BYRAM HILLS CENTRAL SCHOOL DISTRICT
ARMONK, NEW YORK

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Title: *The Keys to Successful Intervention: Assessment for Learning, High Quality Instruction, Meaningful Discourse*

Year: 2012

School/Grade: Wampus School/Math Specialist grades 3 - 5

SUMMARY OF *INVESTIGATORS OF PRACTICE* ACTION RESEARCH PROJECT

Context:

As a Math Specialist in the 3-5 building I provide remedial and enrichment services to designated students and guidance to teachers in the area of pacing and differentiation. I work with a team of math specialists who share two math labs that are richly equipped with resources to help us service teachers and students. For years I've participated on the Response to Intervention (RTI) Team. We are a group of professionals who meet to discuss students at risk. The mandates from New York State, especially those requiring services for AIS and Tier 1 interventions truly affected the services we provide in my building. As a service provider I needed a way to pin point mathematical weaknesses and find the spot of breakdown to begin remediation.

My research last year consisted of designing a student interview that would target the areas of strength and weakness in mathematics. The year was spent designing, refining and testing this assessment for student learning. It was used as the foundation for my research this year as a tool to set student goals and open communication.

The student interview, in conjunction with multiple assessment data, was used with my focus group. The group consisted of third, fourth and fifth graders in need of math remediation. My goal was to seek out and test research based interventions to target specific areas of weakness for these students.

Action Plan:

Originally, I had planned to research technology based interventions as a way to help manage remedial groups that are quite large and of varied levels of ability. I continue to use one for fluency and it is quite helpful. I found a few worth trying out but they required sign in, passwords or site licenses that I do not have the authority to approve. In addition, I was offered limited trials that, once again, do not suit my needs. Since I have the responsibility of remediating a large group of struggling learners, I needed effective interventions for immediate use. Also I need to internalize a strategy and feel ownership before using it with students. With that, I researched effective strategies by working with consultants, examining articles, and reviewing the work from experts in the field. These sources include:

Alteri, Mary. Consultant. May, 2012.

Atkins, Sandy. Consulting/ Personal Interview. May, 2011.

Blanche, Barbara, Ph.D. *Guided Math: Practical Strategies to Differentiate Your Math Instruction Using Small Group Instruction and Math Learning Centers (Grades 3-6).* Bellevue: Bureau of Education and Research, 2010. Print.

Common Core Learning Standards.

Kamii, Bonstance. "Does Action Research Really Improve Math Instruction?" *Teaching Children Mathematics*, March 2012. Print.

Kyriaco, Chris. "Building Mathematics Skills." *Better: Evidence-based Education*. Autumn 2009.

Livesly, Eleanor. Consultant. 2011-2012.

Mack, Nancy, K. "Enriching Number Knowledge." *Teaching Children Mathematics*, Sept. 201. Print.

Principles and Standards for School Mathematics. (NCTM 2000).

For each source, I reflected on my own practice. I continued to use and revise interventions from my own bag of best practices that have already proven to be effective.

Results:

Analysis of the student interviews from my focus group showed a general weakness in number sense and numeracy. A strong groundwork here is the foundation to gain math knowledge. Thus, this became my first area of focus for finding targeted interventions. The challenge I faced was that I not only needed to target the interventions but I also needed a way to monitor student progress. This made me feel a bit overwhelmed until I thought about the RTI work we had done two summers ago with the learning and math specialists k-5. The document we created was a progression of skills and concepts that math students needed to master. With that in hand, I spent time studying the Common Core Learning Standards (CCLS) for math and created a Numbers and Base Ten Check In. This document is a check list I keep in a binder for each student. It gives specific descriptions for each CCLS within the topic of numbers and base ten (including the grade level below and above); it provides specific indicators for meeting these standards as well as prompts for the teacher to use to test a student. For each item, I check off whether a student has mastered, is meeting with support, or is developing. This has become a way of monitoring the progress of each student in the focus group.

The Numbers and Base Ten Check Ins are making me very aware of where each student is in mastering the Numbers and Base Ten standard and in a quick glance I could see where they came from and where they need to go next. Having this information in a succinct document encouraged me to open communication with my students about individual learning goals for that content area. Specific interventions have been collected from materials I researched, consultants I worked with, and materials I had created or revised myself.

Implications:

Assessment FOR Learning

Results from the student interview (created during last year's Action Research project) had shown similar results in students who are in need of remedial math support. Analysis of the screening has shown weakness in students' understanding of place value, numeracy and understanding the base ten number system.

The analysis also shows that my focus group of remedial students does not have flexibility when thinking about numbers. It's obvious in how they handle the manipulatives, that they haven't had enough experience using them in the past. This is indicated by their need to recount the rods that lay on top of a flat; by not making the automatic connection that three rods total thirty; an inability to organize the manipulatives in ways to make keeping track of trades manageable; and finally when students make a trade without exchanging the manipulatives, but simply add them to the others, thus changing the total.

Thinking Flexibly

The focus group needed intensive interventions to improve knowledge of place value. The skill of composing and decomposing numbers is one that can cause great havoc if not mastered. My remedial students who do not see 340 as 300+40 or 34 tens also have difficulty later with multi digit multiplication and long division. These are the students who do not understand the steps they are completing in a traditional procedure and cannot see why an incorrect response isn't reasonable. For example, Marie can follow the steps for long division but when her work isn't accurate and I probe to find where she went wrong, she struggles to explain her thinking and show mastery of place value. When dividing 4,236 by 6, she insisted the quotient 76 was correct. She said, "six doesn't fit into 4, but it fits into 42 seven times and 6 fits into 36, 6 times. Firstly, she did not pay attention to the value of the 4. 4,000 can be divided by 6. Nor did she see the pattern of 6x7=42; 6x70=420, 6x700=4,200. Traditional methods of multiplication and division simply ask students to follow a procedure where many need an acronym or a rhyme to remember the steps. Students, like Marie, do not use math vocabulary to follow these procedures; they use inaccurate statements like add a zero to hold a place; drop the decimal point; and they read the problem 356/6 incorrectly by saying 6 doesn't fit into 3!!!

Quality Instruction

I've found practice in the methods of area model, partial products, and pyramid division to aid a weak knowledge of place value. Working these models for accuracy has been an effective RTI intervention for my focus group. Time is always of the essence and there is much material to cover. So when a student needs to strengthen place value I can do so by continuing to work with the classroom curriculum. All of the models mentioned require students to practice decomposition, understand the value of a digit, and apply strategies of multiples of 10 and 100.

Principles and Standards for School Mathematics suggests that all students should conceptually understand the place-value structure of our number system, see the relationships between numbers, be able to reorganize numbers, and demonstrate mental computation fluency (NCTM 2000).

I found another place value intervention (shown below) when reading *Enriching Number*

Knowledge. Mack has students exploring numbers from different perspectives. She says we should look at number systems from other cultures to deepen mental computation fluency, knowledge of place value, and equivalent representations for numbers.

This particular intervention helped students think flexibly about numbers when equivalent representations are made. It should be used after a student can regroup successfully using the place value blocks.

1. 2 hundred + 4 tens = _____
2. 4 tens + 2 hundreds = _____
3. 24 tens = _____
4. 24 tens = _____ tens + _____ tens
5. 14 tens = _____ hundreds + 4 tens
6. 14 tens = 1 hundred + _____ tens

Allowing Time to Construct Learning

All of the interventions I researched require students to be hands on, use manipulatives, and look at numbers in more flexible ways. Constance Kamii's work has focused on improving math instruction by using Piaget's constructivism theory. She strives to put the learning in the hands of the students, not to simply teach the procedure. Children needing remedial instruction in regrouping used an intervention where they acted as "subtraction detectives." Their job was to find errors, correct them, and explain why the corrections were necessary.

This is an intervention I tried with remedial students to encourage them to pay close attention to showing work for part two and three questions on the NY State Math Assessment. It sparked their interest and changed up the pace of the class. They enjoyed using markers to grade the responses.

By constructing their learning my students have "ah-ha" moments. These are without a doubt the most rewarding moments as an educator. They make me proud and excited to share them with colleagues. When students make connections for themselves, they are lasting. Josie forgot the procedure for turning an improper fraction into a mixed number. She knew to draw a picture for 5/3. She found the correct answer. Jane chose to use the procedure but reversed the numerator and denominator 1 3/2. She didn't see that her answer wasn't accurate because she did not know another way to solve the problem.

Addressing Misconceptions

One morning, I examined a place value regrouping question with a group of fourth graders. 3,220 can be built most efficiently with 3 blocks, 2 flats and 2 rods. If I exchanged my blocks in for flats, how many in total would I use to build the number? Two students found success. Isabella answered 12. Then she corrected herself to say 14. I was puzzled and rephrased the question. She said she was wrong. She would need 20. I asked her to explain her thinking and I quickly made the connection that she was under the impression that she would use 6 flats to

make a block. A cube has 6 sides. She wasn't thinking of the "value" of the block, just its physical structure. Using the manipulatives I asked her to use units to build a rod; use rods to build a flat by stacking them on top; and finally stack flats to build a block. She counted 10 flats to build a block but didn't make the connection that 10 flats equal 1,000 because 100 ten times equals 1,000. She did not recognize that our place value system was base 10. With guidance, she made the connection and beamed a smile that was contagious.

Small Groups are Key

I've experienced the value in having students construct learning to make it meaningful and lasting. This takes time and, of course, small groups of students. Kamii talks about allowing students to construct their own algorithms for arithmetic. She goes as far as saying that if teachers allow students to do their own thinking and to love and become confident with learning before introducing algorithms, remediation is unnecessary. I agree with this statement completely. I've seen my second graders come up to grade 3 with some very interesting ways to add numbers. At times, teachers aren't comfortable with this type of flexible thinking. With large numbers of students it is exhausting at times to keep up with the many varied ways to solve problems. A fast answer is to say "do it this way." When students are taught algorithms before they are ready misconceptions develop and fester.

In a Nut Shell

I do believe there comes a time where more efficient methods are important to practice. Students also need to practice perseverance and working a problem thoroughly for accuracy. As teachers we need to step back occasionally and give the learners time to understand the "why."

My work has shown me that I can target areas of weakness with a well developed student interview and remediate them using quality interventions, but my students need to be readily available to accept these interventions.

Building Self Image

"One of the main barriers to success in developing mathematics skills lied in a pupil's belief that 'maths not for them- its for the clever ones'" Chris Kyriacou, (Autumn 2009), *Building Mathematics Skills. Better: Evidence-based Education*.

"In order to become capable and strategic learners in mathematics, pupils need to have confidence in their own ability and self-identity as learners of mathematics." Kyriako describes the need for high quality professional learning activities to enable teachers to make use of evidence-based strategies. Strategies that make learners feel inclusive, practice critical and deep thinking, and feel ownership will have a powerful effect on building success.

Motivation and self-image are not specifically addressed in the Common Core Standards but I've found them to be the areas most critical to address when working to remediate my "lower-attaining" students. They feel motivated when the environment is one that is safe. They feel part of the learning community when activities are differentiated. Students must be engaged in mathematics at a level appropriate to his ability. With this, a student can take more control over their learning. I've seen this as students make goals for themselves.

Kyriako encourages teachers to ask more challenging questions and have students explain their

thinking. The goal is to create a dialogue where students work is taken seriously. The author describes this instructional approach as co-construction.

The New Common Core has more rigor in the lower grades. Students are encouraged to do more challenging work with problems that require critical thinking. My colleagues struggle with asking "lower –attaining" students more difficult questions because it turns off some. These students can be turned off because the question may be too challenging and they are intimidated to respond in the presence of peers. In addition, when one child is asked to respond to a question at a time, other students may lose focus. The traditional approach of the teacher posing a question and calling on a student to answer is out-dated in our time. Teachers need guidance in encouraging dialogue about mathematics that encourages total participation and accountability.

Meaningful Discourse

I've worked to foster an awareness of metacognitive strategies by setting up a framework in which students share their thinking. This framework was designed after reading *Orchestrating Productive Mathematical Discussions: Five Practices for Helping Teachers Move Beyond Show and Tell*. (Stein, Engle, Smith and Hughes) In the article, the authors describe a process for looking at student work after a rich problem is posed to the entire class.

First, I pose a problem to my students, that I have already solved; exhausting all methods I could think of. Students are asked to work it out using a strategy they are most comfortable with. Once a solution is reached, students are encouraged to try another method to solve. As I walk through the classroom, I encourage students to persevere. I'm also recording particular students' use of strategies and asking specific students to post their work. I've carefully chosen methods of solving ranging from concrete to abstract.

The work is also shared in that progression of complexity. Those whose work is not being shared are encouraged to become active participants by participating in a dialogue. I generated and posted for reference the following phrases to motivate struggling students in the dialogue:

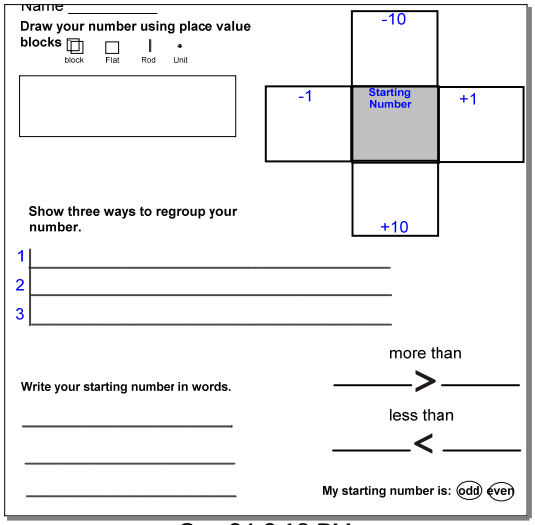
Please clarify…
I wonder if…
I'm confused about…
Does this mean…
Why did you choose…
This is similar to …
This is different than …
I've learned…

Thoughtful Shares

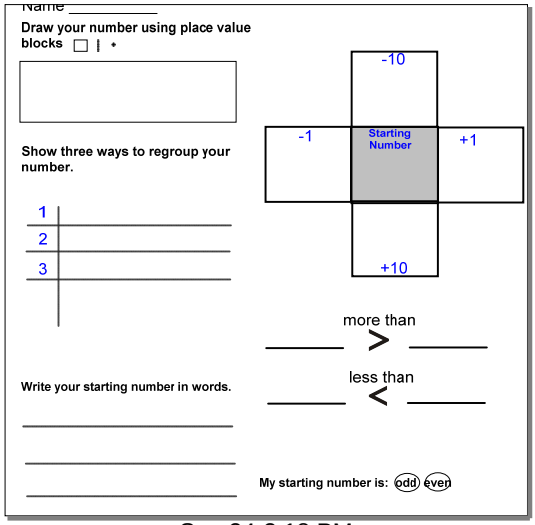
This structure takes time to set up within a classroom. Once it is in place, the results are amazing. This structure encourages a "total participation" environment where work and discourse from students at all levels is valued. Students learn from each other. Each time the works are shared, the structure is set up for review of more conceptual models and offers the comfortable struggle to others who may be able to move on to trying a more abstract model. All are challenged to leave their comfort zone and to investigate a new strategy.

Summing It Up

My research assured me that I'm doing an excellent job with my students. There is not a "quick fix" for struggling learners. The key to success is a combination of assessments for student learning, high quality math instruction combined with meaningful discourse. There is not one particular intervention that will remediate an area of weakness. The intervention needs to be personalized to fit the learner. It cannot be down loaded from the WEB. Remediation is a thoughtful process. My research shows that high quality instruction, assessment for learning, meaningful discourse, and motivation are all part of the design. It takes more than a quality intervention to help students find success. High quality classroom instruction is needed for students to construct long lasting knowledge. That instruction is given by teachers who have participated in excellent quality professional development and who have a thorough understanding of the material they are teaching. Assessments for learning need to be used to find the place where a student must grow from. Personal goals should be set and communicated with all parties who have a hand in guiding the student's learning. My research confirms the need for small group skill focus in order for students to make gains. Ample practice in concepts and skills and patience to build perseverance are crucial to maintain new knowledge. Finally, by offering enriching problem solving tasks where multiple strategies are encouraged and rich dialogue elicited, teachers can offer the motivation for remedial students to apply new knowledge.



Sep 24-2:18 PM

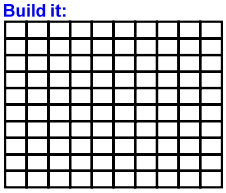


Sep 24-2:18 PM

Word form:

Place on number line:

Build it:



Fraction:

Decimal:

Simplest form:

Equivalent fraction:

Half of this number is:

Dec 17-12:23 PM

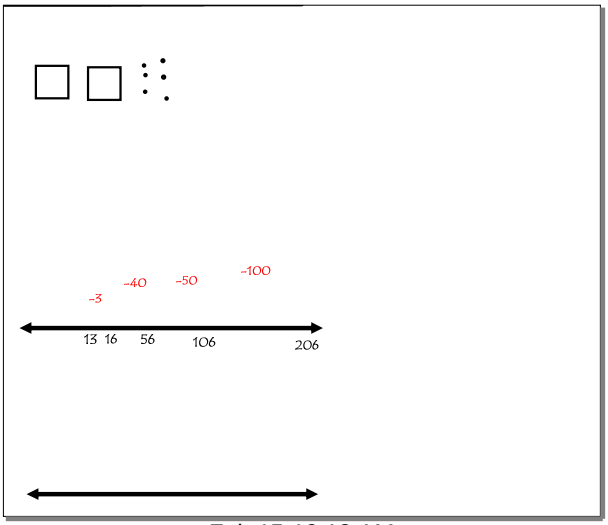
If you are subtracting one quantity from another, the starting amount is called the minuend; the amount subtracted from it is called the subtrahend. The result is called the difference.

minuend - subtrahend = difference

Feb 15-10:28 AM

There are 206 students in fourth grade. 193 exchanged Valentines. How many students did not exchange valentines?

Feb 15-10:16 AM



Feb 15-10:18 AM

$$\begin{array}{r} 217 \\ -\ 139 \\ \hline \end{array}$$

Expand the Subtrahend and the minuend.

$$\begin{array}{rccc} & 200 & 10 & 7 \\ - & 100 & 30 & 9 \\ \hline \end{array}$$

Nov 15-1:39 PM

minuend - subtrahend = difference

$$\begin{array}{r} 217 \\ -\ 139 \\ \hline \end{array}$$

$$\begin{array}{rccc} & {\scriptstyle 100} & & \\ & 100 & 110 & 17 \\ & \cancel{200} & \cancel{10} & \cancel{7} \\ - & 100 & 30 & 9 \\ \hline \end{array}$$

Regroup

Nov 15-1:39 PM

$$\begin{array}{r} 217 \\ -\ 139 \\ \hline \end{array}$$

$$\begin{array}{rccc} & {\scriptstyle 100} & & \\ & 100 & 110 & 17 \\ & \cancel{200} & \cancel{10} & \cancel{7} \\ - & 100 & 30 & 9 \\ \hline \end{array}$$

Check to see if you regrouped accurately by adding.

$$\begin{array}{r} 100 \\ 100 \\ +\ \ 17 \\ \hline 217 \end{array}$$

Nov 15-1:39 PM

217
- 139

Now subtract.

100
100 110 17
200 10 7
- 100 30 9
0 + 70 + 8 = 78

Nov 15-1:39 PM

10
1 11 17
217
- 139

common/math lab/rti/interventions/operations/subtraction

Nov 15-1:55 PM

minuend - subtrahend = difference

567
-178

Feb 15-10:13 AM

minuend - subtrahend = difference

937
-178

Feb 15-10:13 AM

minuend - subtrahend = difference

800
- 345

Feb 15-10:14 AM

300
- 145

Feb 15-10:14 AM

Ms. Davies has 523 books in her library. 87 books are about the subject of math. How many books are not about math?

Feb 15-10:18 AM