Abstract
Math and test anxiety are prevalent in society, and tend to be overrepresented in science classes for non-science majors. Students in these classes often excel in other areas but believe they are not able to do math or to do well on science tests. After teaching labs as a TA for Earth, Wind, and Fire, a geology class for non-science majors, I became aware of how disabling math and test anxiety were for many of these students. The next time I taught labs for this course, I used formative assessment to help reduce math and test anxiety. Although many authors have stressed the importance of alternative methods of evaluation, I knew realistically, that these students would need to be able to take traditional exams. To this end, I gave weekly quizzes that were very challenging, graded harshly, and completely correctable. Students were encouraged to correct their quizzes, and the corrected grade completely replaced the original grade. By the mid term, 100% of the students had mastered rate calculations, and when retested at the final, 80% of the students retained the ability to solve the rate calculations. Students reported feeling less nervous about the midterm exam because they knew they could answer the math questions.

Methods and Interventions
Participants: Students with fewer than 4 absences who were enrolled in my sections of Earth, Wind, and Fire.

Math and Test Anxiety
- Characterized by feelings of dread and paralysis, inability to complete answers
- Main causes: poor preparation and negative feedback
- Generally math and test anxiety are linked
- Two thirds (Jackson and Laffingwell, 1999) to 93% (Burns, 1998) of Americans have negative associations with math
- an "I can't succeed" (Williams, 1988)
- "Emotional and a cognitive dread of mathematics" (Williams, 1988)
- Math anxiety is isolating (Dodds, 1992)
- Test anxiety may result from poor study skills, the setting of unrealistic goals, hostile test environments, and impromptu testing, such as pop-quizzes (Sogouros, 1998).
- Attributed to the actions, whether overt or covert, of teachers (Williams, 1988), and of parents.
- Teachers run the risk of spreading the "communicable disease of math anxiety" that they themselves are carriers of (Williams, 1988).
- "Insulin, irrelevant, negative thoughts...during a testing situation" (Meuley and Host, 1992) causing distraction
- Women report higher rates of math anxiety (Levine, 1995) even in cases when they outperform men.

How can math and test anxiety be reduced?
- Pedagogical
  - Creating positive experiences to replace negative ones which fostered the anxiety
  - Informed and ongoing assessment (Steele and Arth, 1998)
  - "regular and constructive feedback" (Sogouros, 1998)
  - Give easier problems to students with known weaknesses, guaranteeing their success (Williams, 1988).
- Therapeutic
  - Confronting negative experiences
  - Bibliotherapy, journaling, and group work, math autobiographies
  - Teacher as counselor (Furner and Duffy, 2002).
  - Personal stories of success may offer students hope
  - "Changing negative beliefs is a slow process" (Dodds, 92)
  - Need teachers who are patient and encouraging (Dodds, 1992).
- Many cases may also require counseling

Results
- Challenging, harshly graded, given weekly with difficult material repeated
- Average 1st grade was 40%. This was reported to the class in a positive manner.
- Corrected grade completely replaced 1st grade.
- Students were encouraged to work together just before the midterm exam

Conclusions
Formative Assessment: Know what your students know. Let them know what you expect them to know. Give them comfortable with taking tests.

Math and Test Anxiety
- Frequent. low anxiety
- Formative Assessment: Reducing math phobia and related test anxiety in a geology class for non-science majors

References
-Eisenberg, M. (1992, Jan-Feb). Compassionate Math. Journal of Humanistic Education and Development. 31(2), 109-120.
-Steinke, D., Arth, A. (1998, Jan-Feb). Math Instruction and Assessment: Preventing Anxiety, Promoting Confidence. Schools in the Middle. 7(3), 44-48.

Implications, Future work
Students with math anxiety and test anxiety can be retained by using Formative Assessment. A supportive environment is vital so that the students understand the purpose of the quizzes to instruct, not just to evaluate. By frankly discussing math anxiety, I was able to create a safe environment and offer hope to those confronting it. By using compassionate quizzes, I interrupted damaging practices common among math anxious students by making them aware that they are not the only ones who struggle and by showing them that they can do the math.

Formative Assessment: Frequent. low anxiety

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