Mastery Learning in Algebra and Pre-Calculus
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Introduction

Many students do homework and take quizzes which are supposed to prepare them for exams, but they rarely go back to figure out what they missed once they are graded. To encourage students to go back and study what they missed and to discourage them from being satisfied with partial credit, I use topic based mastery quizzes in algebra courses and weekly mastery quizzes in pre-calculus. The goal is for students to master the course material as well as pre-requisite material.

Methods

Students take either weekly or topic based quizzes that consist of two to ten procedural problems. In order to pass a quiz, students need to score at least 80% with no partial credit. When a student passes, their score is recorded as 100%, but until they pass, it is recorded as 0%. However, students can retake quizzes unlimited times outside of class during my office hours or by appointment.

Students receive their first quiz back, but because I give the subsequent tries at different times to different students, I keep those. If a student does not pass a quiz after two tries, I spend time going over the quiz material with them and encourage them to study before they take it again.

Students are allowed to retake quizzes until the last day of the semester. There is no deadline for re-taking quizzes.

Originally my Fall 2009 pre-calculus only had weekly quizzes with points assigned to each problem and graded with partial credit. However, after the class had a bimodal grade distribution after the first midterm, I proposed switching to mastery quizzes which the class agreed to.

Data

Math 110 . Spring 2009

Average quiz attempts	Max attempts at one quiz	Min attempts at one quiz	% of quizzes passed	Average exam score
1.1	2	0	70	96
2.3	5	1	100	90
1.3	2	1	100	89
1.8	3	1	100	88
1.1	2	1	100	86
1.4	3	1	90	84
2.7	5	0	60	84
2.1	4	1	100	81
2.0	4	1	100	76
2.2	5	1	90	73
2.0	4	1	90	71
1.4	2	1	60	70
1.0	2	0	40	69
2.4	5	1	90	69
2.4	4	1	60	65
1.0	1	1	20	63
2.4	4	1	70	63
2.1	3	1	80	62
1.7	3	1	70	59
1.3	3	0	30	49

Math 120 . Spring 2009

Average quiz attempts	Max attempts at one quiz	Min attempts at one quiz	% of quizzes passed	Average exam score
1.1	2	1	86	101
1.3	2	1	100	100
1.7	4	1	100	99
1.4	3	1	100	99
1.4	3	0	86	98
1.3	2	1	71	96
1.9	3	1	100	90
1.9	2	1	100	90
1.9	3	1	100	89
2.0	4	1	100	89
2.0	4	0	71	87
2.0	3	1	100	86
2.1	4	1	71	85
1.4	2	1	57	84
2.3	4	1	100	84
3.0	5	2	86	83
2.3	4	1	86	81
3.4	6	1	71	80
2.4	3	1	86	75
3.0	6	1	100	67
4.1	6	3	86	55
3.1	6	1	57	46

Math 219 . Fall 2009

Average quiz attempts	Max attempts at one quiz	Min attempts at one quiz	% of mastery quizzes passed	Non-mastery quiz average	Average exam score
1.6	3	1	100	90	96
1.6	3	1	80	64	95
1.8	3	1	80	82	90
1.6	2	1	100	98	88
1.4	2	1	60	81	87
1	1	1	60	85	87
1.6	3	1	80	71	85
2	4	1	100	77	85
1	1	1	60	52	77
2	3	1	80	56	75
2.6	4	2	100	62	75
1.2	2	1	0	44	26

Advantages

➢Students go back and study the material. Because each subsequent quiz is slightly different, students quickly realize they need to spend time studying before they retake a quiz.
➢Students pay attention to details like negative signs, notation, and arithmetic.
➢Students spend time in the Math Lab.
➢I am able to spend one-on-one time with students to figure out what they were having trouble with and make sure they understood the material.
➢Students who retook and passed quizzes before tests tended to do better on the tests.
➢Students can still earn 100% even if they need to take a quiz multiple times.
➢Quizzes were fast and easy to grade because no partial credit was given.

Limitations

➢Making multiple versions of each quiz requires a lot of time and work.
➢Some students don't retake quizzes right away or wait until the end of the semester. These students tend to not do too well in the class.
➢Students whose schedules only allow for them to be on campus during class time are unable to retake quizzes.

Conclusions

Mastery quizzes are a good way to encourage students to study and understand topics well. They are easy to grade, and students like getting 100% on them. Students who retry them soon after taking them the first time tend to do well in the course. Students also tend to spend more time in the Math Lab studying and getting help.