on 4th and 5th grade reading and math because research has shown that these are the years in which an achievement gap occurs. The students' lack of foundational skills catches up to them and they can find themselves in a "4th grade slump."



We collected data over a four year period and focused on four key research questions seen below. The first year was a pilot year, during which we had eleven participating schools. After that, we were able to maintain a consistent number of participating teachers and schools, although the specific schools and teachers varied from year to year.



[1] This study is a joint effort of researchers from the University of Maryland in partnership with Montgomery County Public Schools and supported by a grant (#0115389) from the Interagency Education Research Initiative, a combined effort of the National Science Foundation (NSF), U.S. Department of Education, and National Institutes of Heath. This report was prepared from a Power Point presentation to HQT participants on May 19, 2005. Contributors to the presentation were Linda Valli, Robert Croninger, Marilyn Chambliss, Anna Graeber, Patricia Alexander, Daria Buese, and Caroline Eick. Dawn Little and Pam McHugh had primary responsibility for writing the text that accompanies the slides.

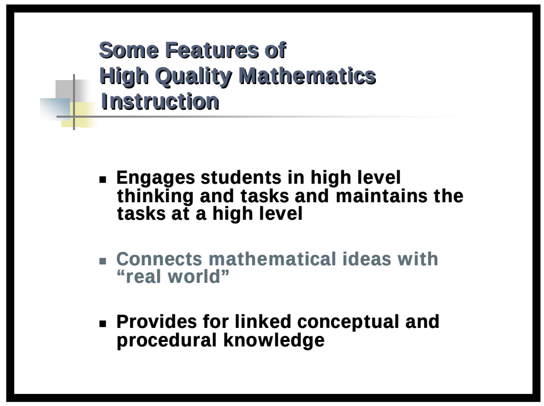
In this report, we focus on data gathered during Year 3 of the study (2003-04) through classroom observations. We first describe some general patterns we found in mathematics classes, then patterns in reading classes. After that, we discuss patterns we saw in teacher-student interactions across both reading and mathematics classes and ways in which participants talked about education policies and organizational factors affecting their teaching.

Mathematics

Some Features of High Quality Mathematics Instruction

Current research in mathematics instruction indicates a broad consensus about the characteristics of high quality mathematics teaching.

You will find some of these features to the right. See page 16 for a list of mathematics references.



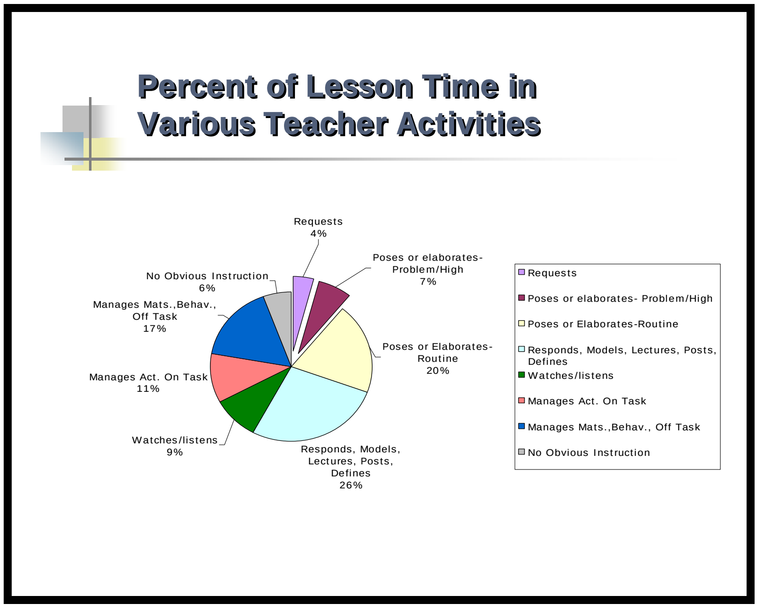
We developed an observation protocol that coded for the following parts of a lessson: Teacher Activity, Student Activity, Classroom Organization, Content of the Episode, Context of the Episode, and Classroom Behavior. An "epsiode" is defined as "a relatively brief segment of a class that occurs just as the coding screen opens." The data captured by these coded categories illustrate what was happening in that classroom at three minute intervals.

Teacher Activity

We developed the protocol[2] in hierarchical form, which began with a teacher requesting the following from a student:

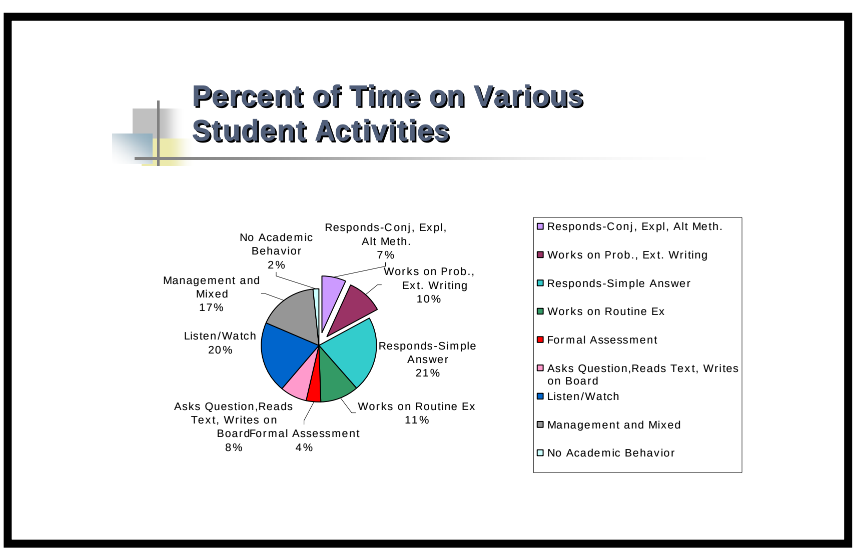
1. Student reflection
2. An alternative method/strategy
3. Student self-assessment
4. Elaboration of student response
5. Attention to student's response/idea

[2] We had a strict definition for determining what a teacher was doing at a given time. Every three minutes the screen on the computer would open to the protocol. The observers were instructed to record what was happening **at that instant.** Therefore, we did not record actions, such as requests, that may have occurred in the classroom at other times during the lesson.



The next choice in the coding hierarchy is the teacher posing a higher order question or problem to solve. The two pieces of the graph that are pulled out show that teachers actually made such requests of a student or posed higher order questions or problems a relatively small percent of the time. For the most part, teachers were responding, modeling, lecturing, posting, or defining for students. This is the turquoise piece of the graph. The yellow section shows that teachers posed routine questions or exercises almost three times more often than higher order questions or problems. They also spent a good portion of their time managing activities, materials, and student behavior.

Student Activity



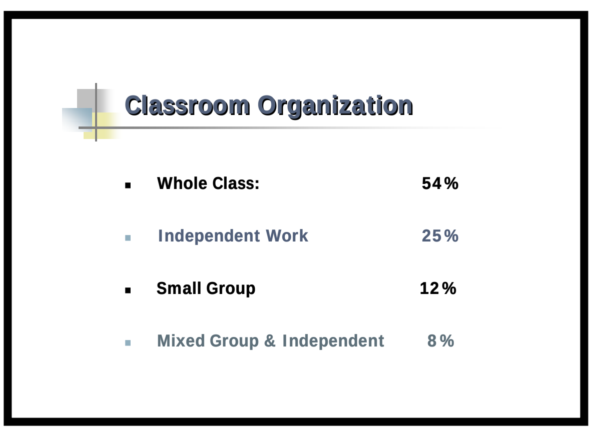
Similar to the hierarchy for the teacher activity, we also had a hierarchy for the student activity. Within student activity were two major headings: "Responds with or States" and "Works on." At the top of the hierarchy and in subsequent order were the following responses/statements from a student:

1. Conjecture
2. Explanation or justification
3. Alternative method
4. Simple answer/statement

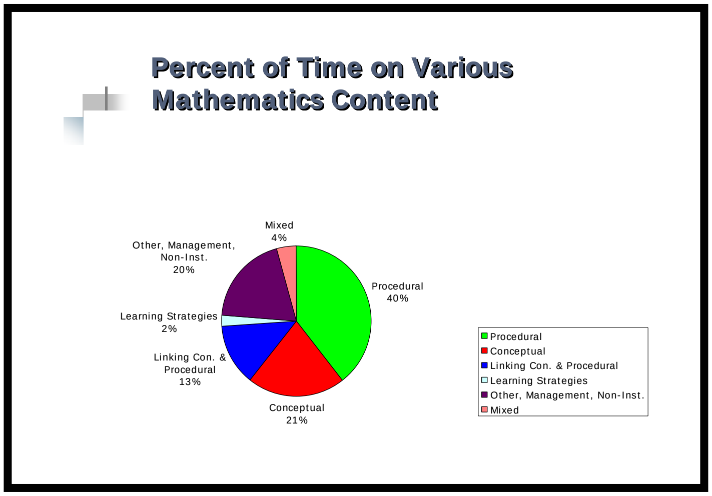
As shown by the lilac colored piece, students responded to teachers with a conjecture, explanation, or alternative method 7% of the time and worked on problems, or did extended writing (purple piece) about 10% of the time. However, if you look at Teacher Activity, you will notice that only 7% of teacher activity included posing a higher order question or task. Students worked on routine exercises (green piece) 11% of the time and gave simple answers (turquoise piece) 21% of the time, while teachers posed or elaborated on routine questions or tasks 20% of the time.

Classroom Organization

We found that teachers spent most of their time teaching mathematics to their students in a whole class setting. Students spent only about 12% of class time in a small group setting and about 25% working independently. Organization could change over a class period. Overall, however, mathematics was taught to the whole class and typically students were not divided into groups within their mathematics classes.



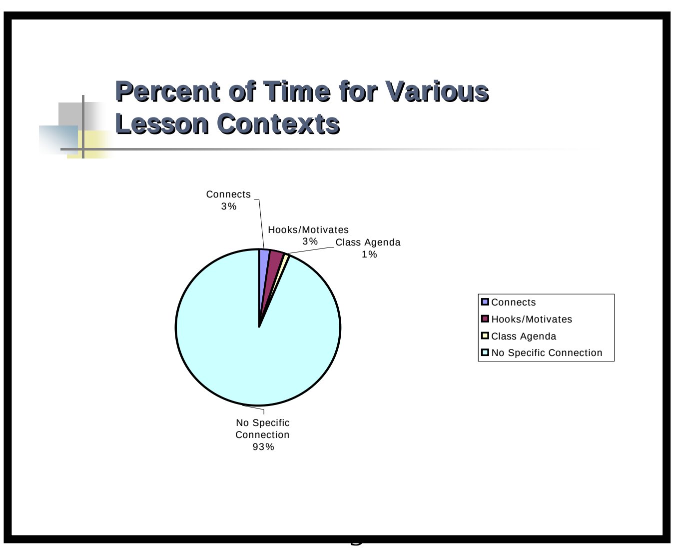
Lesson Content



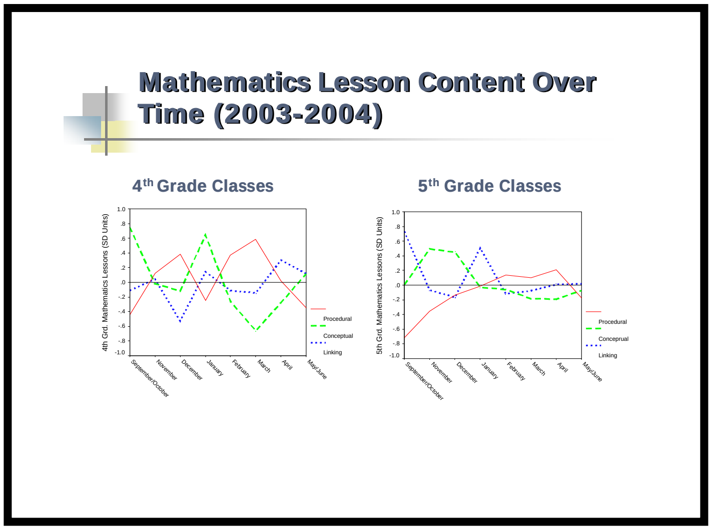
Almost half of the content taught to 4th and 5th grade students was procedural, focusing on routine ways to solve problems. Teachers spent about 20% of classtime on conceptual knowledge and 13% helping students link conceptual and procedural knowledge. Few learning strategies seemed to be taught, but about 20% of the time was spent on management and non-instructional activities, which included such activities as passing out papers, collecting papers, giving a homework assignment, and transitioning from whole class to small groups.

Lesson Context

We used a strict definition for determining the context of a lesson at a given time. When the screen opened, the observers were instructed to note if the teacher or student made **an explicit connection** at that specific instant. Therefore, although teachers and students might have been working on content that was connected to other mathematics, other content areas, or the real world, these particular instances would not be coded if they were not **explicitly made** at the time the screen opened.



Lesson Content over Time

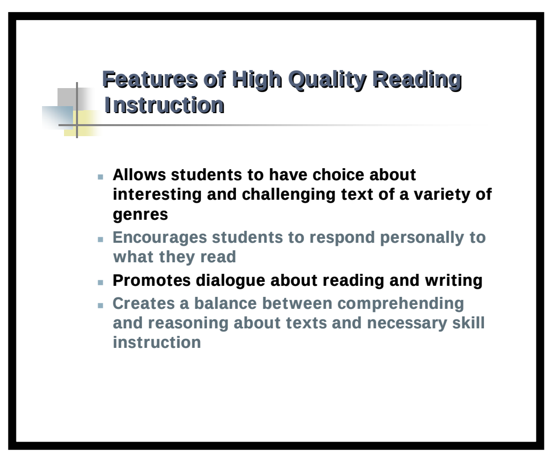


During the 2003-2004 school year, attention to procedural, conceptual, and linking aspects of mathematics changed over time for both 4th and 5th grade. Additionally, how that attention varied was different for the two grade levels. For the 4th grade, teachers were teaching more conceptual knowledge between December and February and more procedural items from November to December and again from February to March. As the procedural lessons began to taper off in March and April, there was a rise in linking lessons in April which tapered off by the end of the school year. For the 5th grade, conceptual lessons slowly built from September to December and slowly tapered off until the end of the year. Linking lessons started off strong in September, slowed down by December and then rose again between December and February, peaking in January. Procedural lessons started off low in September and slowly built up to a peak in April, at which time they began to decline for the rest of the year.

Reading

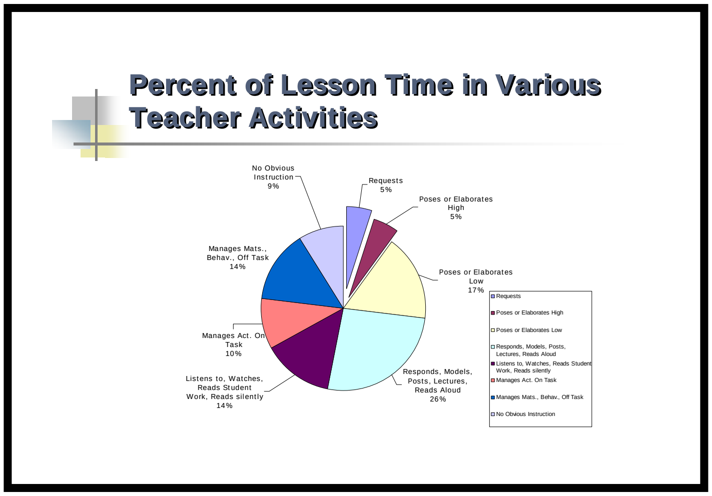
Some Features of High Quality Reading Instruction

After perusing a rich variety of reading research sources, we found several common beliefs about what high quality reading instruction required. You will find some of these common features to the right. See page 17 for a list of the reading references.



Just as we did in math, we developed an observation protocol that coded for the following parts of a lessson in reading: Teacher Activity, Student Activity, Classroom Organization, Content of the Episode, and Classroom Behavior.

Teacher Activity



We developed a protocol in hierarchical form, which began with a teacher requesting the following from a student:

1. Student reflection
2. An alternative answer
3. Student self-assessment
4. Elaboration of student response
5. Attention to student's response/idea

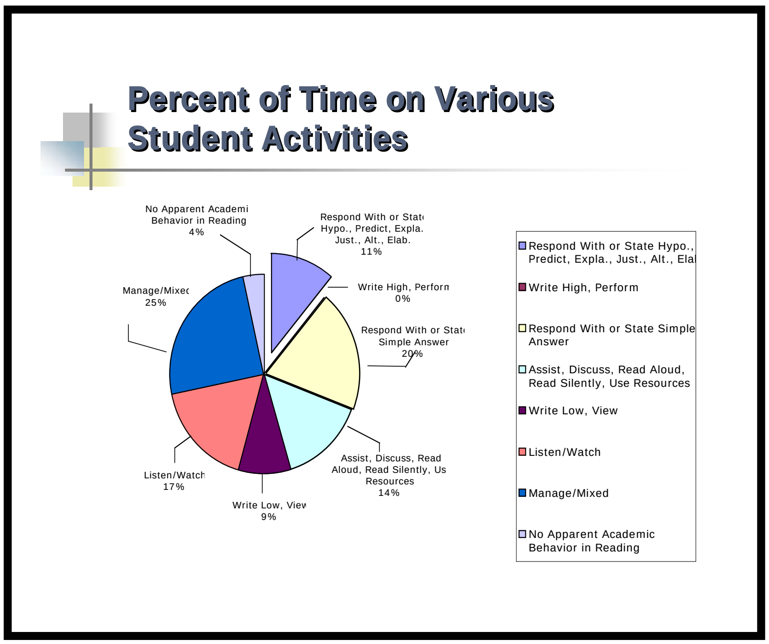
Next on the hierarchy, the teacher posed either a higher order question or task or a lower order question or task. When interpreting the graph you will find that only 5% of the time was spent on posing or elaborating on higher order questions and another 5% was spent requesting students to think metacognitively. These are the two pieces pulled out of the graph. The yellow piece of the graph shows that 17% of the time teachers were posing or elaborating on a lower order question or task. The turquoise piece of the graph shows that approximately ¼ of reading class time was spent responding to student questions, modeling, posting Venn Diagrams, charts or other key components of instruction, lecturing or reading text aloud.

Student Activity

Similar to the hierarchy for teacher activity, we also had a hierarchy for student activity. At the top of the hierarchy was the heading, "Responds with or states" and the following options:

1. Hypothesis/prediction
2. Explanation/justification
3. Alternative answer/statement
4. Elaborated answer/statement
5. Simple answer/statement

The “Responds with” piece of the graph has been pulled out to show 11% of the time students responded with a higher order response or statement, but 20% of the time students responded with a simple answer (yellow piece of the graph). An additional 25% of the time (the dark blue piece of the graph) was spent either on management (getting and/or reviewing materials, transitioning between reading groups, etc.) or Mixed Activity (where there was no clear cut majority of students working on the same activity).



Classroom Organization

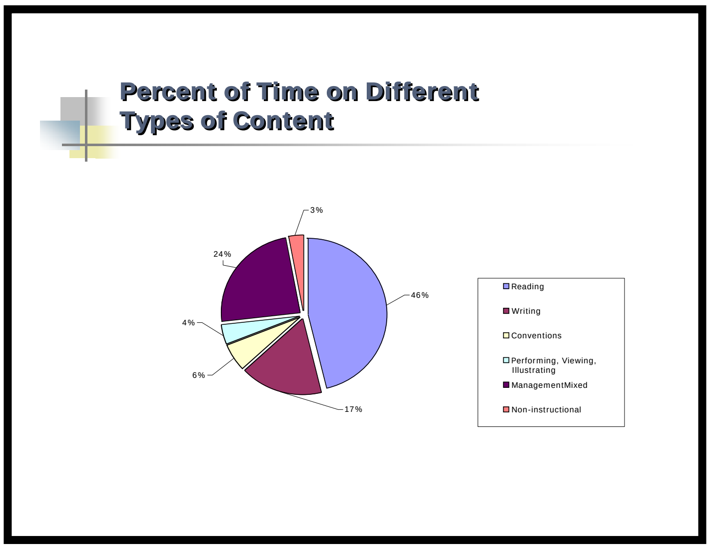
Classroom Organization

Whole Class	44%
Mixed Group & Independent	25%
Independent Work	20%
Small Group	11%

We found that reading instruction occurred in a whole class setting during almost half of the time we observed. However, ¼ (25%) of the reading class time was spent in Mixed Group & Independent with an additional 11% spent in Small Groups. We also found that the way teachers organize their students often changes over one class period.

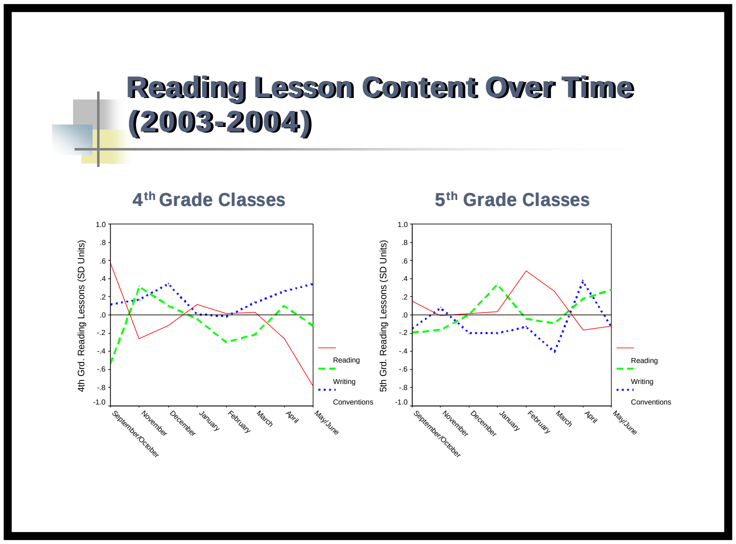
Episode Content

Nearly half of the reading period was spent on actual reading content. The light maroon piece of the graph shows that writing accounted for 17% of class time while 24% of time was spent on mixed activities or management (maroon piece of the graph). Other tasks such as performing, viewing, illustrating and working on writing conventions were also observed during the reading period. But since we specifically requested our observers to code during the reading block, the amount of writing that occurred during the day was probably underestimated. We were able to code writing and grammar when they were integrated into reading instruction, but this graph does not account for all writing and/or grammar instruction that was taught throughout the day.



Lesson Content

Content coverage for fourth and fifth grades showed different trends throughout the school year. In 4^{th} grade, conventions (blue line) were highlighted during the first half of the school year and again towards the end of the year, while in fifth grade conventions seemed to be the focus mostly from March – June. For fourth graders, literacy instruction focused mostly on reading (red line) in September and October, and for fifth graders literacy classes emphasized reading most intensely from January to March. Writing lessons peaked in November and December in fourth grade. Fifth graders had two “peak periods”: one from January to February and the other from mid-March to June.



Variety of Genres in the Classrooms

Variety of Genres in HQT Classrooms

Exposition: 32%

- **Articles: 6%**
- **Essays: 2%**
- **Trade books: 2%**
- **Textbook: 2%**
- **Procedural: 1%**
- **Reference: 1%**
- **Research: 1%**

Narrative: 35.2%

- **Realistic Fiction: 7%**
- **Historical Fiction: 5%**
- **Fantasy: 4%**
- **Autobiography: 1%**
- **Biography: 1%**
- **Fables: 1%**
- **Mystery: .6%**

The information found here is data gathered through teachers' daily logs. This chart shows that teachers spent about equal amounts of time on exposition and narrative. Within each of those text types, they also covered a wide variety of genres.

Please note that the columns do not add up to the total percent because these are selected examples, not an exhaustive list.

Findings about high quality teaching

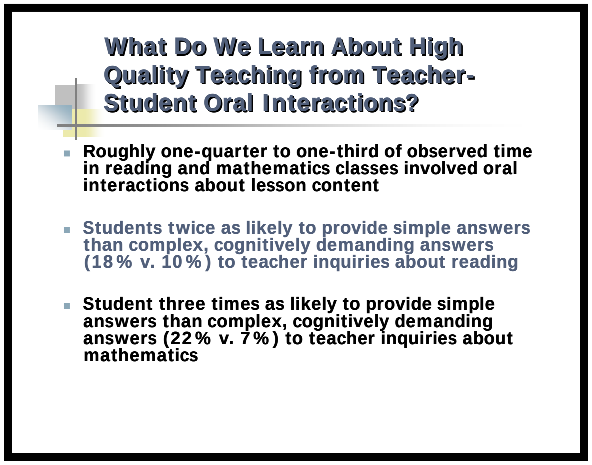
Based on preliminary analysis of our observations of reading classes, we have found that teachers use a variety of both expository and narrative texts. In addition, we have found that teachers primarily conduct teacher-led small group discussions about reading and teachers create a balance between reading, writing, and conventions.

HQT Reading Instruction

- **Uses a variety of both exposition *and* narrative chosen by the teacher to be personally relevant to students' lives**
- **Promotes dialogue about reading primarily in teacher-led small groups**
- **Creates a balance between reading and writing about texts and conventions**

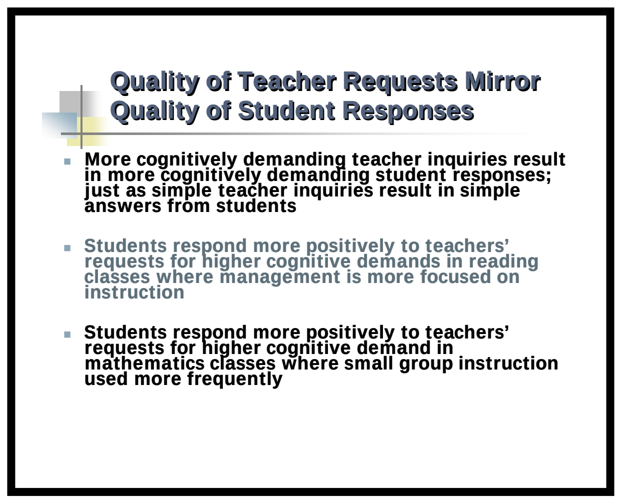
Teacher-Student Interactions

Oral Interactions between Teachers and Students



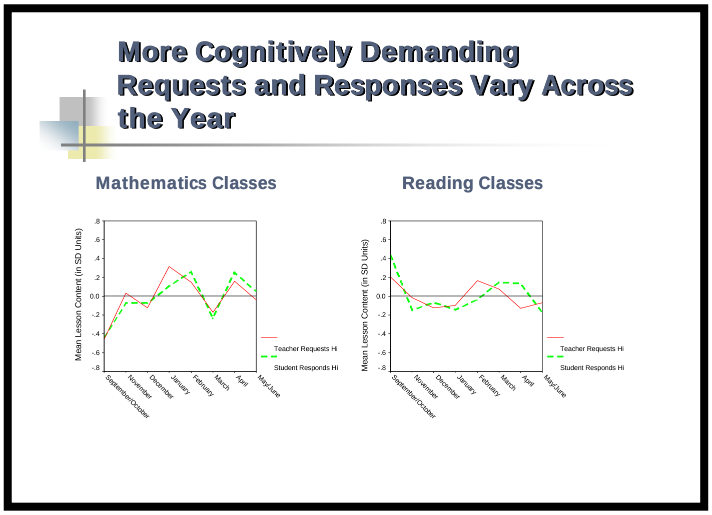
When analyzing the oral interactions between student and teacher, we found that students and teachers were involved in oral interactions for about 25% of a lesson in both mathematics and reading. Of these interactions, students were twice as likely to provide a simple answer as a complex answer to teacher inquiries about reading, and three times as likely to provide a simple answer as a complex answer in mathematics.

Quality of Teacher Requests and Student Responses



The quality of teacher requests mirror the quality of student responses. When teacher inquiries are more cognitively demanding, students respond with cognitively demanding answers. When teacher inquiries are simple, students respond with simple answers. Nonetheless, some teachers were more effective than others in soliciting more cognitively demanding answers from their students. In reading classes, teachers' requests were more successful when management was focused on organizing instructional activities rather than materials and student behavior; in mathematics classes teachers' requests were more successful where small group instruction was used more frequently as an instructional design.

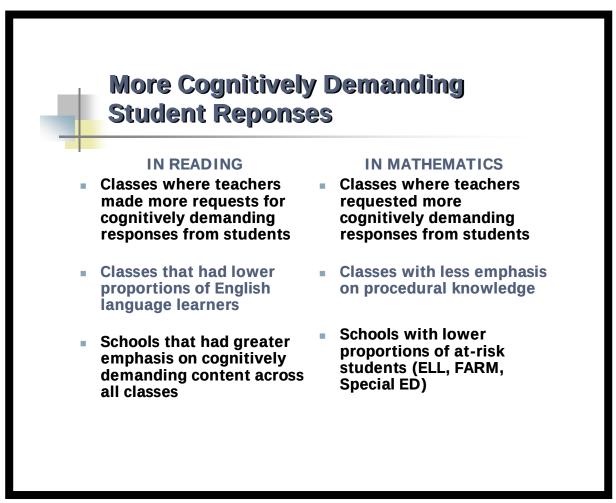
Requests and Responses over Time



We found that the quality of teacher requests and student responses varied across the school year. In mathematics classes, teachers' requests for cognitively demanding responses from students slowly increased until they peaked in January. They then slowly decreased until April when they peaked slightly again. The quality of students' responses almost mirrored teacher requests, except that cognitively demanding responses by students peaked around February. In reading classes, cognitively demanding responses by students were at their highest in September/October and slowly tapered off through the school year with a slight increase between March and April. Teachers' requests for cognitively demanding responses closely mirrored the students' responses with two exceptions. In February, teachers increased their requests and in April, they decreased their requests. In April, when teachers were less likely to call for a more cognitively demanding response, students were more likely to provide one.

Student Responses

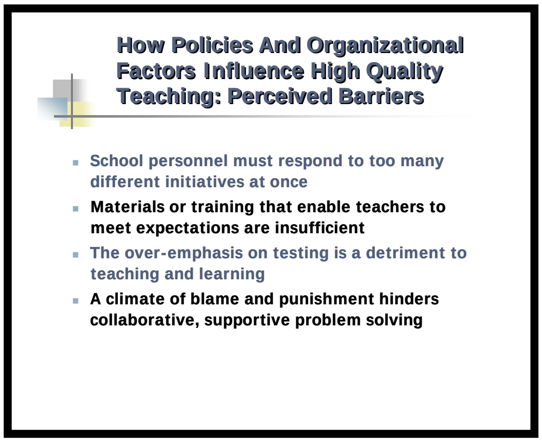
Students were more likely to give a more cognitively demanding response in classes where teachers' requested this form of response in both reading and mathematics. Nonetheless, student responses to teachers' requests varied across classes and schools. In reading, we found more examples of students providing cognitively demanding



responses in classes with lower proportions of English language learners and in schools that placed a greater emphasis on engaging students in cognitively demanding content across all classes. In mathematics, we found more examples of students providing cognitively demanding responses in classes that placed less of an emphasis on procedural knowledge (compared to conceptual and linking) and in schools with lower proportions of at-risk students.

Policy and Organizational Factors

Perceived Barriers

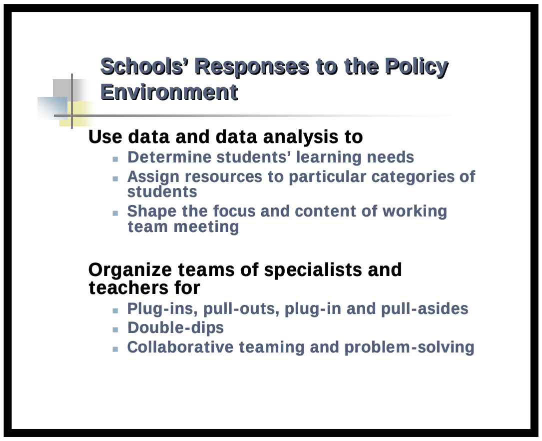


Through teacher interviews, we found several commonly perceived factors that could hinder teachers' ability to teach effectively. These included the possibility of too many initiatives requiring immediate response, insufficient materials or training to enable teachers to meet expectations, an over-emphasis on testing and test preparation, and a potentially negative policy climate that could put excessive responsibility and blame on teachers.

Perceived Supports

However, we also found commonly perceived supports through teacher interviews. These include goals and objectives that are clearly communicated, encouragement to develop a common language and vision within schools, priority given to struggling learners needs, teacher collaboration being rewarded, and data-based decision-making being valued.

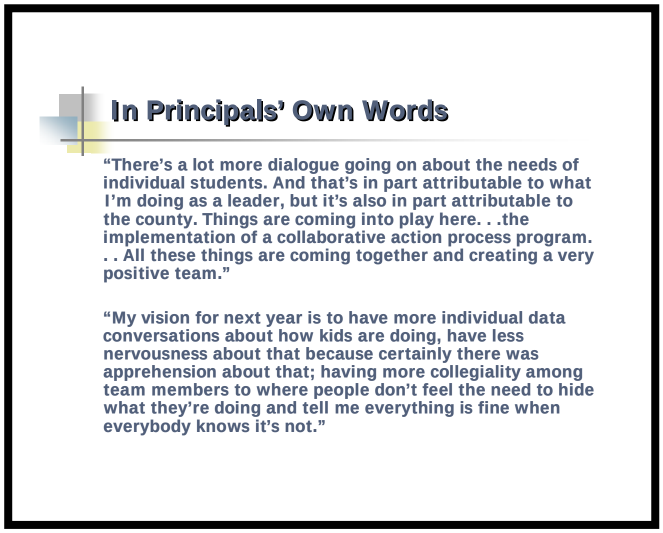
Schools Respond to Policy



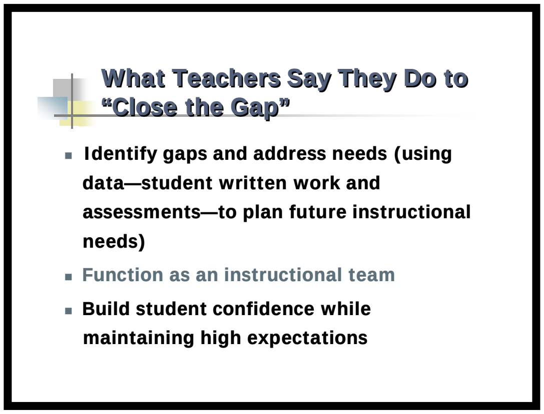
Schools have responded to policy in a variety of ways. They now use data and data analysis to determine students' needs, assign resources to groups of students, and shape the focus and content of team meetings. In addition, schools now organize teams of specialists and teachers to collaboratively plan, problem solve, and work together in a number of ways to promote student learning.

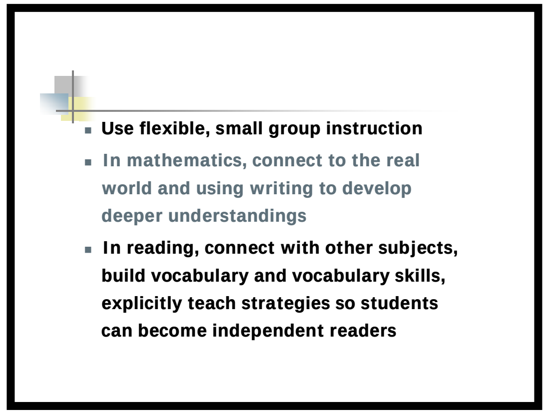
Principals Respond To Policy

Through principal interviews, we found out how principals felt about policy changes and how these changes are affecting their schools and teachers. Data analysis and collaboration seem to be the areas that principals are working on or continuing to work on as leaders.



Teachers Respond to Policy





Through teacher interviews, teachers also addressed ways they are trying to "close the gap." These include: identifying and addressing the needs of students, through data analysis, to plan future instruction; functioning as a working team; building confidence in students while keeping high expectations; using flexible small groups; connecting mathematics to the real world and using writing to develop deeper understandings; making connections to other content areas in reading, building vocabulary, and explicitly teaching reading strategies.

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