Teaching Tip: The Classroom Average

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One day a few years ago, I had some time on my hands so I decided to surf the world wide web. Always in the lookout for new ideas to improve my teaching of calculus, I began searching for calculus-related websites. It was then that I stumbled across Dan Kennedy's website. Dan is a calculus and algebra teacher at the Baylor School in Chattanooga, Tennessee. (He also happens to be the "Kennedy" in the popular calculus textbook by Finney, Demana, Waits, and Kennedy.)

I was amused to read his posted expectations for his math classes as well as an interesting grading system. The grading system rewards collaboration unlike any other I have ever seen. I was so intrigued by this grading method that I introduced it in my own classroom. Let me tell you about this grading system, and how its implementation has affected my classroom.

This grading system relies on the class average. The class average is, as you would expect, the average of the students' grades in the class. However, it is also partially a subjective measurement based on the teacher's opinion of how well the class as a whole is progressing. Dan puts it this way:

"I will be evaluating how well you and your classmates work together through personal observation over the course of the semester. How well do you work together with others in groups? (This is the "collaboration" part.) How involved are you in class discussions? How well can you ask a question when you don't understand, and how well can you explain it to others when you do understand? Do you come for extra help when you need it? Does your attitude help the class or hinder it? Is the class being dragged down by its lowest components, or being elevated by its highest components? Does the class work well together mathematically, or do some students resist work to the point of impeding the efforts of others? Does the class welcome challenges, or seek the path of least resistance? Am I the coach, or am I the enemy? Is it me against you or US against ignorance?"

Thus, the class average is a reflection of how well the class is collaborating to learn mathematics. Collaboration is the key: students should be helping and encouraging each other. In other words, the class should be working together to ensure that everyone has the opportunity to learn mathematics. With such an attitude, understanding and learning happens for everyone so the homework

will be more easily done and other grades will rise. This is reflected in the class average.

The class average affects students' grades in the following way: all tests are curved to the class average. Here is how this is done. Say a class of 30 students, which currently has a class average of 88, takes a test. Grading on a raw scale out of 100, the average raw score is found to be 77. The test caught some students unprepared (for some reason, academic or otherwise), but some did well, and everyone is attempting the right kind of mathematics. Let's say the highest raw score in the class is 92. Now, the highest raw score would have been even higher if not for some careless mistakes, so I decide to curve this to a 98. With the class average, I now have two ordered pairs with which I can curve everyone's raw score in a fair and objective manner: (raw high score, curved high score) and (raw test average, class average).

Using the numbers above, I have the ordered pair (92, 98) and (77, 88). The equation of the line that passes through these points is used to curve everyone's raw score. Notice that according to this curve, a raw score of 20 curves to a 50, a raw score of 50 curves to a 70, and a raw score of 80 curves to 90. The overall effect of this "linear curve" is that is increases the mean and decreases the standard deviation. This still results in a clear comparison of students among students and those that make A's still make A's. A student that fails may still get a failing test grade, but that student will be in a position to believe a comeback is possible, and that student is still responsible to continue trying.

The class average becomes critical when computing the curved test scores. If the class average for the above example was 83 rather than 88, and we leave everything else the same, then the raw score of 20 curves to a 26, a raw score of 50 curves to a 56, and a raw score of 80 curves to 86.

A class is that has overcome the lowest elements that may drag it down and been elevated by the higher elements (i.e., collaborating), is rewarded. Such a class, for the purposes of curving the test, may receive an extra point or two on the class average. This is critical: the class average must move slowly so that all students continue to strive. Awarding an extra five points to the class average would skew the test grades too much. Again, suppose everything in the above example is the same except that the class average is 93 rather than 88. Then a raw score of 20 scales to a curved score of 74.

If a test is especially difficult for a class, then they are protected by the fact that the class average moves sluggishly: say from 85 down to 83. I can understand how an 85 class might become an 83 class in the few weeks between tests, but how could they suddenly plunge to 78 unless one of the assessments was a poor indicator of progress?

This is the basic description of Dan's procedure. I was fascinated by the implications. We all want students to collaborate in a positive manner, but "group work" is where most of the graded collaboration takes place. However, this method stresses that every aspect of learning is collaborative, that each student is, in some manner, responsible for everyone's grade.

When I implemented this method in my classroom, I was surprised to find my students didn't seem to care. Until the first test. You see, it was when they saw

what affect the class average has on their test grades that they began to really buy into it. Those that didn't do homework were suddenly being "gently reminded" by classmates to do homework, relieving me of nagging those students. Students began to keep each other awake during class, study groups were formed, notes were shared, and students began supporting each other's comments during class discussions. And, their grades on homework, quizzes, and other assessments increased, which of course means that the class average increased, and then the test grades increased.

Another interesting effect is that I now can ask anything I want on a test. I now create some fiendishly difficult tests. But the students are protected by the curve. This means I can challenge them without fear of students' failing, and they can be pushed to really show me what they know without fear of failing. I have noticed a decrease in test anxiety in those that normally exhibit such anxiety, and I have noticed a willingness in most to continue to figure out the problems after the test is over. Tests in my classroom have become, in the attitudes of the students, a "Show him what I can do" assessment, rather than a "He's daring me to get all of these right" assessment.

I currently teach two sections of precalculus, one first period and one sixth period. The first period class has a couple of slackers in it who have consistently not done homework for the three weeks leading up to the test. There are also a few very smart and very hard-working students in that class who maintain good grades. Unfortunately, first period also includes a majority of students not interested in getting each other working and collaborating. This is showing in the class average: had the group encouraged the slackers to do homework, the slackers' grades would be better, corresponding in an increase of the class average. First period's class average currently stands at 79, and even the smart, hard-working students cannot raise the lower elements of the class.

The sixth period class on the other hand has no one that fails to turn in homework. They have formed study groups, they encourage each other, and they help keep each other on track. There are no "geniuses" in that class, but their class average is an 85. By encouraging each other, they are learning more and performing better on all assessments.

I gave a different test to each class, but each test was at the same level of difficulty (i.e., both were insanely difficult). The raw test average was similar for both classes, but the grades were very different. The grades in the first period class were curved much lower than sixth period due to their respective class averages. The smart, hard-working students from first period managed very high raw scores which curved to the low 90s. Conversely, the highest raw score in the sixth period class didn't come close to the highest raw score in first period, but due to sixth period's class average of 85, the highest raw score scaled to the mid 90s. A similar effect occurs on the low end as well. The lowest raw score in the sixth period class ended up with a higher scaled test grade than the lowest raw score in the first period class.

By curving test grades to the class average, I believe Dan Kennedy has created a wonderful method. This is an objective curve that reflects the class' own abilities and encourages collaboration. This frees the teacher from makes tests that are too

easy so that "everyone has a chance of passing" and instead lets the teacher create an assessment that pushes the students a little more. But most importantly, this is a curve that the students themselves control.

If you would like a copy of one of my precalculus tests to see just how difficult it really is, or if you would like more information about the curve, please contact me. Better yet, search for Dan Kennedy's website and read the original!