Assessing the Relationship Between Questioning and Understanding to Improve Learning and Thinking (QUILT) and Student Achievement in Mathematics: A Pilot Study

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Appalachia Educational Laboratory (AEL)
at

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Abstract

Good questions, effectively delivered are a key feature of learning and teaching. QUILT is a research-based, field-tested professional development program designed to assist teachers in developing and implementing effective questioning skills to facilitate student learning. The QUILT framework presents classroom questioning as a five-stage process: (1) question preparation, (2) presentation of questions, (3) prompting, (4) processing of student responses, and (5) reflection on questioning practice. A pilot study of the effects of QUILT on student achievement was conducted to explore the feasibility of an efficacy study of QUILT and to identify the methodological issues that would have to be addressed in its conduct. Twenty-eight fifth- and sixth-grade elementary school teachers in a rural school district in Kentucky were trained to implement QUILT as a teaching/learning strategy. During the spring of 2005, the teachers videotaped three different mathematics instructional sessions in which they used QUILT questioning techniques. Each tape was viewed by researchers from the Appalachia Educational Laboratory at Edvantia, Inc., and summarized using a special coding sheet. The QUILT behaviors were examined in relation to gains in mathematics achievement. This was accomplished using the mathematics section of the Measures of Academic Progress (Northwest Evaluation Association, 2005). The findings indicate that teachers implemented some QUILT questioning behaviors but not others in some of their mathematics instructional lessons and that a well controlled, randomized control trial is needed to examine the efficacy of QUILT as an effective instructional technique, being sure to address teacher training, fidelity of implementation, and assessment of student achievement issues.

Introduction

Good questions, effectively delivered, facilitate student learning and thinking as they serve to motivate and focus student attention, provide opportunities for practice and rehearsal, and provide the opportunity for teachers to assess how well students are mastering content (Dillon, 1988). Questioning is a core function of both learning and teaching; questions can stimulate students to think at higher cognitive levels (Dillon).

The QUILT professional development program, developed by staff in 1990 from the Appalachia Educational Laboratory (AEL) at Edvantia, Inc., is research based in terms of both (1) teacher questioning behavior and (2) the design of the staff development program. First, during development of program materials, the relevant empirical research literature (including relevant correlational, quasi-experimental, and experimental studies on effective questioning strategies) were thoroughly reviewed. Program materials have been periodically updated to assure they are consistent with the most rigorous empirical research available on questioning. Second, the research literature regarding professional development practices was reviewed and used in the development of the program. This research literature has periodically been updated to include the most current research regarding professional development. As a result, the QUILT program design focuses on student learning, is built on principles of adult learning, and is designed to be implemented over time. A general description of the QUILT program is contained in the appendix.

The QUILT program has been field-tested (AEL, 1994). In the field test, 42 participating schools were randomly assigned to one of three different treatment conditions: (1) Condition A—staff development training over an entire school year through implementation of all four components of the QUILT model: induction training, collegiums, partnering, and classroom application; (2) Condition B—three days of staff development training (i.e., the induction training) on the QUILT model; or (3) Condition C—three hours of staff development training on topics contained in the QUILT model. The researchers were able to determine that participating in the full QUILT program (Condition A) did positively affect the questioning skills of teachers. Specifically, the researchers found evidence that the full QUILT program design best helped teachers develop and use the QUILT questioning skills in their classrooms.

The QUILT program presents the questioning-answering-reacting interaction between students and teachers as dynamic and interrelated systems whose parts interact to affect the outcome of the teaching-learning process (AEL, 1994). The core content of QUILT includes effective classroom questioning strategies that are research based and consistent with active learning and teaching for understanding (Perkins, 1998; Perrone, 1998). These are embedded in a framework that presents classroom questioning as a five-stage process: (1) question preparation, (2) presentation of questions, (3) prompting, (4) processing of student responses, and (5) reflection on questioning practice. Specific examples of teacher behaviors included in this framework include the following:

(a) **Wait Time I.** Teachers typically require students to respond almost instantaneously to questions, allowing less than 1 second for students to think

through their answers. However, in classrooms where teachers wait 3 to 5 seconds, students give longer responses, answer more frequently at higher levels of evaluation and synthesis, and ask more questions (McGlathery, 1978; Rowe, 1986).

(b) **Wait Time II.** Teachers usually react immediately to a student response, waiting an immeasurably short amount of time before providing feedback or making another instructional move. In classrooms where teachers wait 3 to 5 seconds after the initial student response, students answer more completely and more correctly; exhibit more speculative and inferential thinking; ask more questions; increase interactions with other students; and demonstrate more confidence in their responses (Garigliano, 1972; Gooding, Swift, & Swift, 1983; Rowe, 1974).

(c) **Asking questions at all cognitive levels.** About 75% to 80% of the questions posed in both elementary and secondary classrooms are recall-of-knowledge questions (Dillon, 1988; Gall, 1984; McGlathery, 1978). However, when students are afforded opportunities to answer questions at higher cognitive levels, they demonstrate an ability to analyze, synthesize, and evaluate; they also score better on tests measuring recall and understanding of content (Redfield & Rousseau, 1981).

(d) **Redirecting questions.** Teachers typically answer questions when students do not answer or do not give the answer the teacher was seeking. However, when teachers pose one question to more than one student (i.e., when they redirect questions), students are held more accountable for answering all questions; additionally, the interaction among and between students increases (Ornstein, 1988; Riley, 1981).

(e) **Designating a respondent.** Teachers frequently name a student to answer a question *before* posing the question. However, when teachers name a student *after* posing a question, all students are more likely to attend to the question and to prepare a covert response in preparation to being called upon to answer the questions (Gall, 1984; Ornstein, 1988).

(f) **Repeating student answers.** Teachers commonly repeat student answers; however, when teachers do not repeat answers, students pay greater attention to and show increased respect for their classmates' responses.

It has been documented for teachers in 13 schools (AEL, 1994) that, after one year's participation in QUILT, teachers showed significant gains in knowledge, understanding, and application of effective questioning, including (1) a decrease in the number of teacher questions, (2) an increase in wait time, (3) an increase in the number of redirected questions, (4) an increase in the percentage of questions directed at higher cognitive levels, (5) a decrease in the number of respondents designated before questions are asked, and (6) a decrease in repetition of student answers.

The next step in researching the effectiveness of QUILT is to examine the relationship between such changes in teacher behavior and student achievement. Therefore, a pilot study was conducted to explore the feasibility of such a study and to identify the methodological issues that would have to be addressed in a full-scale efficacy study of the effects of QUILT on student achievement.

Methodology

A pilot study was conducted in cooperation with a rural school district in Kentucky which implemented QUILT district-wide as an instructional strategy. Therefore, the study was descriptive in nature and based on assessing the correlation between the imposition of QUILT questioning behaviors and student achievement.

Participants

The 28 fifth- and sixth-grade elementary school teachers who participated in the study were from a rural school district in Kentucky. These teachers were trained to implement QUILT as a teaching/learning strategy. Some of the participants were among those who took part in the 4-day comprehensive QUILT training conducted by AEL professional development staff; others were trained by school district personnel who had attended a training-of-trainers event conducted by AEL staff. No systematic evaluation assessments were conducted in association with the QUILT training conducted by school district personnel so there is no available evidence regarding the fidelity of QUILT training the teachers received.

QUILT Implementation

At the start of the 2003 school year, almost all teachers and administrators in the school district received three days of QUILT training through professional development workshops held at their schools. The trainers for these workshops were teachers and administrators who had been trained by AEL staff to train other teachers and administrators to use QUILT. Beginning in September 2003, the QUILT questioning technique was adopted by the school district as an instructional strategy to be used in classrooms across the district. The central office personnel who received the initial QUILT training from AEL staff were responsible for training teachers and administrators new to the district in the use of QUILT questioning behaviors in their schools.

During the spring of 2005, fifth- and sixth- grade elementary school teachers from each of the district's six elementary schools videotaped three different mathematics instructional sessions in which they used QUILT questioning techniques. The tapes averaged 14.10 minutes (SD=2.2) in length. Each tape was viewed by AEL researchers, who summarized each session by using a special coding sheet to record QUILT behaviors observed during the questioning session.

QUILT Coding System

The teachers' QUILT behaviors were categorized and summarized using a machine-readable coding system (summarized in Table 1 below) that captures who asks the question, who is asked the question, what kind of question is asked, who responds to the question, what type of response is given, what the teacher's response is (if any), what the student reaction is (if any), Wait Time I, and Wait Time II.

Table 1. QUILT Coding System Summary

Coding Category	Behaviors Coded
Who asks the question	• Teacher • Student
To whom is the question addressed	• Teacher • Designated student to whom the question is addressed before asking the question • Asks the question, then designates a respondent • Whole class • Addresses the question to one or more cooperative groups
What kind of question is asked	• Recall (facts from memory) • Check for understanding of procedures and routines • Use (using knowledge to comprehend, apply, or analyze) • Teacher repeats the question two or more times • Create (synthesizing to arrive at a conclusion) • Teacher asks multiple questions
Who responds to the question	• Teacher • Designated student responds • Whole class, choral response • None • Unknown
What type of response is given	• Recall • Use • Create • Asks for clarification • No answer • Unknown

Coding Category	Behaviors Coded
What is the teacher's response	• Positive feedback and/or praise (e.g., That's right.) • Negative feedback (e.g., That's wrong.) • Corrective feedback • Criticism • Teacher repeats the answer • Teacher repeats the question • Teacher probes • Teacher cues/prompts when answer is incomplete or incorrect • Teacher rephrases the answer • Teacher redirects the question • Teacher uses student response • None
What is the student's reaction	• One student adds on to the answer given • More than one student adds onto the answer given • One student asks a question • More than one student asks a question
Wait Time I	• The estimated length of time in seconds between the teacher asking a question and acting further (e.g., calling upon a student)
Wait Time II	• The estimated length of time in seconds between a student's response and the teacher's reaction (e.g., providing positive feedback)

Coding Procedure

Each teacher's videotaped session was coded by two AEL researchers using the machine-readable coding system to record QUILT behaviors observed during the questioning session. Any discrepancy in coding between the two researchers was resolved by both researchers reexamining the section in which the coding difference occurred and coming to agreement about how the particular behavior should be coded. There were no instances in which the raters could not come to an agreement. Therefore, interrater reliability was 100% for each coded behavior. Each videotaped questioning session required approximately one and one half hours to code to agreement.

Mathematics Achievement Assessment

The assessment of mathematics achievement was accomplished using the mathematics section of the Measures of Academic Progress (Northwest Evaluation Association, 2005), an achievement test already being administered by the cooperating district to assess student achievement in mathematics. This test has been created to measure what a student knows and needs to learn. The test is based on Rasch Units, referred to as RITs, which create an equal

interval scale that aligns student achievement levels with item difficulties. The higher the RIT score, the higher the level of difficulty. The equal interval scale is grade independent, and the scores mean the same thing as when the scale was first introduced. Most students' scores fall between the RIT score values of 140 and 300.

Test-retest reliabilities for the Measures of Academic Progress mathematics test have been found to range from .86 to .93 (Northwest Evaluation Association, 2004). For Grades 4, 5, and 6 on the same test, marginal reliability coefficients, which are indexes of reliability based on combining measurement error estimated at different points on a scale, have been reported to be .94. This method of estimating reliability is purported to yield estimates nearly identical to coefficient alpha (Northwest Evaluation Association, 2004).

The concurrent validity of the Measures of Academic Progress mathematics test has been examined by comparing Measures of Academic Progress mathematics RIT scores with mathematics scores on various states' achievement tests (e.g., the Arizona Instrument to Measure Standards and the Illinois Standards Achievement Test) and the Stanford Achievement Test, 9th edition. For Grades 4, 5, and 6, correlations of .80 to .89 have been found between the Measures of Academic Progress mathematics test and these other measures of mathematics achievement (e.g., the Stanford Achievement Test, 9th edition). The validity of the Measures of Academic Progress mathematics test as a proxy measure for the Kentucky Core Content Test of student achievement in mathematics is not known.

Data Analysis

The completed QUILT coding sheets were scanned, and SPSS data files were created for analysis. Two different types of analyses were then conducted. First, descriptive statistics for the various coding categories were produced and graphic displays of these outcomes created. Second, correlation and regression analyses were conducted to assess degrees of association between coded QUILT behaviors and the average mathematics achievement of the class as assessed by Measures of Academic Progress (Northwest Evaluation Association, 2005).

Results

The reporting of the results has been organized such that for each research question addressed, descriptive statistics are reported and graphic presentations are provided, if appropriate, to summarize teacher questioning behavior. Second, the results of statistical analyses are reported to describe the degree of association between specific teacher questioning behaviors and mathematics achievement.

Research Question 1: Who asks most questions during a QUILT session? Is there a relationship between who asks the questions and average gains in mathematics achievement test scores?

Virtually all questions (99.8%) in the videotaped sessions were asked by teachers. Students were rarely, if ever, observed asking questions of the teacher or other students. This information is summarized in Table 2 below.

Table 2. Percentage of Questions Asked by the Teacher and Student During the Instructional Lesson in Mathematics

Individual Who Asked the Question	Percentage of Questions Asked
Student	0.02%
Teacher	99.8%

With virtually no variance, no inferential statistical analyses were conducted.

Research Question 2: After a question is asked, is there use of Wait Time I? Is there a relationship between the use of Wait Time I and average gains in mathematics achievement test scores?

Wait Time I captures the amount of time teachers allow students to think before asking them to respond. On average, teachers asked approximately 42 questions in a 15-minute period. As is shown in Figure 1, about 50% of the time, on average, the teachers gave the students no Wait Time I (labeled None on the graph). About a third of the time, on average, the teachers gave the students more than 3 seconds of Wait Time I, an ideal wait time in the QUILT model.

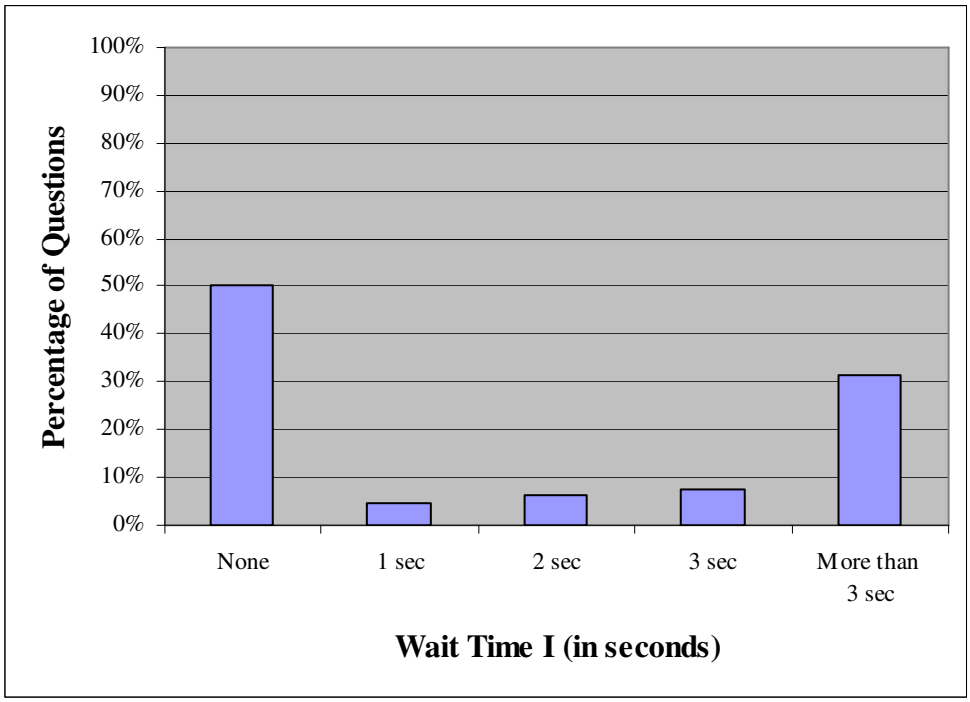

Figure 1. Percentage of questions of different lengths of Wait Time I asked in an average instructional session

The correlation of a teacher's average Wait Time I across three instructional sessions and mean gain in mathematics achievement was small and nonsignificant, $r = .075$, $p = .704$. This indicates that for the sample studied, there is no association between the average amount of Wait Time I teachers provided and average gains in mathematics achievement as assessed by the Measures of Academic Progress.

Research Question 3: Who is typically designated to answer most questions during a QUILT session? Is there an association between the designee and average gains in mathematics achievement test scores?

The designation of a student to answer a question *after* a question is posed is an indication that a teacher is engaging in a QUILT behavior. About 60% of the time, on average, students were designated to answer a question after the teacher posed a question. Almost 20% of the time, on average, the whole class was called upon by the teacher to answer a question in a choral response. About 20% of the time, students were identified by the teacher as the individual who was to answer a question *before* the question was asked by the teacher. This information is presented in Figure 2.

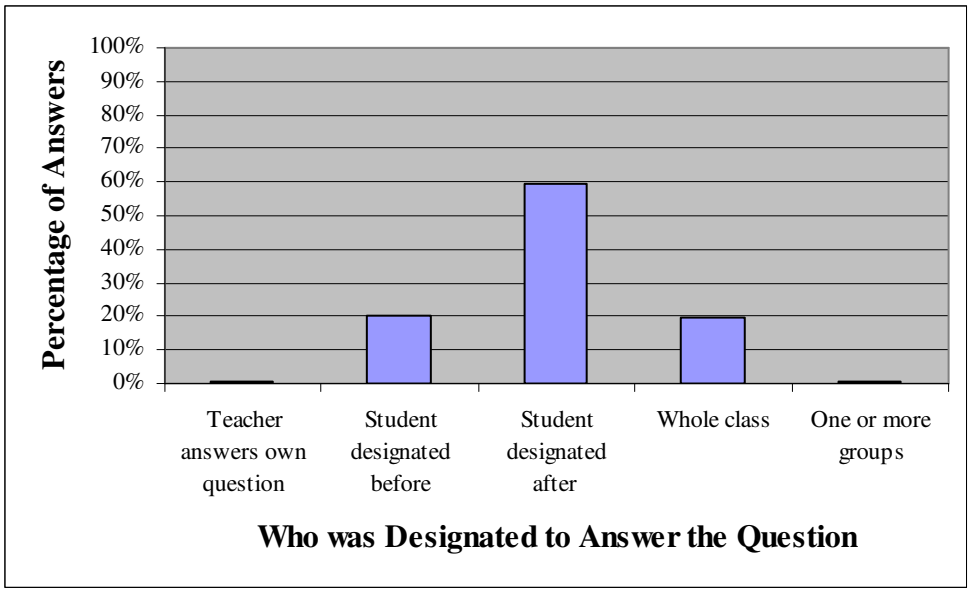

Figure 2. Percentage of questions answered by different designated individuals or groups in the classroom

The correlation between the average percentage of questions per session for a teacher where students were designated to answer after the question was posed and average gain in mathematics achievement for each class was found to be low and nonsignificant, $r = -.056$, $p = .776$. The elimination of an outlier from the analysis increased the correlation, but it remained nonsignificant, $r = .188$, $p = .348$. Thus, there is no evidence that engaging in the QUILT behavior designating students to answer after a question was posed is related to average gains in mathematics achievement as assess by the Measures of Academic Progress.

Research Question 4: What level of question is asked most frequently during a QUILT session? Is there a correlation between question level and average gains in mathematics achievement test scores?

As shown in Figure 3, for the classrooms observed in the present study, about 20% of the questions, on average, were found to be *recall* questions and about 74% were categorized as *use* questions. Only slightly more than 1% of the questions were higher cognitive level *evaluation and synthesis* questions, and about 3.5% of the questions were asked to check for understanding of procedures and routines.

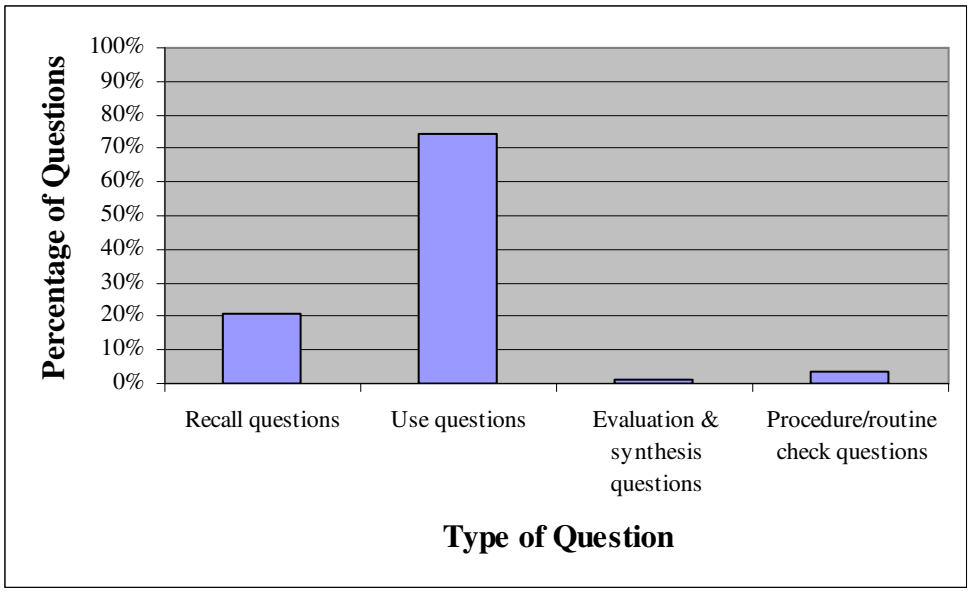

Figure 3. Percentage of different types of questions asked by teachers

Average gains in mathematics achievement scores were not found to be related to the percentage of *recall* questions posed, $r = -.009$, $p = .962$, the percentage of use questions, $r = -.077$, $p = .695$, or the percentage of evaluation/synthesis questions, $r = -.016$, $p = .934$. The correlation between mathematics achievement and the percentage of questions asked to check for understanding of procedures and routines was larger, $r = .293$, but not significant, $p = .130$. In sum, the analysis revealed no discernable relationship between the number of different types of questions teachers asked and the average gains on the Measures of Academic Progress in mathematics achievement.

Research Question 5: Who responds most often to questions during a QUILT session? Is there a correlation between respondent and average gains in mathematics achievement test scores?

The findings revealed that most questions teachers asked were answered by the students to whom they were directed. On average, this occurred 86.38% of the time. More than 12% of the time, the whole class responded to the teacher's questions. Less than 1% of the time, the teacher responded to his/her own question, there was no response, or it could not be determined who responded. These outcomes are summarized in Figure 4.

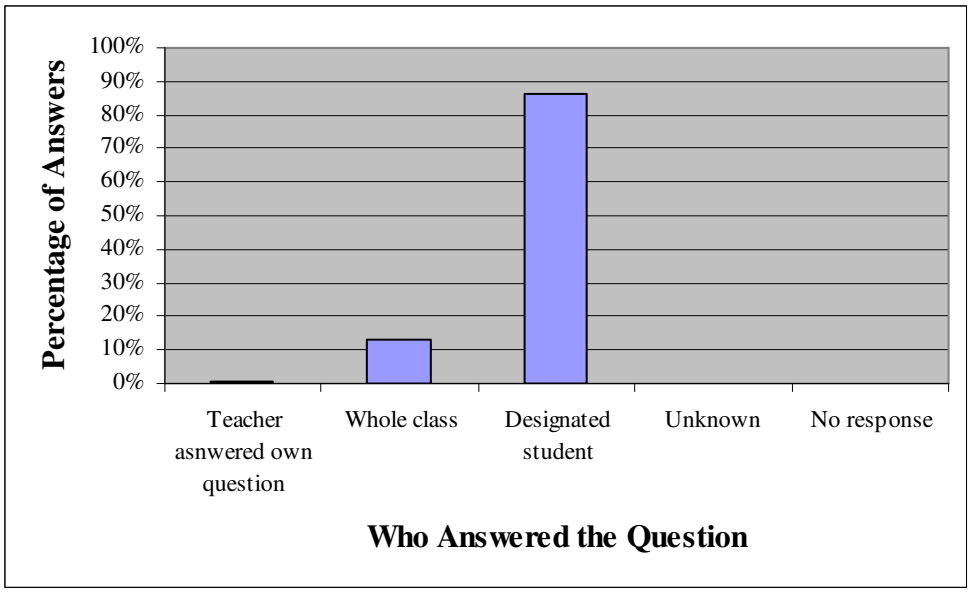

Figure 4. Percentage of answers given by the teacher, the whole class, the designated student, an unknown student, or "no response"

Average gains in mathematics achievement scores were not found to be related to the percentage of answers to teacher questions by designated students, $r = -.149$, $p = .448$. Thus, the desired teacher QUILT behavior was not found to be related to average mathematics gains on the Measures of Academic Progress.

Research Question 6: What type of response is common during a QUILT session? Is there a correlation between the level of response and average gains in mathematics achievement test scores?

On average, most of the responses given to the questions the teacher asked were *use* responses (73.49%). That is consistent with the fact that most questions were *use* questions (74.2%). Recall was the next most common type of response, on average (21.77%). This finding was consistent with the fact that 20.9% of the questions teachers posed were *recall* questions. There were very few of other types of responses given: evaluation and syntheses—1.23%, unknown—1.80%, and no response—1.72%. There were no clarification responses recorded in any of the questioning sessions. These findings are summarized in Figure 5.

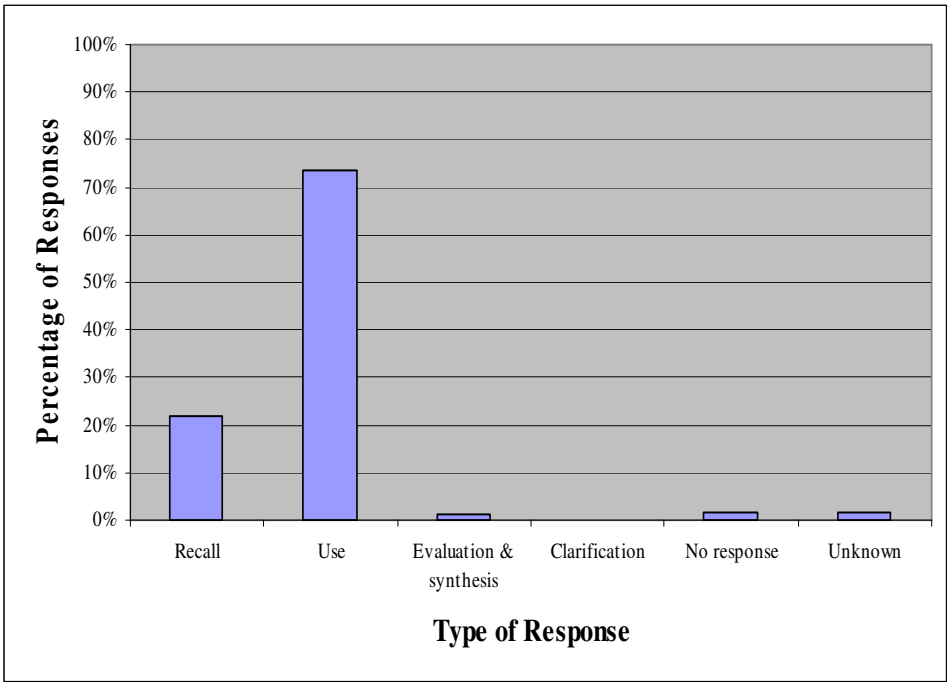

Figure 5. Percentage of answers of different types given in responses to teacher questions

Average gains in mathematics achievement scores were not found to be related to the percentage of *use* questions, $r = -.077$, $p = .695$. This can be interpreted to mean that asking *use* questions and getting *use* answers is not related to the average gains on the Measures of Academic Progress in mathematics achievement that were observed.

Research Question 7: Is Wait Time II used during a QUILT session? What is the correlation between Wait Time II and average gains in mathematics achievement test scores?

Teachers gave no Wait Time II 95.81% of the time, as depicted in Figure 6. In almost all instances, as quickly as an answer to a question was given, the teacher immediately moved on to ask another question, to redirect the questions, and so forth.

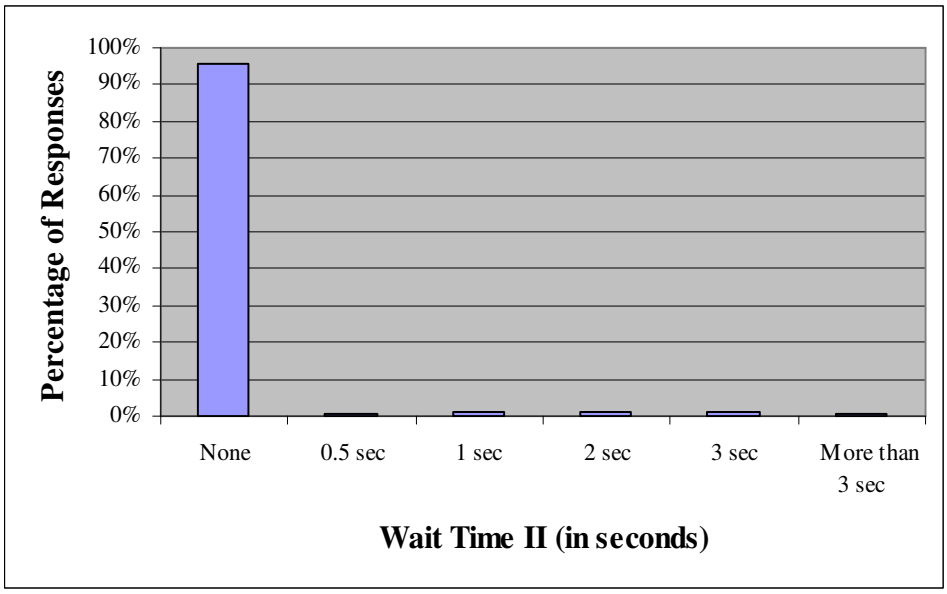

Figure 6. Percentage of responses with no Wait Time II to more than 3 seconds

The correlation between average Wait Time II and gain in mathematics achievement scores was not significant, $r = -.193$, $p = .326$, primarily because the teachers exhibited little, if any, Wait Time II.

Research Question 8: How do teachers typically react to student answers during a QUILT session? Does teacher reaction appear to affect average gains in mathematics achievement test scores?

The average number of questions teachers posed during the teaching sessions observed was approximately 42. As the students answered those questions, a variety of different types of teacher behaviors were observed in response to the students' answers. These responses are summarized in Figure 7. Because teachers gave multiple types of responses to students' answers, the total number of teacher responses is larger than the total number of questions asked and the total number students' answers.

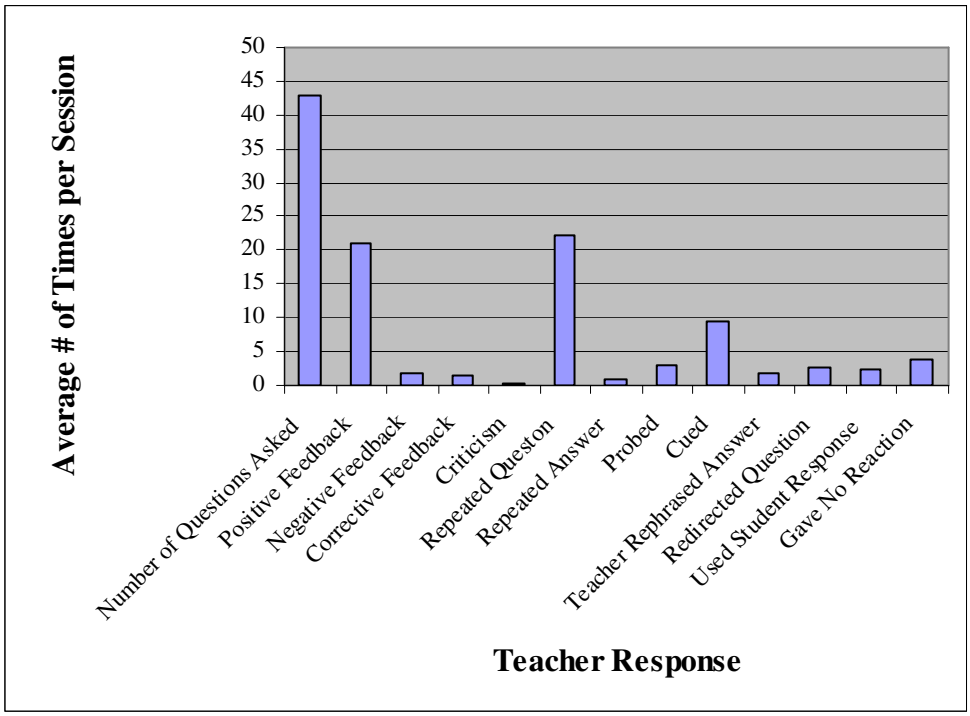

Figure 7. Average number of different types of teacher responses to students' answers to teacher questions

The average number of the different types of teacher responses to student answers for each teacher was examined in comparison to average gain in mathematics achievement for each teacher's classroom. The QUILT model is based on the notion that variety of feedback is appropriate and that there tends to be an overuse of positive or surface answers such as "good answer" and "good try." The QUILT model advocates increased use of corrective feedback, cues, and probes. Examination of the correlations between gain in student achievement and the average number of the various teacher behaviors revealed that only the average number of negative feedback responses was positively related to mathematics achievement, $r = .382$, $p = .045$, $r^2 = .15$.

Research Question 9: How do students typically react to answers during a QUILT session? Does student reaction appear to affect average gains in mathematics achievement test scores?

Students' reactions to teachers' questions, other than to answer them, were minimal. As shown in Figure 8, the most frequent student response was to add on to answers given by other students, but that response occurred only about 5% of the time. Other reactions were observed even less often.

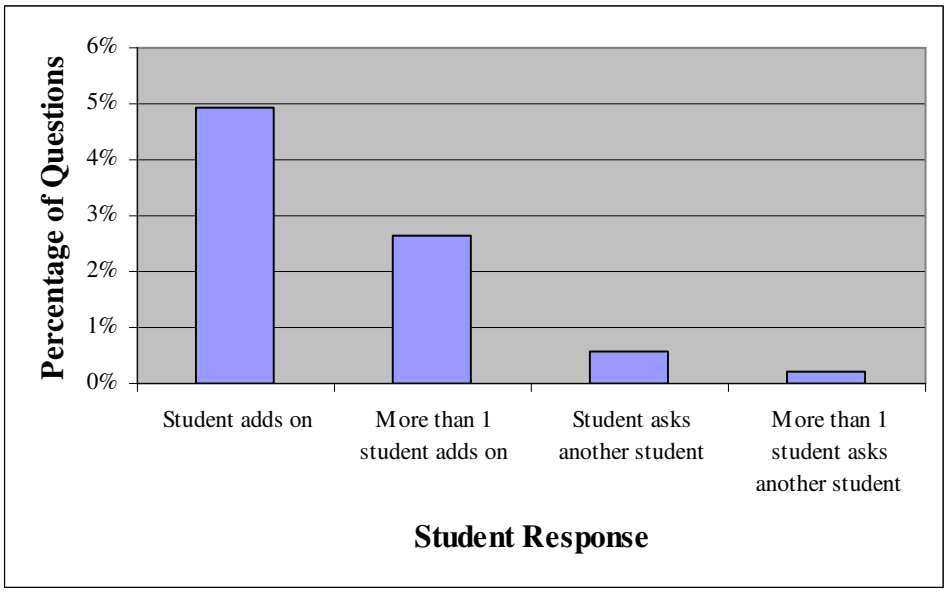

Figure 8. Percentage of different types of student responses to teacher questions

None of the average percentages of the students' reactions were found to be significantly related to gains in mathematics achievement, $p>.05$.

Conclusions

The findings of this pilot study indicate that teachers are regularly implementing some QUILT questioning behaviors as part of the instructional strategies being used in their mathematics instruction. However, this pilot study provided no direct evidence that these behaviors are systematically related to gains in mathematics achievement. The learnings gained from the pilot study will guide the development and implementation of an experimental efficacy study of the relationship between the use of the QUILT instructional strategy and student achievement.

QUILT Behaviors

The teachers in this pilot study were recorded implementing aspects of the instructional lessons observed. For instance, teachers exhibited a Wait Time I of more than 3 seconds about a third of the time—a behavior that would be expected to generate longer student responses, answers at higher evaluation and synthesis levels, and more student questions. Furthermore, more than 70% of the questions posed in the sessions observed were *use* questions. In contrast, (75% to 80% of teacher questions in a typical classroom are *recall* questions (Dillon, 1988; Gall, 1984). Students in QUILT classrooms were designated as respondents *after* the teacher posed the question about 60% of the time (instead of *before* as typically done by most teachers). Teachers were also observed not repeating answers to questions very often. Not repeating answers facilitates students' paying greater attention to and showing increased respect for their classmates' responses.

It was also observed that other QUILT behaviors were not frequently demonstrated during the instructional lessons. For example, the teachers exhibited almost no Wait Time II; they generally reacted immediately to a student response before providing feedback, allowing time for student questions, or making another instructional move. They were also rarely observed posing one question to more than one student (i.e., redirecting questions)-or probing or prompting to scaffold student responses.

The pilot study demonstrated that QUILT coding system is usable to capture QUILT questioning behaviors of videotaped instructional lessons where QUILT is being used. While time consuming to accurately capture QUILT questioning behaviors, it is a highly reliable system.

Gains in Mathematics Achievement

No relationship was found between gains in mathematics achievement as assessed using the Measures of Academic Progress (Northwest Evaluation Association, 2004) and use of QUILT behaviors. This finding may be due in part to the fact that QUILT is a dynamic instructional technique composed of discrete, but interrelated, components that, when disaggregated, do not align with the goals of the Measure of Academic Progress Progress or the

levels of student cognition drawn on by questions posed by teachers as they implemented QUILT..

Next Steps

The implementation of a well controlled, randomized control trial is needed to examine the efficacy of QUILT as an effective instructional technique. Based on the pilot study, the efficacy study should possess three key features.

First, all teachers participating in the study should receive the same QUILT training at the same time provided by the same trainers. One of the sources of potential confounding in the pilot study was different teachers received training from different trainers at different times.

Second, the fidelity of the implementation of QUILT questioning techniques should be systematically monitored to assure teachers do implement QUILT as designed and there is not "slippage" of implementation over time. The pilot study did not include a formal assessment of implementation fidelity. Therefore, it is not known whether QUILT behaviors "not often seen" by researchers in the pilot study (e.g., Wait Time II) were just not commonly used by the teachers or if it was a differential training issue.

Third, the instrument(s) used to assess student achievement should be one(s) that are sensitive to outcomes expected as the result of the use of QUILT (i.e., evidence of divergent thinking when problem solving) and that have evidence of being related to state assessments of student achievement. The Measures of Academic Progress mathematics test used in the pilot study by the cooperating district is an assessment of achievement in mathematics that is not known to be related to the state's assessment of mathematics achievement of students and may or may not assess the use higher cognitive levels of thinking that are the goal associated with the implementation of QUILT.

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Appendix

Description of QUILT Program

QUILT stands for Questioning and Understanding to Improve Learning and Thinking. As a yearlong professional development program for classroom teachers, QUILT applies research on learning, listening, and teacher effectiveness and is designed to enhance classroom questioning techniques and increase student learning and thinking.

QUILT was developed to help educators recognize the relationship that exists between questioning practices and student learning outcomes, know the characteristics of effective classroom questioning, assess personal questioning practices and behaviors, use effective questioning and practices, and teach students how to question effectively (Walsh & Sattes, 2004).

Training in QUILT consists of four components:

1. **Induction training:** Participants learn about effective questioning techniques during a four-day introductory training period, which includes a presentation of knowledge and theory, demonstration of behavior and skills, and application of the process.

2. **Collegiums:** Once trained, participants meet periodically at their respective school sites to learn, share, and interact about the questioning behaviors targeted for practice and improvement.

3. **Partnering:** Teams of educators, trained to use QUILT, participate in ongoing support activities at their respective schools, where teachers observe and are observed by their partners while engaged in the process.

4. **Classroom Application:** During their involvement in the program, participants practice skills in the classroom and teach students about effective questioning practices.

Schools, districts, or states usually send teams of educators to a national QUILT professional development workshop for training in the four components of OUILT listed above. Teams trained in QUILT typically return to their schools, districts, or states and provide an abbreviated version of the training to colleagues at their respective educational institutions where the above components are actualized and QUILT behaviors are introduced as an ongoing teaching/learning strategy (Walsh & Sattes, 1995).

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