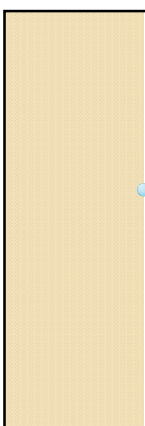



**Mastery Learning and
Elements of Game Design
in Your Math Course**

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**How I Used to Use Online
Homework**



My Traditional Approach (Algebra)

- Homework (1 assignment/section)
- Quizzes (2 quizzes/chapter)
- 20-30% of total grade

Conflict: Student vs. Instructor

If homework is worth 30% of the course grade ...

- Students only need to score 40/70 (57%) of the remaining points in order to pass the class.

Approaches That Motivate Students

Student Contracts

My First Contract With My Students (Fall 2007)

- Any student who meets the following criteria will have the option of completing a final cumulative assignment instead of taking the final exam. In such a situation, the student will keep the grade that they had before the final.

Criteria for Contract

- Perfect scores on all online homework assignments
- Online quiz average of at least 80%
- No more than 2 absences
- Exam average of at least 70%

Results

	Fall 2007 My Class With Contract	Spring 2007 My Classes No Contract	Fall 2007 Campus Wide
Pass	68.5%	49.4%	48.3%
Fail	22.2%	36.5%	33.8%
Drop	9.3%	14.1%	17.9%
Retention	90.7%	85.9%	82.1%

Comparison To Prior Semester Test Averages

Average	Fall '07 With Contract	Spring '07 No Contract
A	35%	12%
B	39%	21%
C	12%	36%
D	8%	9%
F	6%	22%

Comparison To Prior Semester

Success Rate, by Exam

	Fall 2007 With Contract	Spring 2007 No Contract
Test 1 – Transition	83%	74%
Test 2 – Radicals	79%	55%
Test 3 – Quadratic	80%	62%
Test 4 – Functions	76%	61%
Test 5 – Exp./Logs	71%	36%
Test 6 – Conics	94%	92%

Comparison To Prior Semester

Percentage of A's, by Exam

	Fall 2007 With Contract	Spring 2007 No Contract
Test 1 – Transition	44%	30%
Test 2 – Radicals	42%	20%
Test 3 – Quadratic	35%	24%
Test 4 – Functions	41%	21%
Test 5 – Exp./Logs	33%	12%
Test 6 – Conics	92%	76%

Comparison To Prior Semester

Mean Score, by Exam

	Fall 2007 With Contract	Spring 2007 No Contract
Test 1 – Transition	83.0	77.6
Test 2 – Radicals	79.6	67.6
Test 3 – Quadratic	79.7	73.8
Test 4 – Functions	81.0	71.8
Test 5 – Exp./Logs	75.0	58.3
Test 6 – Conics	93.1	88.5

Mastery Learning & Elements of Game Design

Grading System

- I wanted to create a grading system that was not just a translation of the standard grading scale.

Test Grades

- Tests are graded pass (70% or above) or fail.
- Pass = 1 Point, Fail = 0 Points
- Homework and quizzes do not directly count towards a student's grade, but instead can be used to "level up".

Leveling Up

- Students who have satisfactory online homework scores (90% on each assignment) and online quiz scores (70% on each quiz) level up and have a chance to earn bonuses.

Bonus Earned

- 70-79% on test: 2 points (instead of 1)
- 80-100% on test: 3 points (instead of 1)

Mastery Learning

- Leveled up, but failed test: Students can retest the following week for 1 point

Points Available

- 25 points available before final
6 tests (up to 3 points each)
1 test is doubled
4 points for final review quiz/homework assignment
- 100 points from final exam

Grades

- A: 100 points
- B: 88 points
- C: 76 points

Results

- Only 1 drop from 47 students (98% retention)
- 3 students did not take the final
- A: 15 B: 8 C: 5 D: 4 F: 14
- 33% A's, 61% Success

Common Final Results

- 43 of my students took a common final exam, along with 101 students from different classes/instructors.

Common Final Results

- 65% scored 60 or higher (control: 37%)
- 35% scored 80 or higher (control 7%)
- Mean: 12.5 higher
- Median: 14 higher
(Median was greater than Q3 for control)

Semester 2

- Intermediate Algebra
Mean score increased by 6.4 points
Median score increased by 11 points
- Elementary Algebra
Mean: 77.2
Median: 81.5
Q1: 75

Changes On The Way

- I am increasing the required points for A, B, & C by 4 points.

Changes On The Way

- I am adding a second point category to accommodate +/- grades.

Elements of Game Design

Game Design I

- Students start with 0 points and progressively add to their total.

Game Design 2

- Organic learning – learning in nature is a series of failures and analyses, leading to a single success/epiphany

- Most online homework systems allow this:
- Try problem & get it wrong
- Regroup, use learning aids, see a tutor, ...
- Try it again with new approach
- Repeat until you conquer it

Game Design 3

- Retaking a test (mastery learning) also fits with organic learning.

Game Design 4

- Unexpected Rewards
- Perfect score on a test (3 points) allows you to reopen a future assignment
- Expected Rewards

- I give my students a gold coin that they can trade in for the assignment – physical object, less abstract

This Semester – Through 4 Exams

- Typical Exam: 24 leveled up, 15 did not
- Leveled Up: 87/96 passed the chapter exam (91%)
- Did Not Level Up: 37/59 passed the chapter exam (62%)
- Retest: 5/9 passed the retest

Potential Problems

- A student could over rely on the online learning aids or have assistance from a tutor/classmate to level up.

Potential Problems

- This grading system is so different from what students are used to that I have to constantly remind my students at the beginning of the semester.

Why Does This Work?

- “Your students are working hard because they have no idea how they are graded.”

Why Does This Work?

- It's different.

Why Does This Work?

- It's fun!

Why Does This Work?

- Students are doing their homework the right way, for the right reason.

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