



How elementary students can now begin to grasp advanced math—even calculus

WHYWAIT MATH supplements allow elementary students (even Kindergarteners and preschoolers) to begin advanced math concepts way ahead of all the new CCSS.

IT'S BEEN over 40 years in the making. It started when Michael McOmer, a linguist, began tutoring K-12 students in math. That's when he noticed math curriculum's big problem.

It wasn't the math concepts themselves. It was simply the language used to *label* them. Regardless of the topic, he discovered what every struggling math student already knows: advanced math topics are riddled with arcane Latin and Greek terms. As a result, only the top half of any given class is able to get it.

Worse still, curriculum writers appear totally ignorant of the problem. "That's how it's always been done," they argue.

But McOmer knew better. As he tutored, he began to apply his expertise in linguistics. Little by little, he saw how his students' math anxiety and confusion started to decrease. They began to see the marvelous logic of numbers without getting *(continued on next page)*

CCSS and new math textbooks: 5 out-of-the-box suggestions

1. Which textbooks should I buy? Consider NOT buying any new textbooks at all. Let the teachers keep the books they're already comfortable with. Instead, buy digital supplements. Let them fill the gap for meeting the new CCSS standards.

2. What about teacher training? Supplements come in such small doses that teachers can learn them a week or even a day at a time as they go.

3. Which is better? Digital or hardcover?

a. Digital is cheaper. Needless to say, in this age of budgetary constraints, digital downloads or files are cheaper than replacing textbooks.

b. Multimedia is a superior delivery. Few would disagree that most elementary students find well-crafted, multimedia-based lesson supplements more engaging to the senses than textbooks.

c. Updates are instantaneous. New lessons and material can be added on an ongoing basis *as soon as they are available* and always at less cost than having to wait for a full new hard-copy edition.

4. How are teachers reacting to the new standards? They're afraid the new textbook will force them into a new approach. They would rather keep what they're comfortable with. They *(continued on next page)*

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5 suggestions

already have favorite ways of teaching most of the topics. They only need new material to comply with the new CCSS standards. Supplements are the simplest and cheapest way to make up this gap. Again, with supplements, teachers avoid having to learn and adapt to a whole new text.

5. How are parents reacting to the new standards? Parents have seen new standards before. They are suspicious that it won't make any difference. They fear most scores will remain low with too many children staying below average.

So yes, parents are expecting much more! As the rest of this report attempts to show, maybe one answer is to include provocative, new material *way ahead of grade level*.

Studies consistently show that kids' attitude towards math greatly improves when they see they can learn ahead of grade level—much to the satisfaction of their parents!

realized how those same concepts could be taught much earlier, even to Kindergartners and preschoolers. It was from these insights that he hatched six key innovations:

1. Exquisite thin-slicing of curriculum.

Since concepts were no longer weighed down with Latin and Greek terms, McOmber saw how he could now thin slice the curriculum to a much finer degree.

He discovered that even elementary

GEOMETRY	P	K	1	2	3	4	5	6	7	8	9	10	11	12
Identify radius and diameter	W					S								
Identify parallel and intersecting lines		W			S									
Pythagorean theorem		W						S						
Distinguish complementary angles			W						S					
Set theory: union and intersection			W							S				
Congruence vs. similarity				W					S					
Vectors: magnitude and direction				W								S		
Compute area sector					W					S				
Vectors: addition and subtraction					W							S		
ALGEBRA	P	K	1	2	3	4	5	6	7	8	9	10	11	12
Negative numbers: add and subtract	W					S								
Letters for unknown variables	W					S								
Integer slopes	W								S					
Functions: domain and range		W									S			
Negative numbers: multiply and divide			W				S							
Square roots			W						S					
Functions: inverse			W								S			
Matrices			W									S		
Distribute $a(b + c)$				W					S					
Graph ordered pairs				W						S				
Determinants				W								S		
Polynomial multiplication $(a + b)(c + d)$					W					S				
TRIG	P	K	1	2	3	4	5	6	7	8	9	10	11	12
Secant and tangent	W									S				
Sine waves		W										S		
Arcsine			W									S		
Cofunctions				W							S			
Pythagorean identity: $\sec^2 = 1 + \tan^2$					W							S		
Elevation and depression						W				S				
Triangle, general area = $\frac{bc}{2} \sin \theta$							W			S				
CALCULUS	P	K	1	2	3	4	5	6	7	8	9	10	11	12
Tangent to a curve	W													S
Integer values of tangents on a curve		W												S
First derivative of sine function			W											S
Local and global maxima and minima				W										S
Second derivative of sine function					W									S
First degree monomial integral						W								S
Sum rule							W							S

W = WhyWait
S = Standard

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bogged down with abstract Latin and Greek terms. So much so, their belief in themselves—and their grades—started to improve significantly.

How linguistics makes advanced math simpler

Once McOmber had seen the solution, he quickly sensed how his linguistic insights could radically *reduce* math curriculum's scope and sequence. In fact, by separating math concepts from their obscure labels, he

The Grade Gap: WhyWait Math vs. Standard Math. Sample of math concepts with each bar revealing the gap in starting grade between WHY WAIT (*first square*) and STANDARD (*last square*). This shows how WhyWait gives K-12 students *years longer* to master advanced concepts—thin slice by thin slice.

WhyWait™ Math

Watch the toothpick move as the ant walks home.

Picnic

Anthill

WhyWait Kindergarten

To teach first derivative slopes (calculus), an ant carries a toothpick back to his nest—in PowerPoint.

WhyWait™ Math

Smile

Frown

WhyWait 5th Grade

To teach positive second derivatives, a “smiley face” is drawn; for negative second derivative, a “frowny face.”

WhyWait™ Math

(0, 0)

(1.3552, 2.3076)

(2.8137, 3.8081)

(2.1945, -1.1828)

WhyWait 10th Grade

students could easily grasp the content.

2. A wider variety of topic strands in a single class period. With thinner slices, McOمبر recognized that a much greater variety of topics could be taught in a given session. This reduced the chance of boredom (think multiplication tables!) while increasing students’ interest and depth of comprehension.

3. Describing concepts using common terms. In place of arcane terms, McOمبر used familiar words and illustrations that the students already understood. Before teaching, for example, the Latin term *radius*, he first used its English translation: *spoke*. Instead of the abstract *first derivative slope*, he showed *ants carrying toothpicks* (see POWERPOINT slides, left).

This alone allowed students to better grasp advanced math concepts without bumping into new terms that only served to steepen the students’ learning curve.

McOمبر asked, *Why teach two new things at the same time? Isn't it easier to teach them separately?* Time and again, he found that the concept was easier to teach than the label, and could be taught earlier without it. This drastically changed the scope and sequence. Elementary students suddenly found themselves learning high-school math—much to their delight (see table, next page).

Another example: Counting up 4 duckies on a worksheet, but only calling the answer 4 is actually more of an abstraction than the more straightforward answer: *4 duckies*. Writing the letter *d* for *duckies* is simply an abbreviation—*4d* means *four duckies*. Adding

QUIZZES, 4 th Grade Students: Sample "WhyWait Math" Questions	No. of Students	No. Correct	%	Grade (CCS)	Section (CCS)
What is a "secant line"? Draw one.	24	24	100	HS	G-C
How many points does a secant line score?	24	18	75	HS	G-C
$x+7+xy+x+xy+2+xy+xx = ?$	22	15	68	6	EE
$\sqrt{49} = ?$	22	21	100	8	EE
$2\pi = ?$	23	20	87	7	G
The symbol for infinity is: ?	23	22	96	HS	?
$g+5+gk+gk+k+g+2+gk+k+3+k+k = ?$	20	14	70	6	EE
True or False: $\pi = \$3.14, 180^\circ$	25	23	92	HS	F-TF
True or False: $2\pi = \$6.28, 360^\circ$	25	22	88	HS	F-TF
Which function is this: 0:0 1:1 2:2 3:3 4:4 5:5 6:6 7:7 = ?	25	25	100	HS	F-IF
Which function is this: 0:2 1:2 2:2 3:2 4:2 5:2 6:2 7:2 = ?	25	22	88	HS	F-IF
dia- in Greek means?	25	22	88	HS	G-C
$3\frac{1}{2} = ?$	25	24	96	5	EE
If $c = 4$, then $3c + 3 = ?$	25	20	80	6	EE

Sample questions given to a pool of 4th graders (50% ELL and with behavioral markers) during six weeks of instruction using WhyWait Math curriculum. Notice that more than half of the questions are high-school level.

3 more duckies is trivial in Kindergarten and allows them to learn the simple algebraic expression: $4d + 3d = 7d$. Again, McOmber asked, *Why wait until 7th grade? What warrants the delay?* He saw that there was no mathematical or linguistic reason to wait.

4. True integration of topics. Using a strict order of difficulty, students could now build a more robust conceptual foundation.

With increased confidence, they found themselves better equipped to tackle the steeper learning curves of the ever-increasing challenge of advanced topics.

5. Simple linguistic connections. With simple monomials, for example, $2e$ and $4f$ can be made to correspond with noun phrases such as *two elephants* or *four flags*.

Hence, even preschoolers can start to catch on to algebraic concepts using "word problems" that come from the children's real world experience. They handle the algebraic notation with manipulatives—no need for

their math abilities to wait on their writing skills.

6. Detecting redundant curriculum. Since true integration provides advanced tools early on, students have an easier time tackling advanced problems. For example, calculus locates vertices on a parabola much easier than algebra.

On the other hand, algebra can also yield to simple arithmetic. The tedious "FOIL" method of multi-

plying polynomials is entirely redundant in the face of standard, 3rd grade multiplication place-holder technique.

In summary, these six innovations give K-12 students *years longer* to master advanced math concepts—thin slice by thin slice.

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To arrange for a presentation and to explore a custom proposal that would meet your district's needs, please contact:

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