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Changing Outcomes for Kids: Algebra Ready by 8th Grade

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The problem: performance, attitude, and culture in grade-level math at 8th grade

Worst fears: skipping 8th grade common core standards and advanced math is not appropriate for all students

Our path: focus on "rich learning and high expectations for all" and experiment with what works

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Experimental Culture ⟶ Growth mindset

- double-dose (math everyday)
- exercise and math
- teaching algebra to "not ready"
- homework club
- intervention classes
- heterogeneous classes
- flex grouping
- flipped classroom
- SMART Collaborative Classrooms
- coding in math
- team teaching

It's about growth, not proficiency!

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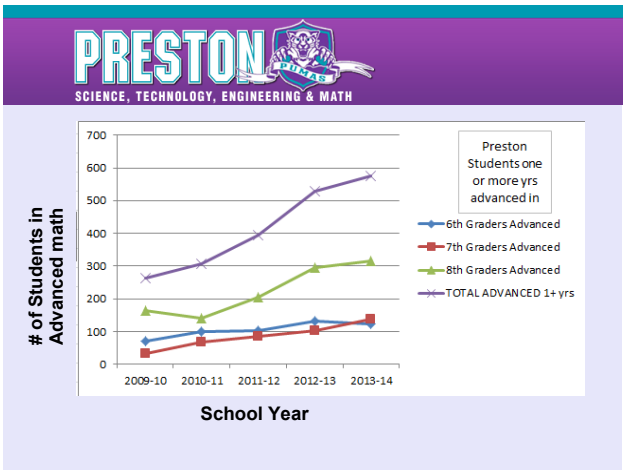
Heterogeneous Classes

- Tracking into accelerated vs. grade-level classes at 7th/8th grade level involved an arbitrary cutoff
- Curriculum differences were minimal
- "What If" we offered everyone accelerated classes with support structures in place for struggling students?
- Double-block is critical to provide extra time
- Differentiation and collaboration must be embraced by all teachers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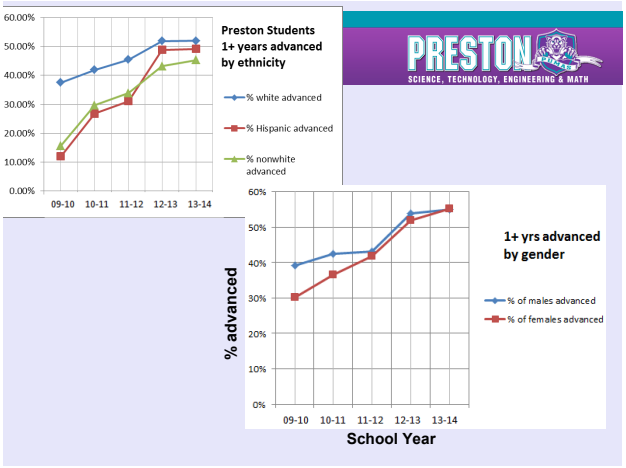
# of Students in Advanced math
700
600
500
400
300
200
100
0
2009-10
2010-11
2011-12
2012-13
2013-14
Preston Students one or more yrs advanced in
6th Graders Advanced
7th Graders Advanced
8th Graders Advanced
TOTAL ADVANCED 1+ yrs
School Year


60.00%
50.00%
40.00%
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09-10
10-11
11-12
12-13
13-14
Preston Students 1+ years advanced by ethnicity
% white advanced
% Hispanic advanced
% nonwhite advanced
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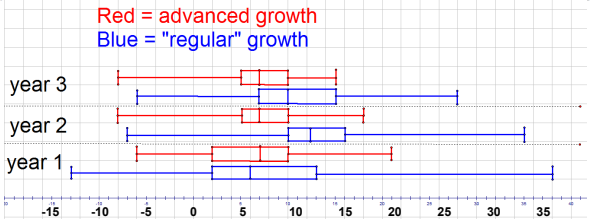
% advanced
60%
50%
40%
30%
20%
10%
0%
1+ yrs advanced by gender
% of males advanced
% of females advanced
School Year

NWEA MAP test growth - typical growth about 6

all classes 2009-2010			all classes 2010-2011			all classes 2011-2012		
grade level	average	7	grade level	average	12.0441	grade level	average	9.8557
advanced	average	6.625	advanced	average	7.72	advanced	average	7.3216



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? How is what we are doing different than just scheduling all in an algebra class?

? What systems have we put into place to help students be successful?

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Flexible grouping is a key differentiation structure

- Formative assessment on specific learning targets
- Form groups: students that need support, students on target, students that need enrichment
- Each teacher in a team prepares a lesson to meet the needs of the group
- Students really enjoy it and see value
- This type of collaboration and differentiation was most easily embraced and implemented

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Connected Math 2XL

Mode Group	Support Group		On Target Group		Enrichment Group	
	Median	Mean	Median	Mean	Median	Mean
Above Target	0.0	4.9	27.3	26.2	70	68.9
On Target	27.3	24.2	54.5	55	18.2	20.8
Below Target	63.6	69.5	27.3	24.2	0.0	6.4

Connected Algebra

Mode Group	Support Group		On Target Group		Enrichment Group	
	Median	Mean	Median	Mean	Median	Mean
Above Target	9.1	5.8	33.3	27.6	66.7	66.6
On Target	18.2	19.7	63.6	63.5	11.1	16.8
Below Target	55.6	62.0	44.4	36.4	0.0	1.6

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Connected Math 2XL

Mode Group	1 Group	2 Groups	3 Groups
Above Target (n = 44)	3	26	15
On Target (n = 37)	0	6	31
Below Target (n = 37)	4	16	17

Connected Algebra

Mode Group	1 Group	2 Groups	3 Groups
Above Target (n = 38)	1	18	19
On Target (n = 63)	2	18	43
Below Target (n = 17)	1	15	17

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Intervention & Enrichment Opportunities

- Students selected for intervention based on data and teacher recommendation - max two quarters per year
- Interventions: Algebra Support, Math Navigator, Math Lab, and Khan Academy
- Enrichments: Math Counts, Stock Market Game, Computer Programming, Chess Club, etc...

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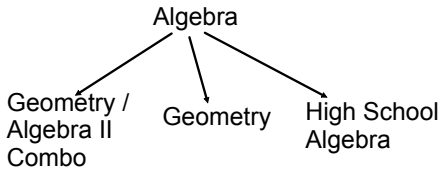
Flexible Tracking

Many opportunities available to accelerate, repeat, or stay on track



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Confidence from Genuine Achievement

- Communicate often with students about academic growth and goals
- Struggling students don't struggle with every concept. Honor their strengths & background.
- Allow re-learning and re-dos
- Show students their data and allow reflection on being a student-mathematician
- Students report feeling more confident about math

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Timeline of our changes:

06-07	Double-block
08-09	Contract for Advancement
09-10	Heterogeneous Classes, Differentiation Book Study
10-11	Flex Grouping, Intervention Classes, Cognitive Demand Study, PEBC (cohort 1)
11-12	Teaching Algebra to "Not Ready", 2 grades flex grouping, PEBC (cohort 2)
12-13	Algebra for All, All Grades Flex Grouping, Flip Teaching, PEBC (internal labs)

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Our insight for you...

Start with a core of those ready - don't wait for everyone!

Key professional development experiences:

- differentiation (Diane Heacox, *Making Differentiation a Habit)*
- level of cognitive demand (*Implementing Standards-Based Math Instruction*)
- Public Education and Business Coalition
- coaching; reflective stance
- workshop model
- lab visits

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School Structures

- Common Planning
- Standards-Based Grading
- Heterogeneous Scheduling
- Lab Visits/Lesson Study
- Significant Training on Differentiation
- Support Personnel
  - Integrated Services support
  - Learning Lab
  - Instructional Coach

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Structures we Developed "in Process"

- Common Learning Targets, Common Assessments

  -had some common assessments before, but refined and made truly common in middle

- Clarity within Team on what is Below/Target/Advanced
- Transitions
- Reflection on Learning

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Pitfalls

Meeting Frequency

- Meeting infrequently
- Meeting too much

Trust

Commitment

- over commitment
- under commitment

Culture - developing a flexed class culture

Proof that all students can be algebra ready by 8th grade

Let n = # of students in your school
Let k = the mathematical readiness rank of a student in your school, $k \leq n$
Let A(k) = true for a student who is algebra ready by 8th grade, and let A(k) = false if the student is not ready for algebra by 8th grade.

We can order the mathematical readiness of our 8th grade students (best, = #1, to worst). Every student is either the best, or some k + 1 for some ordinal number k. Of course, for any ordinal number k, k + 1 is greater (and thus that student's mathematical readiness is worse). The difference in mathematical performance between any student k and student k + 1 is minimal.

We know that our best student is ready for algebra by 8th grade. Thus A(1) = true. Let S be the set of all students for which A(k) is false. S has a "best student," say x. Since A(1) = true, we know that $x \neq 1$. Since every student is either #1 or some k + 1, there is some ordinal number (student) k such that k + 1 = x. Now k is less than x, and x is the "best" student who is not algebra ready. It follows that k is in not in S, and so A(k) = true. But, since the difference in mathematical performance between student k and student k + 1 is minimal, this means that A(k + 1) is true, and A(x) is true. Thus the best student not ready for algebra in 8th grade is actually ready for algebra in 8th grade. Therefore, S has to be empty, and all students can be ready for algebra by 8th grade.

QED