

BYRAM HILLS CENTRAL SCHOOL DISTRICT  
ARMONK, NEW YORK

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**Title:** *What Does It Mean to be Advanced in Elementary Math?*  
**Year:** 2011-2012  
**School/Grade:** The Wampus School: Grades 3-5

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SUMMARY OF INVESTIGATORS OF PRACTICE ACTION RESEARCH PROJECT

**Context:**

As a math specialist at The Wampus School, I teach and facilitate our math program for students in grades 3-5. My work meets the needs of students ranging from the most struggling math learners to students who are extremely advanced in their math comprehension and exhibit deep thinking skills.

My passion has always been working with advanced learners, helping them to deepen their thinking to levels where their knowledge can be applied to real life situations. I help my advanced learners push themselves to struggle, and perhaps feel a little uncomfortable, forcing them to persevere beyond what comes easily to them.

Through my work in Action Research last year, I worked collaboratively with the other math specialists to create a tool to help identify specific needs of math learners at Wampus. The tool was geared to identify the foundational skills needed in grades 3-5, with questioning that helped us assess a student's level of understanding so that we knew exactly what skill(s) needed reinforcement or re-teaching. We met great success with this creation, and we currently use the tool regularly to screen new students and students about whom classroom teachers or specialists have questions regarding their math abilities.

As our work culminated last year, I realized that this tool was ineffective when screening advanced math learners because their understanding was beyond the "typical" student. This year, my goal was to tweak the tool to effectively screen students who had strong math abilities. I hoped I would be able to create a resource that would help us differentiate the math curriculum for a variety of math students with a desire to raise achievement for all students.

As an elementary school math specialist, I work with students on both ends of the academic spectrum. I have grappled with many of the new mandates from the NY State Education Department. The Common Core Learning Standards (CCLS) for Math, which must be fully implemented by 2012-2013 school year, point out that needs of both academically challenged and academically gifted students need to be focused on and met. I agree with this to my core and tried diligently to make sure I was working with students who most needed a forum to stretch their minds mathematically.

## Action Plan:

My research was driven by two questions:

1. How can I revise my screening tool to prove that a student is advanced mathematically?
2. How does the behavior of an advanced math learner compare to that of a highly competent math student?

My rationale for choosing these questions was that over the past eight years as a math specialist, I have had the opportunity to work with advanced math learners and I always wonder how the teaching community at Wampus can **best** differentiate the curriculum to meet their needs.

As noted by experts such as Joe Renzulli and Sally Reis from the University of Connecticut, advanced math students find success in their math learning and respond well to instruction. These students may range from those who perform very well on assessments, but find it difficult to think beyond the lesson without direct instruction from a teacher to those who make connections independently and routinely stretch themselves to think beyond the boundaries of the classroom lesson. Our most advanced math learners have mathematical qualities such as strong problem solving skills, an ability to solve problems using multiple strategies, and flexibility of place value coupled with deep number sense. The desire to learn, stretch, and take risks is intrinsic.

When I am working with groups of teacher selected students, I find that often the groups are compiled of a mixture of advanced math learners who are able to take their learning to very different levels. Additionally, fourth and fifth grade teachers are asked to flexibly regroup their students for math. Having a tool like this would help them identify students who show a need to be enriched beyond the typical range of differentiation in the classroom.

My journey started with looking at and using the screening tool we created last year. I administered it to three students, one from each grade level, who I knew to be advanced math learners. As they answered the questions, I noted which questions should be eliminated or revised to meet their level of deeper thinking.

Last June, the math specialists at Wampus and Coman Hill had the opportunity to have staff development with Sandy Atkins, an expert in the field of math and someone who has a great deal of experience with our conceptual math program, Growing with Math. We asked Ms. Atkins to model different interview techniques and questioning for elementary students. She gave us invaluable advice through demonstration and debriefing conversations. She also gave us a copy of her questions, which she used as a menu from which to choose depending on the student she was screening. After administering our current tool, I consulted my detailed notes from our meetings with Ms. Atkins and edited my tool using her expertise. Some changes were very small such as asking children to skip count backward, in addition to forward, which was already a part of our tool. Other changes were very important and in line with the CCLS, such as adding questions about placing numbers on a variety of open number lines to determine a student's number sense.

I also read a great deal from Joe Renzulli and others experts from the University of Connecticut on traits of gifted students. I read articles from Marilyn Burns, who has wonderful techniques for interviewing young learners. This information was used in my questioning techniques. For instance, I made sure to always ask students why they believed their answers to be correct or how they came to their answers. Additionally, I have pored over the CCLS for math this year, attending multiple workshops, meeting with experts in the field and integrating my knowledge into as many

lessons and activities as possible. This affected the questions included in the screening, as well in ways such as adding questions about fractions which is a huge focus of the grades 3-5 CCLS.

The data I collected involved many trials and revisions of the Advanced Learner Math Student Interview. I was upfront with my students and told them that my purpose for screening them was to learn more about my tool and to revise it to meet the needs of all different types of learners. I asked them to answer the questions honestly and to give me feedback about the process once we were finished. Through these trials, I was able to revise the screening tool several times until I determined from consistent results that the tool effectively identified differentiation needs for our advanced math learners.

### **Results:**

My teaching practice has changed due to this process. I found that when students were encouraged to discuss or verbally support their answers during the screening, they repeatedly self corrected and delved even more deeply into the concepts. I decided to try to apply this to my every day teaching. Although open-ended questioning and inquiry learning were always techniques I utilized, I am more aware of my wording and of continually encouraging my students to **verbally** explain their thinking. For years, I have asked my students to write about how they arrived at their answers. Time and again, they defended the answers they found. In contrast, by talking about their work, they were experiencing their understanding at a different level and even without prompting they were making new and deeper connections to the concepts behind the math.

My screening tool proved that advanced math students are interested in delving deeper into their learning, regardless of the impact it may have on correct answers. Many students screened pointed out “favorite” sections of the screening as those which “made them think”, even when their answers were not entirely correct. When the students were challenged by an activity such as covering a number of place value blocks and continually adding onto that amount while retaining the last total in their minds, they became visibly giddy with excitement. This section was pointed out as a favorite by every child screened because it was “different than anything I’ve done before”, “interesting” and again, “made me think”.

I confirmed that advanced math learners are most definitely deep thinkers. They ask questions that can take their understanding to another level and speak in a language of mathematics including appropriate place value terminology. They explain their answers fully and clearly and are happy to edit their answers through their discussion.

### **Implications:**

I feel I have enough data to meet with teachers at the start of the 2012-2013 school year and help them to differentiate their instruction in the classroom. I will screen any students about whom teachers are unsure. This will allow our math enrichment programs to delve more deeply into concepts and to allow for more discovery learning. Another positive implication is that it will allow our classroom teachers and math specialists to differentiate by providing advanced math learners the opportunities to work with cohorts of peers with similar abilities.

An interesting finding is that there seems to be something missing in the foundation of subtraction, even for our highly competent math learners. I would like to discuss this with the math specialists at Coman Hill to see where the disconnect lies. Could it be taught too early or not deeply enough? Should we require more automaticity before moving on? Does third grade need to start with basic

subtraction before moving to multi-digit subtraction? Are students truly ready to master subtraction before third grade? These are all wonderings that I'm interested in pursuing.

I have an overreaching question having to do with how we teach our math learners. How can we encourage students to think, struggle, and stretch themselves in a variety of instructional settings, regardless of grouping? I know this is a huge wondering, but I want to insure that our young students' minds are stretched and that the children know that they are in safe environments to feel what it is to struggle with learning, so that their desire to push themselves in the future is set in place.

Something I'm interested in studying in the future is the presence of perseverance as a quality in advanced math learners or advanced learners of any sort. I think this is closely tied to advanced math abilities. Also, I hope to be able to work collaboratively again next year. Working independently this year made it more difficult for me to stretch my own thinking or bounce ideas off another person with different experiences. I treasure my opportunities for research in Investigators of Practice and look forward to continuing my studies in the future.