

## **Research Question**

Does assessment-for-learning help under-achieving students experience success in mathematics?

## **My Setting**

P.S. 64 is part of Region 1 in the DOE configuration of schools. It is in the Highbridge section of the Bronx on Walton Avenue, just ten blocks north of Yankee Stadium. P.S. 64 is a school of 994 students. The area population is primarily Dominican: 80.6% Hispanic, 17.9% African American, and 1.5% Asian and others. Of the 80% Hispanic students, 37% have been identified as English Language Learners (ELL's). Of this latter group, 8.3% are recent immigrants to the United States, that is, they immigrated within the last three years. The English Language Learners receive exceptions in standardized reading exams for three years, however, Math tests are given to all students.

As a third grade Lead Teacher in P.S. 64 in the Bronx I am responsible for the math instruction within my own classroom. My teaching goal for the school year 2005-2006 was to be more effective in differentiating instruction and meeting the individual needs of each student. The plan I developed was to use the school and district summative assessments – the unit math assessments and the Princeton Review—as formative assessments to help me to determine student progress as well as what students needed to know. As I compiled the data from these sources in November 2005, I realized that the students were failing and little was being learned. This was a pretty grim reality for me, so I decided to shift my focus. I started to work with assessments for learning (formative), and I started to observe student progress and learning.

As an experienced teacher, I knew that students were learning. I also knew that their reading abilities and language difficulties were handicapping them: Of the 20 students in the class, 10 were reading on a 1<sup>st</sup> grade level, and 10 were at a beginning 2<sup>nd</sup> grade level. Because of their scores on the NYSESLAT (New York State English Second Language Assessment Test), my students were considered monolingual and therefore did not qualify for any supportive language services. However, 50% of the students went home each day to Spanish language dominant homes where 25% of the parents did not speak English.

## Review of the Literature

My initial impetus to focus my research on assessment was spurred by the Association for Supervision and Curriculum Development's goal for 2005-2006: Assessment to Promote Learning. After I began collecting the initial summative data I questioned how it would help me to teach better. As I continued to read and search out the literature I came upon the explanation of formative assessment by Black and Wiliam (1998):

Formative assessment practices can be used to improve performance or practices. Formative assessment encompasses any activities undertaken by teachers or students that provide feed back that will be used to modify teaching and learning activities.

The distinction between summative and formative assessments set me to thinking about how to determine whether the students were processing math concepts and gaining understanding.

Vygotsky's social development theory of learning helped me to begin to shape my inquiry using my knowledge of the unique characteristics of the class: low-level readers, English language learners. Vygotsky described the life-long process of development as dependent on social interaction and held that social learning actually leads to cognitive development. Vygotsky described a **Zone of Proximal Development (ZPD)** – that place where a student can perform a task under adult guidance or with peer collaboration that the student could not accomplish alone. This is, as he describes it, a very powerful place for learning. As I continued to read about Vygotsky's theory, I realized that there were many examples of learning as a social activity and of the ZPD in my class each day. Students always wanted to work with someone and did not want to be alone.

Further research guided me to Paul Black, Christine Harrison, Clare Lee, Bethan Marshall and Dylan Wiliam (1998, 2004) who have focused their research on the study of the impact of formative assessments on teaching and learning. Their studies highlighted some critical issues related to assessment of children's learning: 1) the assessment methods that many teachers use are not effective in promoting good learning; 2) grading practices tend to emphasize competition rather than personal improvement; and 3) assessment feedback often has a negative impact particularly on low achieving learners. Black and his colleagues worked with a group of teachers in England to refine classroom work by developing formative

assessments that could guide their teaching. These included questioning and peer- and self-assessment.

In 2000, the National Council of Teachers of Mathematics called for formative assessment in teaching:

To ensure deep, high quality learning for all students, assessment and instruction must be integrated so that assessment becomes a routine part of the on-going classroom activity rather than an interruption.

Such assessment also provides the information teachers need to make appropriate instructional decisions. Pg. 4

In Chapter 1 of the NCTM Mathematics Assessment Handbook (2001), teachers are urged and encouraged to work with students on understanding and explaining what they are doing, digging deeper for reasons, finding other ways to problem solve, and deciding whether a particular solution is the best one. These are all formative assessment practices that engage both teachers and learners in determining what is being learned and how it is being learned. Grant Wiggins (2006) describes such feedback as critically important to students not only for self-assessment but also to enable rich and comprehensive understanding.

## **The Study**

I returned to Vygotsky and kept thinking about this **Zone of Proximal Development** and how I could use this within the classroom to develop meaningful feedback for both the students and teachers. I was also challenged by Black and Wiliam's findings that improving formative assessments is not a simple matter and not one done in haste. Teachers must know their students and must find their own ways of incorporating different strategies into their patterns of classroom work. With these studies as support for my daily classroom observations, I set out to develop formative methods of assessment that would enable me to coach the students to a higher quality of learning. My inquiry focused on the impact of these formative assessments on student learning.

### **Data Collection**

To get at how my students perceived one another, I used sociograms and a questionnaire. To monitor their mathematical learning and determine how to better support them, I used the assessments of student achievement in Unit Tests as well as anecdotal notes made during oral and partner assessments.

### *Sociograms/Questionnaire*

Three sociograms were done in October, December, and January. With each, I asked the following questions:

- 1) Write the names of 3 students with whom you would like to be friends (October)
- 2) Write the names of 3 students with whom you would like to eat lunch (December)
- 3) Write the names of 3 students you would like on your Math team (January)

The questionnaire invited students to express their feelings about being a math explorer. In an effort to create excitement and interest in learning Math, I began the math lessons by calling it a “club”. At the beginning of the Math period each day, we put on explorer hats to be problem solvers.

### *Assessments of Student Achievement*

I administered 3 Math unit tests (Units 1, 2 and 3). These were tests that corresponded with the Everyday Math Series written and published by the University of Chicago. as evidence of independent pieces of work, as well as the Princeton Review tests given in October and December. I also used 3 problem solving pieces of work to be done collaboratively in partnerships. Problem 1: Fran the frog loves to catch and eat flies. On Sunday she ate 3 yummy flies. On Monday, she ate 6 yummy flies. On Tuesday, she ate 9 yummy flies and on Wednesday she ate 12 yummy flies. When will Fran be able to catch and eat 21 flies in one day?

Problem 2: Would you rather be in a group of five children who share 30 candies, or would you rather be in a group of three children to share 30 candies? Explain why you made your decision.

Problem3: Jessica bought 4 packages of hair clips. Each package had 3 clips in it. How many hairclips did Jessica buy in all?

### *Conversation Notes*

After Unit 3, I made anecdotal notes focused on oral assessments and/or slate assessments with the students. During these assessment activities, the students were free to consult with their partner. I was able to record comments and conversations among the students.

## Data

### *Sociograms*

At the time of the October 27<sup>th</sup> sociogram the classroom desks were arranged in groups of 4. As I compiled the data on who students would like to have as friends, I observed that 98% chose the children who were in their seating group. Two students were not chosen at all. One of the two is frequently in trouble and often sits apart from the class. The other student was new to the school and community and in October was still struggling for acceptance.

Class seating arrangements changed in early December. The students no longer sat in groups of 4 – the seating arrangement was now a U shape. On December 13 each student was asked to write the names of 3 students with whom they would like to have lunch. Every student was chosen; none were left out.

In January the students were asked to write the names of 3 students they would like to work with during math time. Two students were not chosen by anyone. Both of these students have low participation in all classroom activities and discussions, regardless of subject area, and generally appear uninterested in what happens in the classroom.

### *Questionnaire*

Math Explorers is . . . Since the idea of being a Math Explorer was mine, I wanted to be sure the students were excited about it. I was prepared to modify or change it if the responses that I received were negative.

Question #1: Do you like to be a Math explorer? Tell why or why not.

Everyone wants to be a Math explorer. As to “why” the responses included solving problems, helping others, doing times-tables. There was no evidence of “hating Math” or being afraid of doing it.

Question #2: What are your favorite things to do when you are a Math Explorer?

Students’ answers included adding, subtracting, counting money, fractions. These were all concepts we had worked on.

Question #3: What don’t you like to do in Math? What makes you nervous?

These responses included division, working on number multiplying, big math words, subtraction, doing math tests.

Question #4: Do you like working with a math buddy?

Every student said yes. Typical remarks were:

“I help my partner”.

“My partner helps me and shows me how”.  
“We work together”.  
“Sometimes I know something and sometimes my partner knows something. We help each other”.

*Assessments of Student Achievement*

Unit Tests from Everyday Mathematics were administered at the completion of the unit. The day before the test, students reviewed in class the concepts taught in that unit. On the day of the test, the students were each given a paper with an explanation about the problems. There was no reading of each question. It is important to note that the test format mirrors the pages in students’ workbooks.

Unit 1 Routines and Review of Numbers (*Minimal amount of reading required--15 questions in all*)

1 – 5 correct	6 – 10 correct	11 – 15 correct
9 students	8 students	2 students

Unit 2 Adding and Subtracting Whole Numbers (*Included 4 word problems, reading required -- 16 questions*)

1 – 5 correct	6 - 10 correct	11 – 16 correct
7 students	8 students	4 students

Unit 3 Measurement (*Minimal reading -- 10 questions*)

1 – 3 correct	4 – 7 correct	8 – 10 correct
4 students	7 students	8 students

The **Princeton Review Test** is a summative exam prepared and administered by Princeton Review. It was given in October and again in December. These tests are completed independently by each student. The teacher does not read any of the questions to the students. There are 25 questions that cover each of the strands of the New York State Mathematics Standards:

- Number Sense and Operations
- Algebra and Patterns
- Geometry
- Measurement
- Statistics and Probability

In October 24% of the students scored at 70% or above. The passing score as determined by the Princeton Review is 70%. The class average score was 50%. In December 29% of the students scored at 70% or above. The class average score was 56%.

### *Conversation Notes*

I decided to use an oral/slate assessment for Unit 4. The time frame for this was December 20 -23. The students each had an erasable slate and were permitted to work with their math partner. The same content areas as on the written test were evaluated. Unit 4's content is multiplication and division: equal sharing, multiple groups. My assessment was done as I circulated the room and tallied operations. I read the questions to the students; they determined how to solve the problem, consulting their partner if they wished. There were 11 questions. The questions were not available in written form. Here is a sampling: 1) There are 4 packages of glitter glue. 5 sticks are in a package. How many sticks in all? 2) You have 4 boxes of magazines. 10 magazines in a box. How many magazines in all? 3) There are 16 sticks of gum for 4 children. How many sticks per child? 4) The cafeteria has a box of 30 cartons of milk. 6 cartons of milk go on every table. How many tables are there? 90% of the students solved them accurately. There was constant sharing between partners: "What did you do?", "How did you get your answer?", "Hey, look, we both got the right answer!"

With the Unit 5 test which focused on place value in whole numbers, I again used the slate/partner assessment. There were 6 questions: Some examples: Write the number two hundred thirty five thousand six hundred three. 2) On the board I wrote 804, 631: What is the value of the digit "4", the value of the digit "3". I circulated the room and kept a tally record of students' work. Ninety-five percent of the students were correctly solving the problems and checking to see if their partner got the same answer or if their partner needed help.

In December as we completed Unit 5, a mid-year assessment -- a written test -- of student progress was required by the district. Informed by the research I was doing and what I had read about the social component of cognitive development, I administered the test by reading the questions and supporting partners to work together. There were 30 questions. Within this testing format these are the results:

0 - 10 correct  
1 student

11 – 20 correct  
3students

21 – 30 correct  
16 students

Along with oral/slate assessments, I also used problem solving scenarios with the students. Following is a sample of some of the problems:

Jessica bought 4 packages of hair clips. Each package had 3 clips in it. How many hair clips did Jessica buy in all?

Would you rather be in a group of 5 children who share 30 candies or would you rather be in a group of 3 children who share 30 candies? Explain why you made your decision?

Fran the Frog loves to catch and eat flies. On Sunday she ate 3 yummy flies. On Monday, 6 yummy flies. On Tuesday she ate 9 and on Wednesday she ate 12. When will Fran be able to catch and eat 21 flies in one day?

In each of these problem solving activities the students had to explain how they found an answer. Drawings and pictures were encouraged as was partner collaboration. Problem 1 was correctly solved and adequately explained by 95% of the students, Problem 2 by 80%, and Problem 3 by 80%. With this information, I was able to provide instructional interventions for small groups and also encourage peer help which actually happened without any encouragement from the teacher.

### **Analysis**

Through the use of sociogram data, I knew the students were able to work together. Through reading assessments, I knew that they struggled with meaning. The difference in the results of the Unit Tests for Units 4 and 5 as well as the mid-term in comparison with those of the written tests of Units 1, 2, and 3 was startling and led me to come to two conclusions. One has to do with language learning. The other with Vygotsky's notion of social cognition in the zone of proximal development.

### **Math and Language Learning**

I cannot help but think that the students' math learning improved because they were able to talk with one another. For second language learners, it is



one thing to be able to talk with your buddies about daily activities; it is quite another to know with real meaning the language of a discipline like math. Lara Goldstone in her research on *The Mother Tongue*, found that English Language Learners frequently do not feel confident speaking about academic subjects in English. Goldstone found that creating a classroom environment of mutual trust and respect could help these students who are struggling. While many of my students were able to read the math problems, they simply didn't know how to organize the information. Frequently I would "talk them through it" by asking "What do you know? What do you want to find out?" After they answered such questions in conversation with me, they rarely asked for more assistance; they seemed to understand how to proceed. Students like those in my class who do not have facility with academic English need lots of practice with the English language through conversations, play, fun times, and guided practice in each content area. What I saw here was that they did not respond to paper and pencil "high stakes" testing. They froze. But, when the scaffold of being able to interact with me and with their peers was provided, they were able to soar. Most of them knew the math! They could not make sense of the reading.

### **Social Cognition and Assessment**

The data that I have presented suggests that particularly for low-level readers and students who are English language learners, assessments of content should be done within a collaborative social framework. Vygotsky's social development theory of learning supports what I found in my classroom practice. Social interaction and social learning actually led to understanding and learning. When the students were asked to work independently they were less likely to experience success. Working collaboratively, they helped each other think through problem solving steps. Black and William concurred in their research that peer and self-assessment was more effective in promoting good learning. This research was not specifically about English Language Learners, so the results take on increased significance when considering the frustrations and anxieties of second language learners. My students clearly saw the final two assessments as part of the learning activity. This is exactly what the National Council of Teachers of Mathematics (2000) statement about integrating assessment and instruction is calling for. Assessment cannot be perceived by the students to be an extraneous part of learning: it is learning.

What I learned from this experience has had enormous implications for my teaching. I adjusted my assessment practices and the results of the mid-year

assessment test reflect the impact on student learning. It is now clear to me that, as Black and Wiliam (1998), teachers' knowledge of students—both social and academic—is critical to effective teaching and successful learning. It is not a simple matter to incorporate formative assessments into one's practice. I had to think about the implications of the sociograms as well as the initial tests and devise new ways of grouping my students for instruction. I also had to figure out ways to bring their need to be with one another into the learning process. Finally, I had to find ways to bolster their confidence and enable us both to see greater achievement.

### **New Questions for Research**

As I look to the future, I know that the insights I gained through this small study will help me to improve my teaching and thus my students' learning. I am now interested in finding ways to build their confidence such that they will be able to succeed on their own. I am committed to continue this research in the 2006-2007 school year tracking it from Day 1. To that end, I have developed a new question:

Would using formative assessments within a social context from the start of the year better prepare the students for the summative New York State Math Exam?

### **Policy Implications**

My study suggests that all teachers should be well versed in both formative and summative assessment. This knowledge is especially important for new teachers. I came to this action research with many years of experience. New and beginning teachers must be encouraged and supported to think outside the box. School practice might well dictate and require summative assessments but this does not mean that one cannot do formative assessment along the way to determine what students understand and need. Nor does it mean that unit tests and other nominally summative assessments can't be administered in a formative way.

- Promotional policies should rely on multiple forms of assessment. This is especially critical in schools where there is a high percentage of English Language Learners. There should be no one test at any level in the educational life of a child that will determine the child's future.

- Irrespective of their language skills as determined by the New York State English Second Language Achievement Test, language enrichment for second language learners should be available on a weekly schedule.

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