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The Implications of Basic Math Class Required Learnings on the Graduation Rates of Basic Math Students.

Rationale:

I have been teaching basic math at the high school level for 12 years. The curriculum originally had been designed to help students pass the 1980's California Math Competency Tests. About five years ago, a colleague and I rewrote the curriculum emphasizing number sense, real world problems, manipulatives and the "new" state math standards. As I worked with this new curriculum that emphasized 36 number-sense standards, I structured the course so that knowledge of each standard was required to pass the class. Students would need to pass each portion of the tests, representing each standard, with 60% accuracy. My basic math students are freshman and sophomores who are performing near the 4th grade level in mathematics. In order to help them master these standards, I give students the opportunity to make up missed problems on their homework and classwork. They are also required to repeat any of the quizzes they missed using different quiz versions. I also use a software tutorial program that spirals through the K-8 grade-level math standards. Students are required to achieve a minimum number of correct problems in this program for each term. This became the only math class on campus with required learnings that had to be met or the student would fail. Surprisingly, as I began to require more of my students, the pass/fail ratios in my classes seemed to stay the same! I wanted to know for sure if the same percentage of students was succeeding, even though more was required of them. I wondered, would these high expectations and the help in accomplishing them facilitate these students being successful in their next math class, and in passing algebra? Would successful basic math students have enough units of math to graduate? Would successful basic math students pass the California High School Exit Exam (CAHSEE)? Did the required learnings, and success in accomplishing them, lead students to successfully graduate? And so, I began an examination of the performance of the basic math students I have taught in the last three years.

Question:

Does passing as evidenced by an A, B, or C, grade, my high school basic math class that includes "required learnings", transfer to passing in the pre-algebra and algebra level math classes? Does this lead to passing the CAHSEE (California High School Exit Exam)? Does this lead to students graduating from high school? “Required learnings” throughout this research refers to passing 36 standard-based number-sense quizzes with at least 60% accuracy, and completing the required amount of computer software problems correctly.

Literature Review:

In looking for research focused on “basic math students”. I generalized that they are low-achievers (have not mastered elementary math standards by the end of 8^{th} grade), that some are resource or special education students (have learning disabilities or are low-functioning although mainstreamed), and that some are disengaged and unmotivated in school. I also looked for research on Latino students because almost 60% of my students are native Spanish speakers. Unfortunately, there is little research available on the teaching of basic math skills for high school age students. The following section summarizes the information I was able to find.

Math disabilities can be acquired, according to Cherkes Julkowski 1985, from repeated academic failure that frequently results in low self-esteem and emotional passivity in mathematical learning. The emotional reaction of some individuals to math is so negative that they develop math anxiety. This condition causes students to become so tense that their ability to solve, learn, or apply math is impaired (Slavin, 1991). Other common results of math anxiety are confused thinking, disorganization, avoidance behavior, and math phobia (Conte, 1991; Zentall & Zentall, 1983).

When using high-stakes testing to motivate students, Melissa Roderick and Mimi Engel, (2001,) found that teacher interaction with students appeared to have a marked influence on students’ response to the policy. Students with instructors who were positive, who realistically portrayed the consequences of failure, and who encouraged students to set goals were more apt to work hard to pass the tests. Students with instructors who were negative, who did not emphasize goal making or who did not adequately convey to students the implications of the tests were less likely to put forth an increased effort in class to pass the tests. As to the question of whether hard work paid off, of the students making an effort in class or outside of class, 80% reached the required test scores either in the spring or summer, and even high-effort students who did not attain the score baselines saw higher-than-average gains. Of the low-effort students or those with significant learning or home problems, only about half passed in the spring or summer testing. Due to these students’ greater skills deficiencies and lack of external support, it is not clear whether they would have been able to reach the baselines even with increased effort.

Kathryn S. Schiller, (2000) found that state testing policies have a greater positive influence on at-risk students' likelihood of graduating from high school than on the likelihood of high school graduation of students identified as college-bound. The research also showed that extensive testing has the greatest positive effect on at-risk student completion of high school. The number of consequences for students (not graduating, summer school, lose of electives. etc.), has a small positive effect on their high school completion. Consequences for schools, (lose of funding, program improvement, transferring teachers, etc.) has a slight negative effect on at-risk students' probability of earning a high school diploma. The effect of consequences for students on the likelihood of at-risk students' earning a high school diploma is greater than the effect of student socioeconomic status on the same group.

Anne Foegen, (1997) indicates that data drawn from brief samples of student performance on math facts may prove to be useful to teachers as they make decisions related to mathematics instruction. Eric Jones, Rich Wilson, and Shalini Bhojwani, (1997) show that unless instructional assessments are conducted frequently and with reference to the students' performance on specific tasks, it will not be possible to use assessment data to make rational decisions for improving instruction. To an increasing extent, educators have come to the conclusion that traditional standardized achievement testing does not provide adequate information for solving instructional problems, and that a greater emphasis should be placed on data from functional or curriculum-based measurements (Reschly, 1992).

Context:

I am fortunate to live and teach in my hometown. We are a rural agricultural town of 100,000 with three overcrowded comprehensive high schools. My school operates on a modified block schedule, so I teach three 90-minute classes of 28 students each day, and we complete the entire curriculum in half of the year. I teach three new classes for the second half of the year. In one year, I teach two basic math classes, two English Learner basic math classes, and two Geometry classes. I utilize the state's math number-sense standards emphasizing the 36 required learning standards from grades 4, 5, and 6 in all my basic math classes. My basic math room consists of a portable classroom with 30 computers lining the walls as well as desks and tables to seat 28. The technology helps me individualize the program, but the room is small and crowded. I must move to another classroom when not teaching basic math. The California Math Standards, the California High School Exit Exam, and the California and the nation's NCLB (No

Child Left Behind) ranking of a 3 out of 10 drive the curriculum. My school is 76% Hispanic, 14% Caucasian, and 10% other with almost 60% English Language Learners. Forty-eight percent of our students' parents do not have a high school education, and 11% of the parents have a college degree. The feeder schools report over 70% of the students qualify for the free or reduced price lunch program. Our elementary schools and high schools are in separate districts.

In my school district, students must have 20 units of high school mathematics (this is obtained by completing and passing two math classes) in order to graduate. State law requires students to take and pass one year of algebra along with passing the high school exit exam (CAHSEE). Most students take pre-algebra or algebra as freshmen. A few begin at the geometry level, and a few (150, or about 11% of the incoming freshman class) begin at the basic math level. If a student passes the basic math class as a freshman, he or she moves on to the pre-algebra class taken as a sophomore. If students are successful in pre-algebra, they take algebra as juniors. Some students are recommended for the 2-year algebra course, where they take a year of algebra over two years (usually their junior and senior years.) The standards tested on the CAHSEE include 6th grade, 7th grade (our pre-algebra class), and 8th grade (algebra standards.)

I am continually working to help my students and improve my teaching through professional development programs. My original degree is a Bachelor of Science in Petroleum Engineering. I have obtained physical science, mathematics, and multiple subjects teaching credentials along with being Nationally Board Certified in Early Adolescence Mathematics, a teacher researcher through CEMSE (Center for Equity in Math and Science Education), a MetLife Fellow, and a trained Integrated Mathematics Program teacher. This is my 16th year of teaching, and my third teacher research project.

Tools:

Student Records:

In this research project, I collected two types of data. One type of data comes from student transcripts and class records. I am using this data to determine which students are successful in passing basic math, what their next math class grades are (pre-algebra and algebra grades), and which students are on track for graduation (having enough units along with passing the high school exit exam math portion).

Student Interviews:

A second type of data will come from students' interviews. I personally interviewed students who were successful in their math classes and are on track to graduate in order to gather their input on what helped them complete these requirements. The following are my interview questions.

Interview Questions:

1. How did you do in your Math A (pre-algebra) class?
2. How did you do in your Algebra class?
3. Did you pass the High School Exit Exam math portion?
4. What things did we do in basic math (the required quizzes that you had to pass, the required computer points, the notebook, the re-dos, the homework, etc.) that helped you in your other math classes?
5. Did the things we do in basic math help you in other classes?

I chose the seven students randomly from the transcripts I received. These students were meeting their graduation requirements and had been successful in their math classes. During one school day in April of 2005, I personally went to the classrooms of the seven students. I had notified them with a note to their teacher the previous day that I would like to interview them. The students and I talked outside the classroom as they answered the above 5 questions. I knew these were very open-ended questions, so I orally listed items to remind them of their basic math class. I mentioned the computer use, notebooks, quiz requirements, the 3,000 computer points requirement, re-doing work, group work, daily homework, and opportunity to come into the classroom at lunch or before or after school to receive extra help.

Data:

Students with truancy problems, those dropped from class, or those who entered halfway through the school year have been removed from the data. From my class records, I arranged the data as shown in the chart below.

Basic Math Class Data

(from class records for the last three years)

Year	Number of students	English Language Learners		Resource/Special Ed.		Total Students	
		Number Passing the class	Percent Passing the class	Number Passing the class	Percent Passing the class	Number Passing the class	Percent Passing the class
01-02	84	29	41%	8	25%	29	35%
02-03	93	63	48%	24	13%	43	46%
03-04	72	35	35%	17	35%	30	42%

From the student transcripts I received, I was able to determine that 35 of 54 (65%) students who passed basic math were behind 20 or fewer units and were on track for graduation. Twenty-eight out of 30 passed Algebra (three were D's), and all 47 passed Math A (four received D's.) The total numbers vary because of transfers, students currently taking Algebra, and limited access to transcripts.

I interviewed seven students. Three were females, four were males, four were English Language Learners, and one was a resource student (the resource student was also an English Language learner.) They have all passed the CAHSEE (California High School Exit Exam in math) I have arranged their responses below.

Interview Results

Student Profile	How did you do in Math A and Algebra?	What did we do in basic math that helped you in your classes?	Helped overall?
Female	Did well in Math A, passing Algebra	Yes, writing things down, knew about notebook, passing quizzes helped. Went back to study to re-pass. Computer helped review everything.	Helped
Female, Lang. Learner	Math A was easy, passing Algebra with an A	Going over warm-ups, games and manipulatives review with notebook and redos. Practice helped, and redoing. Reviewing and knowing the basics helped.	Career activity helped. Learned division.
Male, Lang. Learner	Passed both.	Making us do the work, when doesn't understand, goes back to basic math method. Redo work until correct, doing	Quizzes, must redo helps.

		homework, and being forced to do it.	
Male, resource, Lang. Learner	Passed Math A, and passing algebra	Be more responsible, such as getting work done right and coming at lunch for help. Games, manipulatives and survey activities helped, so did computer review.	Same.
Male	B in Math A, Algebra was harder.	Make sure you do everything and get it done. Plan ahead and prep for tests. Fraction review helped.	Same.
Male Lang. Learner	Passed, needed to study.	Making me pass all the tests, helped, made you study. Good teacher, understanding homework, remembering.	Do better when study.
Female	Passed	Listen to the teacher, ask for help from all your teachers. Computer points, and had to pass tests, redoing work. Notebooks helped.	Notebooks help, come in the mornings to work

Analysis:

Based on the data collected, I found that although only 41% (averaged over the last three years) of my basic math students passed my class, this is about the same rate of passing (less than half have traditionally passed) as before implementing the required learnings. The English Language Learners had a slightly better passing rate than the total class with 51% and the resource students were the least successful at only 20%. Suggestions for the English Language Learners' success may be the structure of the class that uses cooperative groups, manipulatives, and the computer tutorials which are strategies that may help them learn more. These same strategies may not be “direct” enough or “specific” enough to meet the needs of the special education/ resource students.

Using the data about students’ grades in Math A and Algebra classes, all but four students who passed basic math, passed Math A, and those four received a D. In Algebra, 25 out of 30 students had passed Algebra with a C or better and only 2 of the 30 received F’s. Of the 41% of students’ who passed the basic math class, 65% have completed enough units to graduate. Overall, about 27% of the basic math students from those three school years are on track for graduation.

The interview data pleasantly surprised me! Since all students were at-risk, the literature shows that consequences (pass required learnings or you don’t pass the class), worked! All students mentioned “redoing” quizzes or homework or doing work until it’s right as something that helped them either in their math classes or in their other classes. I required this through daily assessing student work and giving immediate feedback for improvement. As the literature showed, immediate feedback and teacher interaction had a positive effect on students performance. Six of the students mentioned that the review and/or computer helped them in their next math classes. This review and computer program provided immediate feedback on their performance that helped me improve my instruction. Four mentioned studying and prepping for tests while three mentioned their notebooks as useful. These are strategies I have been working into my curriculum to help students learn to study and be organized. Two students mentioned getting help from the teacher; this is a positive motivator and provides immediate feedback.

What does this mean to me as a basic math teacher? For the successful students I randomly chose to interview, all of them remembered and put into practice the idea of redoing their work. Requiring these students to correct their mistakes and redo their work became a habit for them, and helped them in their schooling. All but one student mentioned the class review/computers. The curriculum (number-sense) quizzes along with the computer review of all strands was what they remembered and helped them to move on to the next math class. For four students, studying and preparing for tests, along with knowing they were important, became a part of their learning strategies. Only three students mentioned having a notebook as helpful.

Conclusion and Policy Implications:

My research shows that requiring students to redo their work to correct their mistakes, to learn certain standards, and to evidence knowledge of those standards by passing tests was seen as helpful by the students. These strategies of redoing work, and preparing for tests were put to use in their other classes and helped them be successful in their more advanced math classes. Over half (65%) of the successful basic math students are on track for graduation. Therefore, even if a student begins in my basic math class in high school, he/she can still complete the graduation requirements.

For my teaching, I will continue to have required learnings and continue to test for the acquisition of those learnings. I will also continue to make “redos” a habit for my students, along with the use of review and notes, and keeping a notebook.

These conclusions lead me to recommend the following policies:

1. All classes should have standards-based required learnings. Students should be taught and expected to redo their work for correctness and be allowed to re-take the assessments for these learnings.

2. As part of professional development, all content area teachers should be trained to teach and to promote mastery learning through re-doing incorrect work and tests, in a positive, supportive manner. How to manage this approach in a mixed-ability class should also be included.
3. Alternate programs should be developed for students who are not successful in basic math, in an effort to reduce their dropout rate.
4. Further research should be done to find out why students who did pass basic math were behind in units (i.e., failed classes in other content areas), in order to determine what can be done to support these students in completing their high school graduation requirements.