

Extreme Differentiation

a 2012 talk by Graham Mitchell

**I've taught the basics of
software development to
nearly 2,000 students during
the past 14½ years.**

Disclaimer:

**What works for me
may not work for you.**

- I have a hundred flaws you don't.**
- I have a dozen strengths you don't.**
- You have constraints that I don't.**

The Problem

The Problem:

Most of my students were
passing, but many of them
weren't *learning*.

There were **gaps**.

**(Show assignments
from 2004 and 2009.)**

2004-2005 Summary

Cycle 1	18 assignments
Cycle 2	23 assignments
Cycle 3	11 assignments
Cycle 4	25 assignments
Cycle 5	23 assignments
Cycle 6	13 assignments
Total	113

2009-2010 Summary

Cycle 1	9 assignments	
Cycle 2	11 assignments	(+5 bonus)
Cycle 3	11 assignments	(+5 bonus)
Cycle 4	12 assignments	(+13 bonus)
Cycle 5	8 assignments	(+10 bonus)
Cycle 6	8 assignments	
Total	59	(+33 = 92)

Student	501	502	503	504	505	506	507	508	509	510	511	512	513	514	515	516	517	518	519	520	521	522	523	524	AVG
Andy	10	10	10	10	10	10	10	10	10	10	10	10	10	10	100	10	100	10	100	10	10	10	10	81	96.2
Austin	10	10	10	10	10	10	10	10	10	10	10	10	10	10	100	10	100	10	98	10	10	10	10	74	94.7
Betty	10	10	10	10	10	10	10	10	10	10	10	10	10	10	96	10	97	10	93	6	10	9	10	63	90.3
Bobby	10	10	10	10	10	10	10	10	10	10	10	10	10	10	98	10	98	10	100	10	10	10	10	92	98.2
Bradley	10	10	10	10	10	10	9	10	10	10	10	10	10	10	100	10	100	0	100	0	0	0	0	69	76
Charlie	8.5	8.5	10	10	9.5	9	10	10	10	10	10	10	10	10	98	10	100	10	100	10	10	10	10	71	92.5
Edward	10	10	10	10	10	10	10	10	10	10	10	10	10	10	100	10	100	10	100	10	10	10	10	80	96
Fred	0	0	0	0	10	10	0	0	0	0	0	0	0	0	75	0	65	0	94	0	0	0	0	42	23.4
Harold	10	10	10	10	10	10	10	10	10	10	10	10	10	10	100	10	100	10	100	10	10	10	10	89	97.8
Henry	10	10	10	10	10	10	10	10	10	10	10	10	10	10	100	10	100	10	100	10	10	10	10	81	96.2
Indiana	10	10	10	10	9	9	10	10	10	10	7	7	10	10	100	10	100	10	100	10	10	10	10	58	88.8
Matthew	10	9.5	10	10	10	9.5	10	9.5	9	10	10	10	10	10	100	10	100	10	100	10	10	10	10	92	97.5
Michelle	10	10	10	10	10	10	10	10	10	10	10	10	10	10	96	10	100	10	98	0	0	0	9	51	79.2
Molly	8	6	0	0	10	10	10	10	10	7	8	8	10	10	98	10	100	10	96	10	9	0	0	54	71.8
Oscar	10	10	10	10	10	8	8	5	10	0	0	0	0	0	100	10	100	10	93	10	10	0	4	63	66.2
Penelope	10	10	10	10	10	10	10	10	10	10	10	10	10	10	100	10	100	10	100	10	10	10	10	81	96.2
Rachel	10	10	10	10	10	10	10	10	11	10	10	10	10	10	100	10	98	10	100	10	10	10	10	70	94.2
Robert	10	10	10	10	10	10	9.5	10	10	10	10	10	10	9.5	100	10	100	10	100	10	9	10	10	57	90.7
Sierra	10	10	10	10	10	10	10	9	10	10	10	10	10	10	95	10	100	10	96	10	10	10	9.5	62	91.5
Stephen	10	10	10	10	10	9	10	10	10	10	10	10	10	10	96	10	100	10	100	10	10	10	10	50	89.5
Tobias	10	10	10	10	10	9	10	10	7	10	10	10	10	10	100	10	100	10	100	10	10	10	0	57	86.5
Yesenia	10	10	10	10	10	10	10	10	10	10	10	10	10	10	100	10	100	10	95	10	10	10	10	46	89

There were gaps.

In April of 2010,
I *snapped*.

Nothing
is obvious.

**BEWILDERED
+ EXPOSURE
= OBVIOUS**

(stolen from Leon Schram)

**With enough practice,
anyone can learn
almost anything.**

The System

**(Show assignments
from this year.)**

1st Six-Weeks

300 points	"S" rank	100%	25 points per day
225 points	A	90%	18.8 points per day
150 points	B	80%	12.5 points per day
85 points	C	70%	7.1 points per day

(below 85 points is failing)

2nd Six-Weeks

1300 points	"S" rank	100%	75 points per day
1000 points	A	90%	56.3 points per day
700 points	B	80%	41.7 points per day
400 points	C	70%	26.3 points per day

(below 400 points is failing)

3rd Six-Weeks

2000 points	S	100%	75 ppd
1700 points	A	90%	58.3 ppd
1200 points	B	80%	41.7 ppd
750 points	C	70%	29.2 ppd

4th Six-Weeks

3400 points	S	100%	75 ppd
2600 points	A	90%	56.2 ppd
1850 points	B	80%	40.6 ppd
1200 points	C	70%	28.1 ppd

3400 points	100%
2600 points	90%
1850 points	80%
1200 points	70%

2,120 points

80% + 3.6%

83.6%

**2600
- 1850
= 750 pts**

**2120
- 1850
= 270 pts**

**270
÷ 750
= 0.36**

The Result

**In 2004, at the end of cycle 4,
most students had done 77
assignments.**

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**This year, as of now, students
have averaged 86 assignments
each, 94% of which are perfect.**

Pros & Cons

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Pros:

Fewer gaps!

Pros:

**I get to use every
good assignment
I've ever created.**

Pros:

**Students can't escape
demonstrating
mastery.**

Pros:

**Students can work
until they get it.**

**And they can fly
if they're able.**

**In 2004, at the end of cycle 4,
most students had done 77
assignments.**

**This year, as of now, students
have averaged 86 assignments
each, 94% of which are perfect.**

Student A

72%, 63 assignments

Student B

68%, 51 assignments

Student C

59%, 54 assignments

Student D

99%, 103 things, 3346 pts

Student E

100%, 103 things, 3443 pts

Student F

100%, 177 things, 8603 pts

**Right now I have 20
students with a “100%”**

**Their points range
from 3443 to 9549.**

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**Their points range
from 3443 to 9549.**

(Remember: 1200 points is passing.)

(Pros & Cons)

Pros:

**Students learn
by doing.**

Pros:

I get to work one-on-one with students.

Pros:

**I make them
ask questions.**

Pros:

I use fewer copies.

Pros:

**Fewer students are
frustrated.**

Pros & Cons

Cons:

**I'm no longer the
center of attention in
my classroom.**

Cons:

I have to repeat myself.

**When I get the same
question over and
over, I treat that as a
flaw in the sequence.**

**Where were they
supposed to get the
prior knowledge?**

Why didn't they?

Cons:

**The students are all in
different places in the
material.**

On Thursday, February 2, my students turned in 109 programs, representing 64 different assignments.

There were 7 of one assignment, 6 of another, and no more than 3 of any other assignment.

Cons:

**txGradebook can't
handle my system.**

(You should use a spreadsheet.)

Rants & Tips

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Rants:

**I almost never ask my
students to memorize
anything.**

**If they can find the
answer on Google in
under 10 seconds, it's
not worth memorizing.**

Rants:

**If they practice it
enough, they'll
memorize it.**



Rants:

Eliminate busy work.

**Focus on interesting
problems.**

Rants:

Help them learn.

Facilitate.

Be the expert.

Don't do the work.

Rants:

**If they pass,
but don't learn,
you have failed.**

Rants & Tips

Tips:

**Good teaching is a
marathon, not a sprint.**

Tips:

Grade in class.

Tips:

**Perfect assignments
are much faster to
grade.**

Tips:

**The one who asks the
questions is the one
who is learning.**

Tips:

Don't snip the cocoon.

Tips:

JumpMath
Saxon Publishing
Khan Academy

Questions?

The End

<http://GrahamMitchell.com/>