Course Redesign at Pierce: What works and what still needs work

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3 Math course redesigns at Pierce

- ASAP
- MAP Intermediate Algebra
- MOD Algebra 1

ASAP

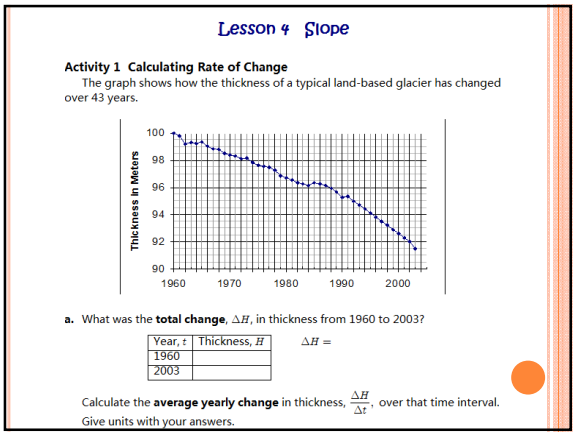
- Algebra Success At Pierce – get through your Algebra ASAP!
- 14 unit learning community in 1 semester, for total immersion in Math
- 10 units of Algebra 1 and 2 blended together
- 3 unit College Success course
- 1 unit Directed Study – study skills

Who can take **ASAP**?

- Students who place at Algebra 1 level
- Students who passed Prealgebra
- Students who place at Algebra 2 level but want to review
- Students who passed Algebra 1 but want to refresh Algebra 1 (audit) and take Algebra 2

Materials for **ASAP**

- Custom book blends Algebra 1 and 2, minimizing repetition
- Directed learning activities stress critical thinking
- Homework includes skills practice problems and applications
- Clicker questions explore concepts
- Study Skills booklet (for directed study)



Lesson 4 Slope

Activity 1 Calculating Rate of Change

The graph shows how the thickness of a typical land-based glacier has changed over 43 years.

a. What was the **total change**, ΔH, in thickness from 1960 to 2003?

Year, t	Thickness, H
1960	
2003	

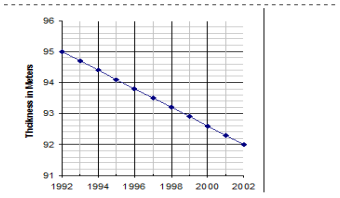
$\Delta H =$

Calculate the **average yearly change** in thickness, $\frac{\Delta H}{\Delta t}$, over that time interval. Give units with your answers.

b. The graph appears to be almost linear from 1992 to 2002. Read the graph to complete the table.

Year, t	Thickness, H
1992	
2002	

c. Calculate the slope of the graph from 1992 to 2002. Include units in your answer.



d. What does the slope tell us about glaciers?

Support for ASAP

- 1 Supplemental Instruction leader for each ASAP community (5 communities this semester)
- S.I. leaders funded by BSI funds for 13 hours per week – 5 hours in the classroom and 8 hours outside running study group sessions
- College success companion course taught by a counselor
- Counselor and Math instructor meet on a regular basis

Success of **ASAP**: Spring '08 – Spring '10

	Math 125 Success		
ASAP Status	Not Successful	Successful	Grand Total
ASAP	50	100	150
	33.33%	66.67%	100.00%
Non-ASAP (Alg 2)	2196	2502	4698
	46.74%	53.26%	100.00%
Total Count	2246	2602	4848
Total Proportion	46.33%	53.67%	100.00%

P-hat = 66.67% is significantly above P = 53.67%
Z = 3.19 , alpha = .001

But Note: The probability of a student making it through BOTH Algebra 1 and Algebra 2, as separate courses, is normally about 25%

Retention in **ASAP**: Spring '08 – Spring '10

	Math 125 Retention		
ASAP Status	Not Retained	Retained	Grand Total
ASAP	22	128	150
	14.67%	85.33%	100.00%
Non-ASAP	1015	3683	4698
	21.60%	78.40%	100.00%
Total Count	1037	3811	4848
Total Proportion	21.39%	78.61%	100.00%

P-hat = 85.33% is significantly above the population P = 78.61% z = 2.01 alpha = .022

ASAP MET (Math Exit Test) for Algebra 2: Spring '08 – Spring '10

ASAP	**Average**	**53.3**
	S.dev.	**18.8**
	n = 126	

Non-ASAP Algebra 2	**Average**	**52.8**
	S.dev.	**18.2**
	n = 3439	

ASAP (Algebra 1 & 2) did as well as Algebra 2 classes in 1 semester

MAP – Modeling with Algebra Project

- Algebra 2
- Features Discovery/ Directed Learning Activities
- Instructors minimize lecturing and encourage group work – (*try to get the students to do more work than you do!*)
- In-class tutor (funded by BSI funds)
- 4 sections running this semester

MAP MATERIALS

- Discovery/ Directed learning activities – "struggling" is a good thing
- Critical thinking stressed with real world problems and data
- Videos for skills problems
- Skills Practice problems and Reading questions scored in WebWork
- Concept questions with clickers

Activity 2 Slope and Linear Models

The taxi fare in three different cities is described below. In each city, you pay an initial charge when you get into the taxi, and then your fare is based on the distance you travel. Each city uses a different distance unit to compute the fare.

City	Initial Charge	Distance Unit	Charge per Unit
Boston	1.45	$\frac{1}{8}$ mile	0.30
Honolulu	2.25	$\frac{1}{4}$ mile	0.75
New York	2.50	$\frac{1}{6}$ mile	0.40

a. Compute the charge per mile in each city. (Do not include the initial charge.) In which city do taxis charge the highest mileage rate?

b. Write a linear model for the taxi fare in each city, using miles as the input variable. (**Hint:** What is the initial value for each model?)

c. In which city do taxis charge the lowest fare for a 5 mile ride?

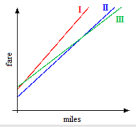
d. For what distance are the taxi fares in Boston and New York equal? (**Hint:** Use the appropriate models from part (b).)

e. Choose the correct graph for each city. Explain how you decided.

Boston:

Honolulu:

New York:



Lesson 24 Roots and Radicals

Activity 2 Heart Rate

An animal's heart rate is related to its size or mass, with smaller animals generally having faster heart rates. The heart rates of mammals are given approximately by the power function

$$H = f(m) = km^{-1/4}$$

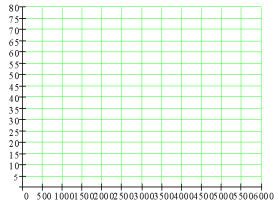
where m is the animal's mass and k is a constant.

a. A typical human male weighs about 70 kilograms and has a resting heart rate of 70 beats per minute. Find the constant of proportionality, k, and write a formula for H as a function of m.

b. Complete the table with the heart rates of the mammals whose masses are given

Animal	Cat	Wolf	Horse	Polar Bear	Elephant
Mass (kg)	4	80	300	800	5400
Heart Rate					

c. Sketch a graph of H for masses up to 6000 kilograms.



d. What would be the mass of a mammal whose heart rate is 40 beats per minute?

e. Write the formula for H using a decimal fraction for the exponent.

Write the formula for H using a radical.

Examples of Reading Questions

RQ3 What sort of variables can be described by a linear model?

a. Increasing variables
b. Variables that change at a constant rate
c. Variables that describe time
d. Variables that can be graphed

RQ3 Describe the intercept method of graphing.

a. Make a table of values and plot the points.
b. Extend the line until it crosses both axes.
c. Solve for y in terms of x.
d. Plot the points $(x, 0)$ and $(0, y)$ and draw the line through them.

RQ4 True or False.

a. The notation $f(t)$ indicates the product of f and t.

b. If $y = f(x)$, then $f(x)$ gives the value of the input variable.

c. If Q is a function of M, we may write $M = f(Q)$.

d. In the equation $d = g(n)$, the letters d, g, and n are variables.

RQ2 True or False.

a. An exponential function $f(x) = b^x$ is always positive.

b. The function $f(x) = ab^x$ has a horizontal asymptote at $y = 0$.

c. The value of b determines how rapidly the graph of $f(x) = ab^x$ increases or decreases.

d. The graph of $f(x) = ab^x$ is decreasing if $b < 0$.

Examples of Concept Questions

Lesson 11

1. What are the x-intercepts of the graph of $y = 3(2x - 7)(x + 2)$?

a. $\frac{7}{2}$ and -2 **b.** $-\frac{7}{2}$ and 2

c. $3, \frac{7}{2}$ and -2 **d.** $3, -\frac{7}{2}$ and 2

2. What happens to the x-intercepts when you multiply the right side of $y = ax^2 + bx + c$ by 3?

a. The are tripled

b. They are divided by 3

c. They move 3 units to the right

d. They are unchanged

3. If the perimeter of a rectangle is 56 inches and its width is x inches, what is an expression for its length?

a. $56 - x$ **b.** $28 - x$

c. $56x$ **d.** $\frac{28}{x}$

4. Which statement is true?

a. All rectangles with the same perimeter have the same area.

b. The solutions of $x(18 - x) = 80$ are $x = 80$ and $x = 18$.

c. If the perimeter of a rectangle is 20 cm, the largest area it can have is 20 sq cm.

d. If you know the x-intercepts of the graph of $y = x^2 + bx + c$, you can write it in factored form.

MAP MET (MATH EXIT TEST) SUCCESS: FALL '09 – SPRING '10

MAP Intermediate Algebra

Average =	64.23
St.Dev. =	16.93
n = 108	

The MAP mean of 64 is significantly higher than the Population mean of 53

z = 6.35

alpha= 0.00003

All Intermediate Algebra

Average =	52.621
S.dev.	17.851
n = 1533	

MAP SUCCESS AND RETENTION FALL '09 – SPRING '10

- MAP success = 47% compared to 53% overall (under but not statistically significant)
- MAP retention = 71% compared to 78% overall (under but not statistically significant)

MAP CHALLENGES

- Many students in class are not level prepared – makes discovery harder than it needs to be.
- More class time is spent on critical thinking activities, less on skills
- Convincing students that the "struggle" of the discovery approach is more effective than the chalk and talk lecture method they are used to.

MOD (MODULARIZED) ALGEBRA 1

- Team taught; 4 sections all run at the same time slot in adjacent rooms
- Mastery of modules (80%) required to move on
- Students move to the appropriate classroom after each Module test.
- Master grade sheet in shared Dropbox

MOD (ALGEBRA 1) STRUCTURE

- Directed learning activities (minimize lecturing)
- Students must have homework portfolio complete to take the Module test
- In-class tutor funded by BSI funds
- Students who complete at least 4 modules out of 9 can complete the course next semester

MOD CHALLENGES

- "Why can't I just get a C?" (Because a C in Algebra 1 results in a fail in Algebra 2!)
- Once students fall behind, they rarely catch up
- Close to half of the students fail module 1 three times. Now what?

MOD SUCCESSES

- Every student is accounted for
- Students filtered into the on-track classes create the best classroom environment you'll ever see
- Students filtered into the slow track actually like the attention and not feeling inadequate next to high achieving students.
- Every student that masters all 9 modules is "gold" on the MET

WHAT WORKS AND NEW CHALLENGES

What Works: ASAP

1. Repeated material in elementary and intermediate algebra is eliminated
2. Students focus intensively and exclusively on math
3. Community building through SI and counseling support
4. Student attrition over two semesters is diminished

What Works: MAP

1. Reading Questions encourage students to read before coming to class
2. Activities and Concept Questions engage students
3. Focus on applications increases writing ability and critical thinking without detracting from mastery of skills (but it takes time!)

What Works: MOD

1. Mastery learning does not allow students to ignore topics
2. Many students benefit from a slower pace, in fact, most cannot finish Algebra 1 in one semester
3. Students learn more efficiently in a more uniform group
4. Self-paced learning is not effective: developmental students need more structure

Challenges

1. Traditional courses are "easier"
2. Scheduling in self-paced courses is tricky
3. Instructors need to learn new teaching styles, grade more papers, and collaborate with colleagues
4. Discovery learning is difficult when students are not level-ready
5. Holes in very basic conceptual understanding hamper ALL students more than lack of skills

Wrap up

- Let's hear about *your* course redesigns!

Pierce college Math course redesigns

- Bob Martinez, Math faculty
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- Kathy Yoshiwara, Math faculty
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- For info about the materials contact
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faculty.piercecollege.edu/yoshibw/ka/m125/VideosAndToolkit.html