

6-1-2010

Developing Female Self-Efficacy For Middle School Mathematics

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Developing Female Self-Efficacy
For Middle School Mathematics

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Honors Thesis
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Table of Contents

<i>Section I</i>	<i>Page #</i>
1. Foreword	3
2. Self-Efficacy	7
2a. Dimensions	8
2b. Sources	10
3. Self-Efficacy and Other Educational Aspects	14
3a. Self-Efficacy and Motivation in Classroom	14
3b. Self-Efficacy and Attitude towards Education	16
3c. Self-Efficacy and School Work	17
4. Adolescent Females	21
5. Females in Academia and Mathematics	24
5a. Math Performance	24
5b. Testing Approaches	25
5c. Societal Thoughts	27
5d. Spatial Imaging	30
6. So...Why do Females Need Self-Efficacy in Math?	31
<i>Section II</i>	33
1. Introduction to Methods	34
2. Mastery Experience Methods	35
Technique 1: Goal Setting	35
Technique 2: Multiple Strategies	40
Technique 3: Motivation	41
3. Vicarious Experience Methods	44
Technique 4: Exposure to Success	44
Technique 5: Mentoring	45
4. Verbal Persuasion Methods	47
Technique 6: Practice Not Natural	47
Technique 7: Communication Style	49
5. Emotive/Psychology Methods	53
Technique 8: Positive Mood Induction	53
Technique 9: Classroom Environment	55
6. Conclusion	57
7. Afterword	60
Reference	62

1. FOREWORD

Slowly approaching the classroom, the walls cluttered with posters from floor to ceiling explaining measurements, pi, and operations, I rolled my eyes. I knew this would be just another math class, with just another teacher, followed by numerous hours of nighttime homework tears of not understanding. It was all too familiar. In eighth grade, when I walked into advanced math I could not have recalled a positive math experience up to that point. Sixth and seventh grade was filled with tears of confusion and explaining to my mom “I will never take more math than basic requirements which is okay because I will never do anything math related for a career.” However, eighth grade dried those tears and rattled my outlook on the world of mathematics; so much that I now *want* to teach middle school math.

How could my life alter that much? Was it that I just was a developing adolescent still experiencing many of life’s defining moments or was there more? I believe my experiences can be looked upon to draw many conclusions of how to teach successfully because obviously something worked. In sixth and seventh grade I never received attention from my math teachers; this was probably due to the fact I was very shy. Personally, I believe I interpreted the little amount of interaction as a sign that I was not successful in the subject. I grew less confident in math every day from this lack of attention in class. Middle school aged females, like me at the time, constantly have negative self feelings. The fact that I felt insufficient in math only continued adding to my negative math self image. I came to the conclusion that I did not possess the ability to do math like my older sister; I was just no good at it.

With that mind set, I walked in to eighth grade math not caring about a class for the first time. The teacher I had was known for being extraordinarily strict. We sat in partners of two. The partners were organized in clean rows facing the overhead and teacher, drawing all your attention forward. Looking back, the start of this class is a blur. Every class session I felt was very similar: warm-up, lesson, class work, and assigned homework. In hindsight, I now realize all the techniques he appropriately used in class. Sometimes we did warm-ups alone, sometimes in partners, and sometimes with groups. One month every student had a turn to teach the class a lesson. Often during class work we were able to work together in cooperative groups. He had many checks and balances though to assure that everyone was doing their own work, to assure you were the one learning.

One of the most bizarre things he did, in comparison to other teachers was very simple. Occasionally, he would ask us how long we had spent on the homework. He would emphasize to every individual to take your time on homework and show you care. Specifically, he explained that those who take time will find that they are better at the topic. Giving math one more chance, I took his advice and started slowing down my homework to see if it would help before the next quiz.

As usual for quiz hand-back days, the class nervously and anxiously awaited the return of the quizzes. Standing in the front of the class, the teacher explained that because not many people did well he wanted to pair up people and have us work together to figure out the answers and turn in it again. The class average was below 50% with only two people over 70%. These are never words anyone wants to hear before getting quizzes back. He paired me up with a friend of mine and the two of us waited anxiously to see

our quiz grades. Shocked, the teacher came to me and handed me a quiz with a big fat 100% labeled across the top. Quietly, he said, “You have worked really hard recently on homework and class work and it shows.” Floating on success all day, I barely could hold in the excitement to show my mom.

At home after hugs and congratulations, my mom’s reaction was eye openly similar to my teacher’s. She informed me that my hard work is what created my success. Over time this idea sank in and I really began to take it to heart. In math, the harder you work on the ability, the higher your ability will be. Math does not just come naturally. Like most people, I loved the feeling of success so I continued to work hard on math through high school calculus and into college. Sometime in high school, math became easy to me and now I only face the occasional struggle. Knowing that when I face that struggle hard work can overcome it still helps me to this day. The seventh grade math tears were wasted; if I would have just worked hard I could have succeeded. I also needed my teacher, though, to pay attention to me and believe in me.

Why would I choose to share this personal story at the beginning of a thesis? The answer is very simple; this story illustrates an example when raising a person’s self-efficacy in math affected their math output. I realized that I could be successful in math if I worked hard and so I started believing in myself. This belief resulted with me having enough confidence to want to teach middle school mathematics. I hope every non-self-believing female can learn that kind of confidence and personal belief. The purpose of this thesis is to explain the how and why behind raising self-efficacy with female middle school math students. By fully understanding the idea of self-efficacy, it is easy to show that females can benefit in the world of academia with higher self-efficacy, specifically in

the world of mathematics. Of course, it is not just enough to say it needs to be done, but it is important to explain how. The second half of this paper will explain nine tips to raise the self-efficacy of students in the classroom.

2. SELF-EFFICACY

Often in the world of academia self-efficacy is discussed without being fully defined or completely understood. The term was birthed in 1977 by Albert Bandura, a famous psychologist, while researching snake phobia (Green, 2003). The idea of self-efficacy revolves around having the belief of ability, not the possession of actual ability. It is defined as having the cognition of possibility for solving a problem (Green, 2003). Put more simply, it means an individual's belief or judgment that they can succeed or accomplish something, like a task.

Self-efficacy is closely related to confidence, motivation and having a "you-can-do-it" attitude. Although related, it is important to realize that self-efficacy is the belief in ability not the ability, not the motivation, and not the confidence. Having a high level of confidence might increase one's self-efficacy but they are still both differing traits. Confidence is the feeling of assurance, trust or faith whereas self-efficacy is not just fate or trust but a true belief. The relationships and outcomes involving self-efficacy is why many people spend hours researching the trait. Bandura, cited in Ponton (2002), discusses some of the outcomes of self-efficacy:

"Self-efficacy influences the courses of action people choose to pursue, how much effort they put forth in given endeavors, how long they will persevere in the face of obstacles and failures, their resilience to adversity, whether their thought patterns are self-hindering or self-aiding, how much stress and depression they experience in coping with taxing environmental demands, and the level of accomplishments they realize." (p. 55)

The idea of influencing outcomes and efforts because of self-efficacy is why researchers study it in various situations, including the world of education.

In 1977, when Bandura described the term, he described it as a term in reference to one specific task. For example, one person might have a high level of self-efficacy about being able to do well on one specific math test or one specific type of problem. The self-efficacy would not translate to all math tests because it was believed to be a purely task specific trait when coined by Bandura.

In the early 1980's, the term broadened to include both the singular and/or global idea of self-efficacy (Green, 2003). The global idea can fit under the category of personality traits. An example is that a person with a high level of global self-efficacy would believe that they have the ability to perform task A, B, C or D. When the belief interchanges between tasks it becomes more of a personality trait. Just because self-efficacy became global, the old idea of singular task self-efficacy did not get thrown out the window. Instead, self-efficacy can now be classified as either 1) specific self-efficacy or 2) broad self-efficacy.

Dimensions

Self-efficacy has three different dimensions. When examining a person's self-efficacy one can look and classify each of the three dimensions: generality, strength and complexity (Leithwood, & Jantzi, 2008). Figure 1 illustrates these different dimensions.

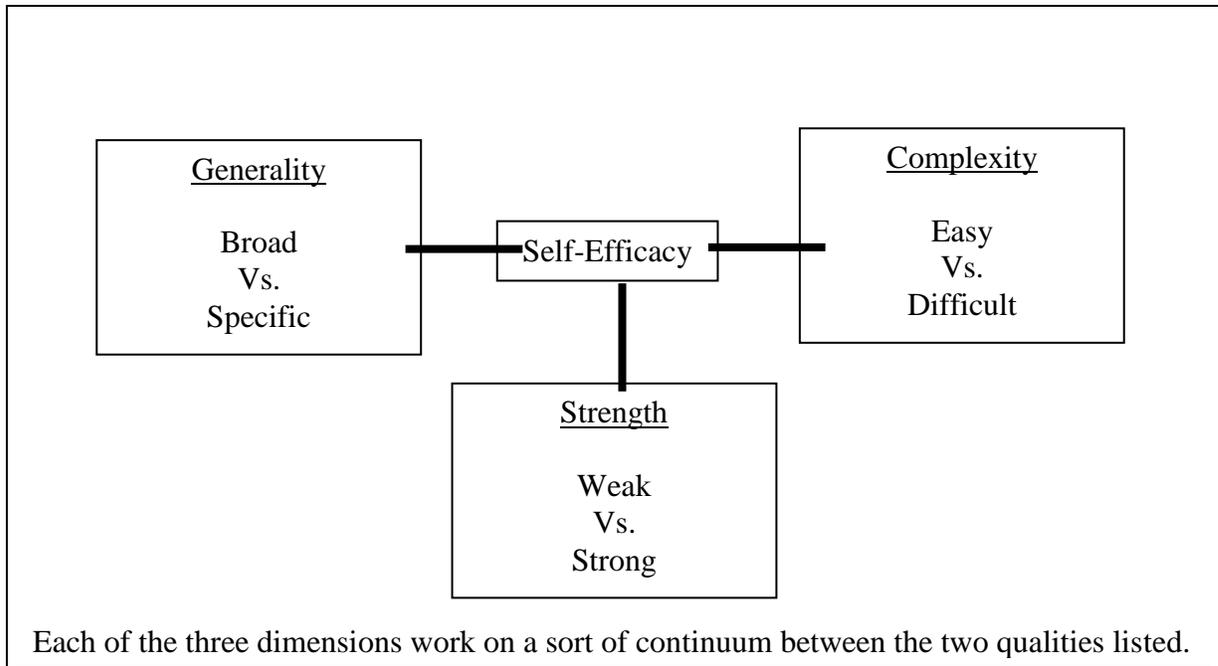


Figure 1: Dimensions of Self-Efficacy

Generality is in reference to the idea that the trait can be broad and specific, as discussed previously. When looking at a person's self-efficacy level you can see if it seems to be across the board spectrum or task specific. This could be done by simply comparing their self-efficacy levels on two completely different tasks. If the levels are similar, the person probably has a more global level of self-efficacy versus if the levels greatly differed the person would be exhibiting a task specific efficacy.

The dimension of *Strength* involves levels of persistence. A person with a weak strength involving self-efficacy would be found giving up on a problem sooner. This

might be shown by exhibiting signs of self doubt more quickly. The person with a high level of self-efficacy strength would do the opposite. These people would show greater persistence with a longer lasting idea of self-efficacy. The strength of self-efficacy really can not be measured one hundred percent accurately. A person can self gauge or compare strength on a continuous scale, like 1-20. People, or students, can also be directly compared involving strength. For instance, a teacher can observe two students and see what student has greater self-efficacy strength. The student with the greater strength self-efficacy would be demonstrated by showing a longer lasting belief that they can accomplish the given task.

The last dimension is *Complexity*. Complexity involves the level of the task at hand. Different people will have different levels of self-efficacy depending on the complexity of the problem they are presented. For instance, a fourth grader might have greater self-efficacy on an addition test than on a multiplication test. An easy way to observe self-efficacy altering due to complexity is to create a list of ten problems increasing in difficulty each time. Give the students the problems to look at and write down whether they believe they can complete each problem. Then teachers can have the students solve the problems. Comparing which problems each student said they believed they could solve, would show that complexity of the problem influences self-efficacy. Most likely the students would demonstrate less self belief in the harder problems.

Sources

If self-efficacy is important and relates to academia then it is important to realize how a person can gain, learn and improve self-efficacy. There have been four sources

classified as influential to gaining self-efficacy. Figure 2 illustrates these four sources.

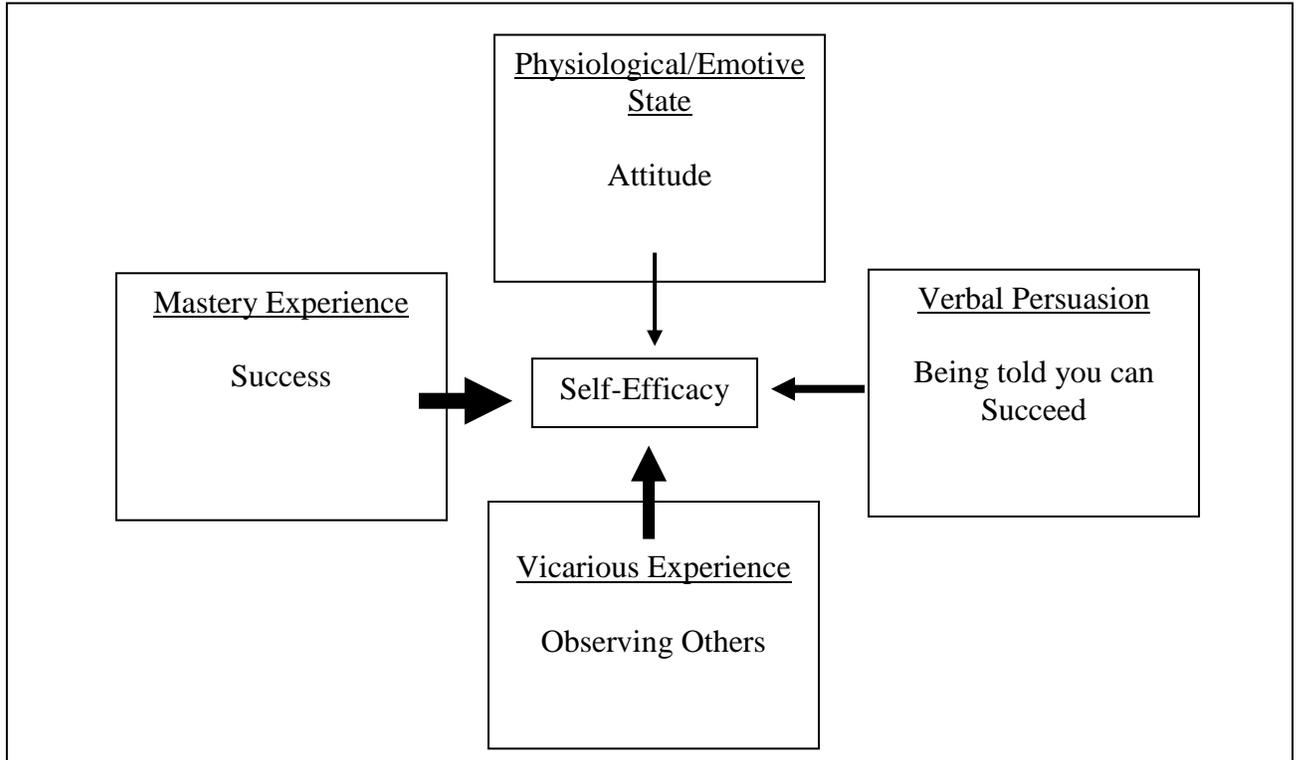


Figure 2: Sources of Self-Efficacy

The most influential source of the four is referred to as a *Mastery Experience* (Ponton, 2002). Mastery experience can be described as successful completion of a behavior that builds self-efficacy (Hagerty, 1997). For instance, if a person gets an “A” on a certain unit math test their self-efficacy towards the subject would grow. When I received my 100% on my Algebra I quiz in eighth grade, I experienced the mastery source of self-efficacy and had an increased level of self belief because I had succeeded. The completion of any task could grow task specific efficacy or a global efficacy. There is not really a way to hypothesize which type of efficacy would be affected, or if both would. Self-efficacy can have the most growth through mastery type experiences of success.

The second most influential source of self-efficacy is *Vicarious Experiences* which includes observing others (Hagerty, 1997). The “others” can be teachers, parents, adults, students, family members, peers and virtually anyone else. This source can be compared to the idea of second hand smoke for understanding. Just like a person can gain lung cancer through second hand smoke, a person can gain self-efficacy through a second hand experience. For instance, if a student observes another student working hard and then succeeding at that subject, the student could gain their own self-efficacy. In my personal experience, I have witnessed this many times. Going back to that one specific Algebra I quiz demonstrates this idea. My teacher had us work in partners which in turned helped our self-efficacy vicariously grow as our partners understood and succeeded. Because self-efficacy can be gained in this vicarious manner it shows how the classroom efficacy can build off of each other creating an environment of efficacy.

The third most influential source of self-efficacy is *Verbal Persuasion*. Verbal persuasion is just what it sounds like; it is someone telling a person they can (Ponton, 2002). This will increase a person’s self-efficacy. For example, a teacher telling a student that they can succeed will help them believe that they can. For me, my eighth grade teacher and mother acted as my most powerful source of verbal persuasion for my math self-efficacy. In general this source is most affective when the person is being supported by someone they value. For instance, being told you can by someone you love versus a stranger or a new acquaintance will have a different affect on the individual. As a teacher if the student values you, verbal persuasion can be quite successful as an efficacy source as long as it is done correctly (Apter, 2006).

The least influential source that affects self-efficacy is the *Physiological/Emotive State*. When people are in a better state or have more general positive emotions, they will have a higher level of self-efficacy. Learning to be in a positive mood will help keep a higher level of self-efficacy in the person. There are many techniques that could help raise a person's physiological and emotive states that in turn would help self-efficacy. For me, I found that once I succeeded on a quiz my mindset completely transformed to being excited towards my success. This positive attitude I believe helped me continue a strong level of self-efficacy specifically towards mathematics. Although the least influential source, this source can still have great affect on an individual (Ponton, 2002).

There are many personality traits that will help aid the success of these sources of self-efficacy. A major help is having an overall positive attitude, like mentioned above (Ponton, 2002). When a person has a positive attitude the sources will have an easier time actually affecting the person. Also, when people seem to possess a fear of failure they often receive the sources of efficacy at a higher level (Moriyama, 2008). This is because these students who have an uneasiness towards failure and will work harder at succeeding. When a person works harder to succeed, they will succeed more and then they will have higher levels of efficacy due to mastery experience. The other trait that has a great deal of affect on the sources of self-efficacy is the social positioning in regards to the task. For instance, if a person feels that they should be succeeding due to social positioning then they will be more apt to learn self-efficacy towards that task (Moriyama, 2008).

Overall, it is important to know self-efficacy is about the belief of having the ability. It has three dimensions including complexity, strength and generality. Specific or

global tasks can be discussed in reference to self-efficacy. There are four sources of efficacy: mastery experience, vicarious experience, verbal persuasion and physiological/emotive states. Different personality factors contribute to how successful the sources of efficacy can be for an individual, so methods for the development of self-efficacy are difficult to pinpoint one hundred percent accurately. Efficacy can be tied to academia in many ways. So as current or future teachers it is important to really understand what efficacy is and how it affects classrooms. In order to fully understand self-efficacy in the classroom it is necessary to discover and understand the ties and parallels to education.

3. SELF-EFFICACY AND OTHER EDUCATIONAL ASPECTS

Efficacy can be tied to academia in many ways. As current or future teachers it is important to understand what efficacy is and how it affects classrooms. Many traits are closely related to self-efficacy and are discussed in the world of education. So in order to fully understand and increase self-efficacy in the classroom, it is first necessary to understand the ties and parallels to education.

Self-Efficacy and Motivation in Classroom

There has been a growing level of concern for student motivation in recent years sprouting from the continual desire from teachers to have their students become independent learners (Adami-Bunyard, 1998). Many people have hypothesized about the reasoning behind the decrease in student motivation. One idea for the decrease involves the growing number of students in poverty and experiencing other serious life hardships (Allen, 1995). These hardships all can distract the learner and the students focus more on problems in their lives and less on education. This leads to lower levels of educational motivation. These students are usually classified as at-risk students, meaning they are at-risk for failure; ultimately this can decrease their motivational levels and their personal idea of self competence (Bryan, 1991). With lower expectations of themselves, the student will have a decreased level of self-efficacy, a belief to succeed. Bryan & Bryan (1991) make this relationship clear when they state:

“It is significant that, when children doubt their abilities, they have lower expectations for future success, tend to exert less effort on achievement-related tasks, are less likely to use the skills they have, and are differentially motivated to learn in school.” (491)

The phrase “lower expectations for future success” from that quote refers to self-efficacy.

Having a low expectation is like having a low belief in oneself; low belief in ability is

low self-efficacy. Motivation and self-efficacy are clearly tied together. In fact, Franken (1994) studied this connection and came to the conclusion that self-perception (which includes self-efficacy) was in the base to all motivational behavior (Papanastasiou, 2008). Striving to succeed will increase the likelihood of reaching the goals, reaching the goals will increase perceived self-efficacy for both the teacher and the student.

Since the two factors of motivation and self-efficacy are clearly related, it is important to understand motivation on a simple level. Motivation can deal with personal and situational factors. In education, many types of motivation style have been labeled. Rogers (2001) labels motivation styles into three dominant categories for easy understanding.

- 1) *Mastery oriented motivators* work to succeed and have a positive approach; they often do not give up with harder tasks. These individuals find motivation in success.
- 2) *Learned helplessness motivators* fail to encourage their own talents and will give up at hard tasks. These individuals lose motivation when experiencing difficulty.
- 3) *Self-worth motivators* will develop self-protective strategies to avoid failure and use failure as reflection on perceived levels of ability. These individuals automatically protect their self-worth at any sign of possible failure.

As a teacher it is useful to realize your own style and the style of the students in the classroom. This way you can motivate the most students affectively and in result assist in raising their efficacy. Whenever examining motivation in the classroom, one should also look at the affects and relationship it has with self-efficacy. Self-efficacy though will always be hard to research concretely because everyone will rate and perceive their self-efficacy individually and therefore differently.

Self-Efficacy and Attitude towards Education

Motivation is not the only aspect that ties into a student's self-efficacy in the classroom. The environment has an important role as well. Students who believe they have a less malleable environment will consequently have lower levels of self-efficacy (Leithwood & Jantzi, 2008). Environment engulfs many things in the classroom including the teacher, the physical set-up, the materials, the community and many more aspects. All these items make up the student's attitude of and towards the classroom. The malleability of the environment can relate to the attitude of the students and ultimately their self-efficacy. This is because if they have less belief that they can change anything to do with the classroom they will have less belief they can change their own academics. If the student has a lower level of academics and does not believe they can alter the environment, they will have a static belief in their ability to change. This static attitude towards the environment can greatly hurt a student's self-efficacy.

Attitude can also be affected by tasks; meaningful tasks can also affect self-efficacy (Adami-Bunyard, 1998). Tasks in the world of education refers to the work, projects, papers, homework and so on that students take part in. Negative task attitudes can result due to boredom or irrelevancy, little or no life connection and having no feeling of responsibility in the tasks. As a teacher, it is important to realize tasks with these qualities can create lower levels of motivation and attitude for the student. Motivation levels and attitude then play a part in the student's belief of their ability to meet the goals, their self-efficacy. It is very obvious that self-efficacy has a lot of interlinking qualities in the world of education including attitudes, motivation, tasks and environment.

Self-Efficacy and School Work

Education is based around the teaching of curriculum and content. Educators continually strive to find the best methods possible to teach material so it is retained at the maximum level by students. Self-efficacy can play a major role in learning; that is why this paper discusses the connections. “Self-efficacy is a powerful predictor of future expectations, especially academic behaviors,” (Green, D., 2003, p. 108). If self-efficacy can be used as a prediction of academic behaviors, then it can be coined as a trait that possibly causes these academic behaviors. For both male and female students, it has been found that having higher levels of self-efficacy is correlated with higher levels of achievement scores when compared to achievement scores from students who report lower self-efficacy (Kenny-Benson, 2006). As a teacher, this can be seen as reasoning behind taking time to work on improving a student’s belief in themselves. Even if the scores do not rise, at least the student will have a higher level of self-belief.

Self-efficacy has been found to help many different areas of learning, which ultimately helps overall learning. For instance, the rate of performance is increased as students demonstrate higher levels of self-efficacy. This relationship is also true with skill acquisition, persistence, and expenditure of energy (Green, 2003). Improving all these areas will help improve a person’s academics as a whole. If a person is able to put more energy into his/her work, for example, then that person will find that they have higher levels of success in academics. I learned this first hand in Algebra I, finding as I put forth more energy into my homework, my quiz scores raised, and ultimately my self-efficacy too. Hagerty (1997) describes the connection further with the idea that “People with a stronger sense of self-efficacy will decide to approach a complex situation due to their

expectation of success,” (pg. 3). This all stems from the fact that the person had a higher level of self-efficacy, which gained a higher level of energy to put forward. In reality, because of the mastery experience source of self-efficacy, it works in a sort of circular growth manner. (Refer to figure three for an illustration.)

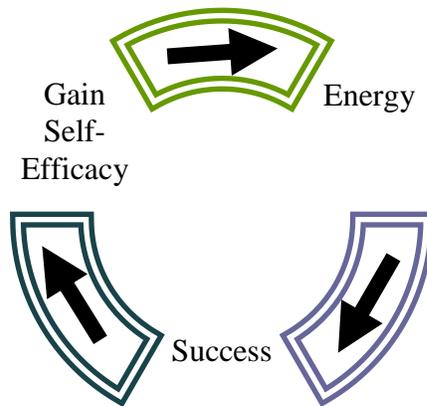


Figure Three

A person’s success, due to more energy in class, due to higher self-efficacy, will not only leave them with academic success but also a potential raise in self-efficacy. This is because the person sees themselves as successful and therefore gains more belief in oneself. This involves the mastery experience source of self-efficacy (refer to figure two for a reminder of the four sources.)

Wanting continual improvement in education, the self-efficacy and academic connection continues to be researched. Hagerty (1997) discusses a study involving using self-efficacy raising curriculum in schools. (The efficacy raising curriculum involved utilizing a series of tips and methods to pinpoint efficacy, you will find some of these tips used in the methods sections located in the second section of this paper.) He grouped schools together in to two groups. One group was labeled the “efficacy schools”, which used self-efficacy raising curriculum and the other schools were labeled “non-efficacy

schools” and used the same curriculum they had been using. The “efficacy schools” had a greater level of change in achievement than the “non-efficacy schools.” In fact the “efficacy schools” raised 9.1 points in mathematics while the “non-efficacy schools” improved 4.6 points. There was a 95% difference in the math improvement, suggesting that self-efficacy truly can help academics, specifically mathematics.

In 1997, Marsh & Yeung also found that student academic self concept had significant but casual effects on math achievement. This all relates to the idea that students with higher self-efficacy levels approach situations differently affecting their participation, standardized tests, course grades and continuation into higher level mathematics. A more recent concern is that it has been found that around middle school math problems become more complex and that is also when self-efficacy seems to decrease. This happens, of course, at different times depending on the individual but the trend is usually around the middle school age bracket. In fact, enthusiasm as a whole towards mathematics decreases for both genders during this time. According to Wimer, Ridenour, and Thomas (2001), a study of enthusiasm toward mathematics revealed the results shown in Table 1.

Age	Girls	Boys
Elementary	81%	84%
Adolescence	61%	72%
High School	15%	25%

Table 1: Percent of students reported enthusiasm towards math.

These numbers present some interesting thoughts. Why does female enthusiasm decrease so much faster than their male counterparts? What happens during adolescence that

results in the low level of high school enthusiasm for math? The answers could be something as simple as that as math problems get harder, the self-efficacy of the students decreases. Ultimately this causes a loss of success in these students.

Papanastasiou (2008) found that self-perception and belief in oneself is ranked third for having the greatest affect on success, only being beaten by transmission teaching and active learning. Proving that self-perception really is important to education, specifically math education. As mathematics teachers, self-efficacy therefore should be an important aspect to incorporate into the classroom with your student classroom population in mind of course. To fully understand self-efficacy it is beneficial to understand the ties and influences it has on other traits.

4. ADOLESCENT FEMALES

Self-efficacy supports academia especially in the realm of mathematics. Specifically, it would be very useful for female students. To understand why middle school female math students would be assisted, it is necessary to understand the female adolescent and the female math student. The female adolescent is a complex group that is slowly developing into adulthood. No female teenager is obviously the same; however, studies have identified general traits about this time of life and these generalities are what we will discuss.

For a female, and really any teen, the teenage years are time filled with pressure to act and behave like a “grown-up”. The truth is that teens are not grown-up; therefore they are being forced to act older. This means they are purely acting in life not being themselves (Apter, 2006). Females tend to hide their uncertainty and questions in life behind this created adult facade. Proceeding in this false created self throughout middle school, the females often start to become less honest with themselves and with others. Along with a decrease of honesty, comes a higher degree of self-consciousness and ultimately teenage females become more self-protective. Love and concern from role models to the middle school teenager often can be reciprocated with pure irritability from the teen. The irritability is based in the teens desire to be confident, self-sufficient and be a “grown-up”. Because teens are becoming more self-protective and self-conscious, hearing concern or even love can often make the teen feel like they are not living up to the standards they should be and irritability is how they protect themselves from critique.

All these pressures on the female teen, or in her mind, can lead to lower self-worth, higher anxiety and/or depression (Kenney-Benson, 2006). These traits often lead

to low self-efficacy and confidence. Middle school and college aged male and females were studied only to find this fact to be true; in fact males generally had higher levels of self-efficacy (Casey, Nuttall, & Pezeris, 2001). This is not a one time study result. In fact, it was found that boys had overall higher self-esteem and worth on a non-context instrument (Skaalvik, 2004). Non-context means the study was an overall rate of esteem instead of a directed specific esteem towards a task. Adolescence females are starting to realize how hard life is and feel pressured to grow up (when they are not grown-ups) creating lower self-efficacy, self-worth and self-esteem in them that often has long lasting affects.

As referenced earlier, motivation is closely related to self-efficacy because the more motivation, the better the student will do, the better the student does the higher level of self-efficacy. Although the efficacies in middle school genders are slightly varied, it is interesting to note that motivational levels are often very closely similar. This trend could be just unique to a specific school, district or region of the study. (An interesting side note is that western civilizations are more likely have closer levels of motivation in each gender affecting the differences in efficacy (Chen, 2007).)

Female middle school students often are focused on “fitting in.” Fitting in refers to their social grouping within the school. Peers become a key factor to their everyday life, including their decisions academically. As a female wants to act grown-up, their peers help form and shape their individualized idea of grown-up. Motivation in general becomes more peer-originated and less self-originated. Taking more outside advice for motivation depletes self-efficacy. If someone is ruling their life based on others, it is hard to have an idea of what they can personally achieve. Peers not only affect a female’s

motivation and reasoning behind decisions but also greatly affects actual achievement. If a peer group deems it “un-cool” to succeed academically in one or more subjects, it is often that a female will implant less self-efficacy in that subject. They will have a lower belief that they can succeed in the subject. This is due to the fact that they will create no motivation to have a positive high belief of success in the subject all because it was deemed “un-cool” (Apter, 2006).

All these discussions of the teenage middle school female have to be taken with an understanding that each individual is unique and these are just trends noticed in studies. The studies involving middle school females are not cut and dry simple because it involves a very complex web of factors to study. Overall, it is significant to recognize that the female pressure to act grown-up in the teenage years often creates lower levels of self-efficacy because the students are just acting older. The acting creates more self-consciousness increasing levels of peer reliance and therefore lower personal self-efficacy.

5. FEMALES IN ACADEMIA AND MATHEMATICS

The topic of females in mathematics is not a new one. Numerous studies have been conducted with the aim at discovering some aspect of this topic. One of the reasons this is researched is due to the fact that it has been found that although there are few gender differences in math achievement in the younger years, as students get older more gender differences present themselves. These differences usually revolve around problem solving and geometry (Casey, Nuttall, & Pezeris, 2001). As a society that strives for equality between sexes, studying this difference is extremely important to the math world. Why does the achievement gap in math between sexes grow as student's age? To answer this problem it is necessary to know what affects math performance.

Math Performance

Math performance is affected by both intakes and the environment. *Intakes* involve situations over which the teacher has no control. These are the items the student takes into the class on the first day including background, home library, and economic status (Moriyama, 2008). The background category is the widest ranged. Background refers to not only past math experiences but past experiences that have shaped the student's self-efficacy, motivation and determination to succeed. Background can also include family involvement. Overall, the background category refers to every situation the student has encountered up until the first day of class. After the first day of class, experiences out of class can still be referenced under background. No child who comes into a math class is a completely empty slate, but in fact they each have a wide variety of factors that already influence their math learning.

Environment also plays a key factor on math performance and is important to observe when studying any aspect of the differences in gender and mathematics, in this case self-efficacy. The classroom environment including the teacher, the climate, the class participation, the feelings towards math and the self-perception all affect learning. They all play a key part in self-efficacy too. If a student does not feel like they are in the right environment to learn they will find lower levels of beliefs in their abilities because they do not even believe the environment is right.

To find out how females are different in the world of mathematics the inputs and environment that affect specifically females need to be examined. It is found that the interaction between the archetypal adolescent female personality traits and the items that affect math performance is what creates the difference. It is not often claimed that male and female middle school students are being taught differently, but rather a females interaction with the environment is different or the females input and background is drastically different than those of males.

Testing Approaches

Long term goals in middle school often involve high school and/or even college dreams. Some middle school students even have long term career goals already at this age. These types of long term goals are often what can motivate a female student. They are looking for long term improvement for a long term reasons. This can be referred to as being mastery focused individuals (Kenney-Benson, 2006). On many one time objective tests it has been found that boys outperform girls. It is important to realize that females are actually not doing any worse in mathematics than males in the classroom, but rather show differences during these one time assessment tests. Male students are often more

competitive; they view these one time tests as a time to shine. Desiring to out-perform other males, often causes higher male success at one time tests. (One time tests can refer to state tests, specialty tests, SATs, PSATs, etc.) Since males and females approach school work very differently, it is easy to now see how the differences in the two genders outcomes can happen later in life.

Other than having different driving factors behind test taking, females and males differ slightly in personality background that affects test taking. As discussed earlier, females often try to act confident during the middle school years presenting itself in irritability when something gets tough (Apter, 2006). This causes a usually higher level of stress in unfamiliar testing situations for females. The high stress usually lowers self-efficacy in a female due to the self-efficacy source physiological/emotive (refer to Figure 2). Although males and females sometimes are found to have equal levels of self-efficacy at this time of life, the stress in a female during a testing situation can drastically alter their self-belief. Overall this stress and anxiety changes their self-efficacy and confidence which makes it difficult to focus and therefore males usually do better on these tests (Kenney-Benson, Pomerantz, Ryan, & Patrick, 2006). These females are trying to act like they do not care about the results and tend to build up an inside stress causing a difference in results. Their motivation style turns into learned helplessness. This is similar to my personal story; I sort of gave up, figuring the results of math did not really matter anymore.

The other difference in test taking is a background personality trait often found in many females. Generally, females have a higher level of risk aversion (Anderson, 2002). This means that females will often evade a risk instead of trying it out. Risks can refer to

tough mathematics problems specifically tough problems on one time assessments. Females simply do not guess as much as males on tests like the SATs. This could also be affecting the gender gap on achievement tests in mathematics. Risk aversion is not a trait seen purely in middle school females. In fact it was found that even high math achievers, both young and college aged women, have a clear aversion to risk taking (Anderson, 2002). This involves the complexity dimension of self-efficacy (refer to Figure 1).

Confidence decrease and aversion to risk taking all impact the self-efficacy. These females are displaying lower beliefs in themselves and their ability to solve a problem. It is possible that with a heightened self-efficacy that these females could work over their backgrounds which formed risk aversion and test anxiety.

Societal Thoughts

Social and biological factors play a key part into a developing child's education, especially middle school females who are at peak awareness of societal pressures. In fact, as students grow older they become more and more aware of society and often start to develop societal thoughts. Lower confidence in females in mathematics has a great deal to do with socialization. The gap in male and female achievement in mathematics rises as students grow older and females become more aware and influenced by societies thoughts.

As the female middle school students adapt to images created by society they fight to hide their true self. In fact, a girl views voices of society as authority figures. They then trust they will feel secure if they take the role society believes they should fill, instead of their own. At this age teens and pre-teens often take the role of a "savvy teen" or a "sexual pre-woman" (Apter, 2006). Boys often take their male society image at age

four before starting education. Therefore, this does not change anything academically for males. However, the female change happens in the teens and therefore if the teen views the societal female image as un-mathematically bound, they will believe the same for themselves. Essentially, in the teen years “Girls feel pressure to conform to ideals of sophistication and maturity that they know they cannot really meet” (Apter, 2006, p.43).

Females see these grown-up women as less mathematically focused because of simple stereotypes created by society. These often lead teens to believe that certain academic domains are gender specific including math. This idea can change a student’s emotion, intellect, physicality and social domain towards a subject (Apter, 2006). When a female believes that males are better at mathematics, they can emotionally attach to that idea ultimately lowering their self-efficacy through the source of vicarious experience (refer to Figure 2). The confidence and self-efficacy differences in male and female students towards math could revolve around the idea that females do not want to break the status quo. So in order to believe society’s status quo the females start believing and acting in that belief. “Thus, it is important for teachers to recognize and understand that preconceived attitudes and expectations about boys and girls are likely to have an effect on children particularly in their mathematics classrooms” (Wimer, Ridenour, & Thomas, 2001, pg. 86).

Not only do female teens take on the societal image of a low achieving female in math, the pressure of just knowing the stereotype can alter the assessment. For instance, many females do not try to necessarily fit the stereotype exactly but they are aware of the stereotype (Hayman and Legare, 2004). Awareness can cause high anxiety in a testing situation, where females already have higher levels of anxiety in comparison to males.

The anxiety springs from the knowledge that the stereotype is alive and then females start to wonder whether it is true.

When discussing societal imaging it is important to realize how images can affect a student. There is a major difference between public representations and mental representations. The public representations are how society illustrates groups, in this case how society illustrates females in mathematics. Individuals then view this public representation and create their own mental representation of the group. So in this case after the female middle school students view societal images of females in mathematics, they create their own view of where females fall in mathematics. Their own view often is similar or related to the public representation. These mental representations have been proved to be understood in children as early as elementary school. These students perceive gender competencies for men and women regarding careers and academic domains (Heyman, & Legare, 2004). These mental representations can really affect middle school students as they have a heightened awareness for peer grouping and social settings. Middle school students have less desire to stray from the peer ideas, in this the society's ideas. This idea is similar to the self-efficacy source of vicarious experience, where a person gains (or loses) a trait due to simply observing others.

Societal imaging probably is a key to differences in efficacy between genders. Being told or showed by society that your gender is not as successful at a subject can easily transform into personal self beliefs. Females often start believing this. The idea can then lower test scores which in result will lower a student's self-efficacy. The lowering of self-efficacy and test scores acts in a continuous circle type system. The lowering of self-efficacy will then create lower test scores which will once again lower self-efficacy.

Spatial Imaging

Before pinning all the mathematical differences in gender to society, testing differences and self-efficacy it is important to mention that other factors that have nothing to do with self belief could have a hand in the divergence. One of the leading ideas involves spatial imaging or representation differences. As boys grow up they spend time playing with Lego's, Lincoln logs, and tinker toys. All these toys involve building and forming objects. Building and forming helps support spatial imaging. In mathematics spatial imaging becomes very important in geometry and other mathematical areas. By having more exposure to these areas, boys often find spatial imaging easier and are able to mentally picture items without manipulatives with grater ease. This mental picture technique can then carry over throughout the math domains. Females do not have the same opportunities from birth. In fact, many girls play with dolls, Barbie's, pre-built doll houses and kitchens. These toys involve less mental thoughts involving spatial imaging potentially setting up females for less success in math. Yes, females need help increasing their self-efficacy in math because of confidence and stereotypes but spatial imaging support, and other techniques could also help decrease any small gap there might be.

6. SO.....WHY DO FEMALES NEED SELF-EFFICACY IN MATH?

Although there is not a major gap between male and female success in mathematics there is always room for female improvement (Refer to Figure 4). Females are succeeding usually equally or above males in the classroom, however males often outshine females on assessments. This can be related to the high anxiety caused by female self-doubt during one time assessment situations. Females strive for long term goals and then become more stressed and less focused on one time assessments. The anxiety and stress could result from middle school female's low levels of self-confidence and high levels of confidence in which society deems they should be. Females then pretend to be someone else and if the public representations of who they should be is not good at math, then they will have less self-efficacy towards math. Less self-efficacy then creates lower test scores. (These relationships are all supported in the above sections.)

Females often are found to have lower levels of self-efficacy than males especially during the middle school years. Imagine how well females could do if they had high levels of self-efficacy towards math. It is not needed to compare the females to males at this point, but instead realize that self-efficacy does affect academics and females have lower levels of self-efficacy. As teachers, it is our job to inspire and teach to the best of our ability. If teachers could improve female academics by improving and supporting self-efficacy then they should. It is not because of the gap between male and female mathematics because there really is not much difference, but because it is important to allow students to be the best they can be. The next section of this paper goes through nine different techniques that teachers can use in order to support that self-efficacy in the classrooms. Although this paper is focused on why it is important to

increase the female self-efficacy in the classroom, many of the techniques mentioned will eventually help both male and female self-efficacy.

METHODS TO RAISE SELF-EFFICACY IN FEMALES
IN THE MIDDLE SCHOOL MATH CLASSROOM

“Rather than only concentrating on changing the textbook or the approach, perhaps there are more significant and subtle factors inherent in the attitudes of students themselves that must be more seriously investigated and taken into account”
(Tapia, M., & Marsh, G., 2001, p. 16)

1. INTRODUCTION TO METHODS

In the classroom it is necessary to do more than just talk about the issues at hand but rather implement strategies for change; action is how change is created. If female middle school math students could use more self-efficacy in order to increase test scores and their math achievement levels as they age, then it is necessary to give them opportunities to raise their self-efficacy. Teachers have the perfect opportunities to do this and can incorporate many methods into lessons to expose a student to the four sources of self-efficacy: (1) mastery experience, (2) vicarious experience, (3) verbal persuasion and (4) physiological/emotive state (Hagerty, 1997). With the exposure to these sources students can have the opportunity to raise their self-efficacy affecting their math achievement. This section explains nine techniques for classroom use. Many of the techniques utilize many sources of self-efficacy. However the techniques are categorized by the prominent sources involved in the technique. The techniques are split into four sections based on the most prominent source of self-efficacy. (For a review of self-efficacy sources refer to Figure 2)

MASTERY EXPERIENCE TECHNIQUES

GOAL SETTING

Goal setting is often discussed in many aspects of the world including education. However, to make goal setting successful it needs to be implemented correctly. With correct goal setting students will be able to see their responsibility in achievements increasing their self-desire to work harder. When a student understands that hard work leads to success, they will coincidentally increase their self-efficacy, believing in themselves when a tough problem comes their way, just like I learned to do in eighth grade Algebra. They will understand that if they work hard they can solve the problem. Thus, it is important to implement successful student goal setting.

The first step, as a teacher, to creating a successful in-class goal setting process is to set specific overall course goals. These should be set before the beginning of the class. Aside from course goals, it can be useful as a teacher to create unit goals as well. These goals should be clearly explained to students in order to have transparency between the teacher and student. While creating course and unit goals the teacher should remember four things: be specific, be challenging, be valuable and be within perception (Ponton, 2002). Course goals are a key component because they involve a base for student goals within the course.

Goal setting needs to be consistent and not a one time referenced object. Caporrimo (1990) wrote that Bandura, the father of self-efficacy, believed goal setting incorporated three parts: self-observing, judging and self-reaction. At the beginning of the unit (and/or year) the teacher should assist in helping set reasonable goals for each student. These should be individualized and relate directly to the student. Goals should

include a combination of performance and outcome goals but focus more on the performance goals in order to increase self-efficacy. Performance goals involve things like “I will study 3 hours before a test”, “I will review my notes daily”, “I will do homework daily” or anything regarding to the work. Outcome goals refer to exactly that, the outcomes. These goals include things like “I will get an A”, or “I will get at least a B on all my homework.” It is important to focus on performance goals in order to relate the idea of working hard. If the student focuses too much on the outcome and does not reach the outcome they will in result lower their self-esteem. My eighth grade math teacher understood this and tried to get us thinking of the performance. This seems to be the reason he would ask how long our homework took. Encouraging us to spend and longer time on homework, encouraged us to work harder in order to achieve success.

Regulating goals is a key to the process. There are many methods to self-observe goals. In a mathematics classroom one successful (math related) method is graphing. Depending on the age and capability level of students there are a variety of graphs that can be successful. A student can graph their progress and achievement as well as their effort. Graphing effort can be graphing the amount of time spent on an assignment. Effort could also be self-rated by a student on a class created 1-10 scale. For instance, the student could rate how hard on a scale of 1-10 they tried on an assignment before turning it in. The teacher’s job in this process is to grade and return assignments in a timely manner. Once the student gets the assignment back, they can compare the effort and end result. Generally, the student will see that the higher level of work, the higher the outcome. In a more advanced math class the student can graph effort and achievement on the same graph or correlate the two data points. The goal of this activity is for students to

see that with harder work they can achieve higher levels of success. This success will eventually correlate into self-efficacy due to the mastery experience source.

After self-observing progress the next key step to goal setting is *judging*. The student can observe their progress of performance and outcome goals, judging what needs to be altered to meet those goals. For instance, maybe a student will judge that they are not progressing towards their personal outcome goal. They then can decide that they need to morph their performance goal in order to successfully meet the desired outcome. As a teacher, it is okay to assist students in observing and judging where the students could morph their goals.

The final part of the process is *self-reflection*. This can be accomplished in a multitude of ways. A common way to accomplish this part of the process is journaling. Giving self-reflection time can be very useful. Outside of journaling, self-reflection can be accomplished in one on one conferencing with the teacher. The teacher should try to ask open ended questioning during this time in order to truly create self reflection time and questions. Zimmerman (1986) showed that self-regulation is truly a predictor of success because good problem solvers are more aware of their own thinking. Self-regulation grows from goal setting, as students learn how to gauge and regulate their own academic achievements. Teachers should continually point out student's improved success in order to increase their self-efficacy. Pointing out success will improve self-efficacy due to the sources of mastery experience and verbal persuasion. The mastery source comes from the success when the students realize that performance goals affect outcome goals. The verbal persuasion source involves the student's conversation with the teacher as the teacher encourages the whole goal setting and reaching process. Figure 5 is

a sample graphic organizer that can be used for goal setting in the classroom. Figure 6 is an example of the organizer filled out.

<i>Goal Setting</i>			
<i>Name:</i>			
<i>Teacher's Unit Goal:</i>			
<i>My Outcome Unit Goal:</i>			
<i>My Performance Unit Goal:</i>			
<i>Relationship between outcome and performance goal:</i>			
<i>Assignment Tracking</i>			
<i>Assignment Name</i>	<i>1-10 Effort</i>	<i>Grade Prediction</i>	<i>Actual Grade</i>
<i>Self-Reflection of My Goals:</i> <i>How well did I do? Why did I do this well? How can I alter my goals for the next unit?</i>			

Figure 5. Sample Goal Setting Graphic Organizer

Goal Setting			
Name: Student A			
Teacher's Unit Goal: To show 75% or above understanding on combining like terms			
My Outcome Unit Goal: To show a 85% understanding on like terms			
My Performance Unit Goal: To finish all work related to this concept (Class work and Homework)			
Relationship between outcome and performance goal: If I work to complete all my assignments I will have a better understanding on the concept of combining like terms. This will hopefully allow me to do better on my outcome goal of receiving 85% on the unit test on combining like terms. I usually do not do my homework and usually get C's.			
Assignment Tracking			
Assignment Name	1-10 Effort	Grade Prediction	Actual Grade
HW: Basic Combo	10	B+	A -----GO ME!
Warm-Up Basics	5 – Friends Distract	C	C
HW: Two Terms	9	B	B+
Warm-Up Two Terms	10- Moved Seats	A	A
Quiz 1: Combining	10	A	B
Class: Distributing	8	B-	B+
HW: Distribute and Combine	9	B	A
Unit Test	10	B	B+
Self-Reflection of My Goals: How well did I do? Why did I do this well? How can I alter my goals for the next unit? I learned a lot about me. If I try harder I get better grades. Who I sit by can alter my outcome and effort. So I need to make sure I am surrounded by people I can put more effort in my work when I am around. When I put more effort in, I am more successful. I met my outcome of above an 85%! I am going to try this next unit as well but make my performance to always have above an 8 on the effort scale.			

Figure 6: Sample Completed Graphic Organizer

STRATEGIES

As most individuals in the world are aware of, every person learns differently and also is unique in their thought process. For instance, some learners are more audio based and can greatly succeed in a lecture type environment, while some kinesthetic learners relay on doing the task to learn. The classroom needs to reflect these diverse differences in order to allow everyone to believe that they can do it. The teacher should not only teach with a variety of methods reaching audio, visual and kinesthetic learners but should also present a variety of strategies for solving problems (Allen, 1995). This method is especially useful in the domain of mathematics to gain self-efficacy. When students are not comfortable with the method used to solve a math problem they will in turn have higher levels of personal belief that they can accomplish the task.

By providing multiple solution strategies to a problem, teachers can very simply help increase self-efficacy in the classroom. The most difficult part of this method is finding, creating and teaching multiple methods to solve a problem. Often teachers of mathematics have grown accustomed to one method of solving a certain problem; so that is the method they teach students. However, teachers need to make an effort to provide the wider range of methods because it is a teacher's job to provide equal success for all students. As students find a strategy they are comfortable with they will find a strategy they can succeed with. The success will cause a gain of self-efficacy due to the source of mastery experience.

It is hard for students to have a belief they can accomplish the problem if they do not receive access to the solution strategy that fits them as a learner. In eighth grade, I believe my teacher approached this by letting the students sometimes explain their

solution paths. Every student viewed problems differently, so by allowing multiple students to explain their understanding more students could see the method that worked for them. This increased success, increasing self-efficacy. A good text to use for reference for multiple strategies and methods to differentiate instruction is *Fulfilling the Promise of the Differentiated Classroom: Strategies and Tools for Responsive Teaching* written by Carol Ann Tomlinson.

MOTIVATION

As discussed earlier, motivation has many ties with self-efficacy. When students are more motivated to accomplish and complete their work, they will work harder. The harder students work the better they will do, the better a student does, and the higher level of belief they will have in their ability to solve a problem. Ponton (2002) describes the relationship: “We are less motivated to engage in activities that we feel ourselves incapable of performing successfully” (p. 54). Discussing increasing motivation as a technique involves the strongest source of mastery experience. This is due to motivation increasing success rates and therefore increasing self-efficacy through mastery experience.

In order to build self-efficacy in the students, the motivation in a classroom has to include both extrinsic and intrinsic (Adami-Bunyard, 1998). Extrinsic motivation strategies can be clearly seen in most traditional classrooms including grades, punishments, rewards and other things of the sort. Creating intrinsic motivation is more difficult to see and measure; therefore making it harder to include in the classroom. One method to do this is including the class in the decision making process. For example, imagine a two-sided worksheet the class needs to complete for homework in the next two

days. The teacher can lay the decision of how to complete the assignment in the student's hands. The students could choose to do side a the first night and side b the second, all odd numbers the first night and even numbers the second night or any other creative combination. Leaving the decision in the class' hands will help make them believe that they can complete the assignment because they helped develop it. This belief in ability to complete an assignment can also be referred to as self-efficacy.

Another key method to adding intrinsic motivation in the classroom is promoting and maintaining interest in the lesson and unit (Adami-Bunyard, 1998). When students find significance in the curriculum and corresponding assignment they will find more motivation to complete the assignment and have more belief that they can. Building interest can be very simplistic; for instance when creating homework or story problems for the class, connect the problems to student's life and/or interests. In order to increase female's efficacy, teachers should try to go beyond sports analogies. Although these can be the most simple to create (i.e. find the area of the basketball court), there needs to be a wide variety of problems. This will help legitimize the idea that the public representation of male dominance in mathematics is false. Think of the diversity of subjects that can be incorporated into a math problem: movies, TV shows, the arts, recipes, pop stars, shopping, etc.

Motivation to succeed in mathematics will help individuals achieve at higher levels and then ultimately help increase their math self-efficacy and attitude towards the subject. This involves the mastery experience source of self-efficacy increase due to the raise in success. In a classroom setting, motivation can also cause the vicarious experience source of efficacy, as students observe others succeeding due to motivation.

These heighten levels will only help the student achieve higher levels of achievement in the future. Unfortunately, Tapia, & Marsh, (2001) explain that the development of motivation needs to be consistent over a series of years and not just an isolated year in order to affect a student's self-efficacy and attitude towards math. Often students will not have access to teachers who will provide this opportunity for more then one year at a time. Districts and schools should take initiative to add continual support and motivation to students throughout the tough middle school years especially.

Example problem that can be morphed to meet a student's interest:

Trisha went shopping for (*fill in item of interest for student*). She bought the item for \$(*fill in reasonable price*). At the same shopping trip her dad asked her to buy 2 gallons of milk. She spent \$(*fill in reasonable price*) total. Her dad wants to know how much each gallon of milk was. How would Trisha find this out? And what is the cost of the milk?

VICARIOUS EXPERIENCE TECHNIQUES

EXPOSURE TO SUCCESS

Females can have low sense of self-efficacy in mathematics due to public representations of males being more dominant in the subject, as discussed in section one. It only makes sense that in order to increase efficacy it would work to prove the public representation wrong. That way the female students will not create false mental representations. One way to do this is to introduce successful females in mathematics to the class (Halpern, 2007). With this the females can increase their efficacy through the vicarious experience source. This can be incorporated with biographical readings, current news and/or reading about women in math related careers. These activities can be extensions to a lesson. For instance, if the lesson was about solving equations it could be accompanied by reading and responding to an article about a famous women who somehow utilizes solving equations in her career or who made herself famous by solving a complicated equation. These articles will probably often revolve around science as well as math but that is still beneficial to the females. Not only does it support mathematics but it also relates and shows the relationships between the subjects.

Other than reading about famous women, you could prove the public representation false by incorporating long term female interest in careers that are math related. This could be architecture, business, economics, and a variety of other fields. These careers can be implemented into the lesson very simplistically and also more complexly. On a simple level, story problems can be based around careers and females using math. On a more complex level, students can be prompted to research careers that are math related even finding famous females and males in these careers. With the

research, project based learning groups can be created in order to also learn math and research. Empowering females with the belief that they are the same as the males in the math domain will raise their personal self-efficacy. This is through the vicarious experience source because it is based in improving one's self-efficacy by observing other people succeeding. Do your students know Marie Curie? I bet she used some math in the process of winning two Nobel peace prizes.

MENTORING

A common method to increase self belief of ability is mentoring (Adami-Bunyard, 1998). Mentoring can refer to many different arrangements including cross age group, cross city, or cross class mentoring. When students have someone mentoring them they will increase their personal belief that they can do it. For instance if there is a sixth grade female who demonstrates low signs of self-efficacy in mathematics, try pairing her up with a eighth grade female who demonstrates high levels of efficacy. It is best if the two students come from the same background or at least similar backgrounds. Basically it is best if the students can connect easily in order to achieve the most out of the mentoring situation. The sixth grader then can be encouraged that she has the ability to succeed with hard work by a peer, which is occasionally more successful then being encouraged by an authority figure. Self-efficacy increasing from mentoring primarily revolves around the idea of vicarious experience as a source of efficacy.

In today's traditional classroom, and in society, mentoring is often seen. For instance, many schools have big buddy programs. These are where different classrooms pair up for activities. Many schools utilize this time for friendships across the grade levels and often do arts and crafts or games. This time could greatly affect math due to

the influences mentoring has on self-efficacy. Mentoring is often seen in many after-school programs including such like Boys and Girls Club. Overall, reading and writing is more commonly seen involved with mentoring and it would be interesting and beneficial to expand this to math as well to increase the math self-efficacy. The great part about mentoring is that anyone can use a mentor and be a mentor.

VERBAL PERSUASION TECHNIQUES

PRACTICE NOT NATURAL

Often you hear teachers and parents supporting their students by giving positive feedback. This can be things like “good work”, “you’re a natural”, or “you are just so good at that.” This language can be referred to as a “diet of success” (Apter, 2006). In reality, these types of comments can sometimes hurt a child’s long term development, especially in the realm of self-efficacy. Self-efficacy is the belief of ability to solve a problem. If a student hears over and over that they are natural at something they will start to apply the idea about succeeding from being a natural to other areas of their life. This is ultimately limiting intellectual growth especially when problems become complex. If students think math success is from being a natural, then they will lose self-efficacy in themselves as soon as they fail once. One fail might leave them to believe they aren’t a natural and lower their self-efficacy. However, this idea is not saying that teachers and parents should not praise students, because they should. Praise just needs to be done correctly.

Instead teachers and parents need to support the idea that succeeding in math, like other things, comes with practice (Hagerty, 1997). For instance, one could bring up sports analogies in order to explain this concept to students. Just like football in order to throw a good pass you have to practice throwing, when solving equations you have to practice solving to solve it successfully. Make sure to not only include sports analogies but also art, dance, theatre, music and other areas to reach all the students in the class. If you have culturally diverse students, brainstorm analogies that would hit home with them too. My teacher in eighth grade used this idea of praising effort and hard work; it actually worked

on me too! After hearing that hard work brought success over and over, I decided to actually spend a little bit more time and practice on my homework. Surprise, I ended up succeeding and he remembered to point out that my success was due to my practice.

Installing this idea that math takes practice and is not natural is not a one time thing. It is necessary to continually bring the idea into the classroom. This could also be done by showing science research showing the brain is expandable and continues to make new connections. By showing students this, they can see that the phrase “you’re a natural” makes no sense because with practice the brain makes new connections everyday. Basically, you are telling students that hard work makes the mind work harder. This can not be a one time discussion either. Constantly point out during new lessons the new connections formed in the brain. Understanding that succeeding takes practice, allows students to see that they can succeed if they put in the practice time. If the student then chooses to put in the practice he/she will have a heightened belief of self-efficacy because they believe that hard work leads to success. The increased self-efficacy will come from the source of verbal persuasion because the teacher (and/parent) is verbally telling the student that they can succeed with practice. That hard work and increased efficacy will help increase test scores starting the continuum of success and higher self-efficacy which also will involve mastery experience source of self-efficacy.

As far as females are concerned, their self-efficacy is mainly lowered in math because of stereotypes and one time assessment anxiety (Allen, 1995). As for stereotypes it is important to build the belief that stereotypes, just like everything else, are malleable. Talk about what stereotypes females have and what stereotypes males have. It is not necessary to bring up the idea of math stereotypes revolving around male success because

it is possible that some students have not had this public representation placed into them yet and do not need it. Then explain that these stereotypes do not have to be followed, anyone can be successful at any of these things because all it takes is practice, and nothing is natural ability based. Once again, this all involves the verbal persuasion source of efficacy because students are hearing the self belief. With standardized tests the same aim can be taken. Explain to students that whatever the result of the test is, it can be changed. The students practice and determination is what causes the success, nothing else. After understanding that the student, as an individual, causes the success, she will have a greater belief in practicing and therefore a larger confidence in her ability to achieve success after practice. This is a verbal persuasion source of self-efficacy that can lead to mastery experience that causes even more heightened levels of efficacy.

COMMUNICATION FROM TEACHER

Any basic lesson in communication would teach that there is so much more to communicating besides words. A teacher can communicate a wide variety of things with his/her communication style or method. Self-efficacy is one of the many things that can be communicated to students through the teacher. It is important to use supportive self-efficacy communication strategies in the classroom. The communication style changes perceptions the students have on academics. Looking back to my personal schooling, I feel I had the privilege of working with many teachers who understood how to communicate personal self-efficacy. I have been honored to have had these opportunities for the verbal persuasion source of self-efficacy through my teachers, like my eighth grade Algebra teacher. As a future teacher, I want to provide these opportunities to my students.

Gender equality is significant in regards to communication and self-efficacy. This is because if the females students sense that the teacher favors the male math students they could potentially lower their personal math self belief. If this is communicated it also could legitimize the public representation of male dominance in mathematics, also lowering a female's math self-efficacy. As teachers and future teachers it is necessary to attempt to avoid instances that potentially could lower a student's self-efficacy. One way for a teacher to self check on equality of communication is by simply observing their own teaching (Allen, 1995). This could be done by videotaping and watching the class later or by asking a non-biased observer to tally a set of questions during a live lesson. There are many things lessons should be observed for: calling on males and females equally, the amount of time helping each gender, what gender is asking more questions, do both genders seem comfortable, are sarcastic comments being followed by inquiring students, is your math voice masculine and are the genders receiving equal higher order questioning?

Most of these things are simple to understand why it is important to observe in a classroom in order to be communicating equality. In 1985, there was a study done by Klein who proved statistically that teachers often ask math based questions in a more male influenced voice (Wimer, 2001). This can communicate the idea to students that math is more male based, supporting the public representation of math. This should be avoided; the only way to observe this is to simply watch teaching and if seen consciously avoid it. There are also strategies to help assist the teacher in randomly asking questions such as random name generators.

Higher order thinking is equally as important to recognize. High level thinking involves complex thoughts, like explain the why or how verbally in a math problem. This high level questioning can lead to high level thinking in a student overall (Wimer, 2001). It is important to ask both genders an equal amount of higher level questioning in the classroom in order to communicate equality. Some education philosophers believe that public representations make teachers call on boys more often to answer higher order questions when no one volunteers. After becoming aware on the communication of equality style, one can consciously make an effort to change, then in a month or so it would be beneficial to go through the process again to track progress.

Not only does the amount of communication affect the overall class self-efficacy but also the communication format can aid the growth of self-belief. The figure below labeled “Table 1” is adopted from Denise Green’s *Self-Efficacy; A Communication Model for the Development of Self-Efficacy in the Classroom*.

<u>Table 1: Communication Styles and Self-Efficacy</u>			
<u>Communication Style</u>	<u>Presentation of Information</u>	<u>Learning Method</u>	<u>Self-Efficacy</u>
<u>1. Teacher Prescriptive</u>	<ul style="list-style-type: none"> Lecture format, closed syllabus 	<ul style="list-style-type: none"> Passive note taking Minimal feedback Negative reinforcement 	<ul style="list-style-type: none"> External/ Forced
<u>2. Teacher Manipulative</u>	<ul style="list-style-type: none"> Lecture format, Closed syllabus Suggestive teaching, Pop questions Pop quizzes 	<ul style="list-style-type: none"> Passive note taking Minimal modeling behavior Negative reinforcement 	<ul style="list-style-type: none"> External/Forced Minimal Internalization of modeled behavior
<u>3. Teacher Parental</u>	<ul style="list-style-type: none"> Lecture/discussing format, Student-peer teaching Some choices on learning material and work 	<ul style="list-style-type: none"> Minimal passive learning Active group and individual learning Frequent feedback 	<ul style="list-style-type: none"> Internalized Self-goal setting behavior
<u>4. Teacher Empowerment</u>	<ul style="list-style-type: none"> Active/shared teaching discussing format Student/peer teaching Negotiation on learning material and work load 	<ul style="list-style-type: none"> Active group/ individual learning Mentoring Independent study Timely feedback 	<ul style="list-style-type: none"> Fully internalized Self-directing Individual self-monitoring Goal-setting

The chart describes four teaching styles including teacher perspective, teacher manipulative, teacher parental, and teacher empowerment. The second column describes how a teacher communicates in each of these methods and the third column explains the actions of students. The most pertinent column is located on the far right and discusses the type of self-efficacy developed with that communication style from the teacher. As you can see, to develop the greatest and highest levels of efficacy Teacher Empowerment would be the best route. Green though would express the ideas of switching styles in order to optimize development. Switching styles would mean using multiple styles in the course of a class throughout the year. This would allow all types of learners to succeed. A teacher can chose to mainly utilize one style and briefly touch on other styles randomly during the year. “Matching curriculum style with curriculum content may be one way of optimizing student development of self-efficacy and learning” (Green, 2003, p. 111). Therefore, it is important to familiarize oneself with each communication method. Specifically Papanastasiou (2008) discusses how the teaching method (communication style) does have a great deal to do with mathematical achievement. This communication chart applies across academic domains but does have a place in mathematic achievement. By improving and matching communication styles a teacher can improve class self-efficacy and attitudes through the source of verbal persuasion.

PHYSIOLOGICAL/EMOTIVE STATE TECHNIQUES

POSITIVE MOOD INDUCTION

A positive mood has been found to alter a student’s performance in many ways. In a study published in 1991, by Bryan & Bryan, it was found that positive moods do affect self-efficacy specifically. The study was done with students with disabilities in all

different math achievement levels in junior and senior high. The diversity of levels and disabilities within the study allows the study to expand and suggest that positive moods can help self-efficacy in math in junior and senior high students. When people are in happy states of mind they often are found to believe more in themselves (Bryan, 1991).

To establish positive moods in students there are many routes to take involving visual, mental, and written methods. The easiest positive mood induction to lead is mental. Have the students close their eyes, be quiet and relax in their own thoughts. Sometimes turning off the lights can allow students to reach a deeper mental positive mood. From here, there are two routes that teachers can take to create positive moods. The students can either be prompted to think about happy moments in their past or prompted to imagine possible happy moments in their future. These can be funny moments, celebration moments or just moments of happiness due to peace.

When speaking to students have them try to imagine these happy moments with all five senses. What does the moment look like? Smell like? Sound Like? Taste Like? And Feel Like? For most students you will need to explain taste and feeling moments. Does the ground feel hard or soft against your feet? Is the air dry, heavy or moist? Is it raining or can you feel the sun beating on your skin? These are just some questions the teachers can prompt students to think about in order to reach a full happy moment. When the teacher prompts the student to open up their eyes they can either start the lesson, test or assignment or continue the positive mood exercises. Students can be prompted to write down their mental happy moment or share it with a partner. If you plan to have students share, be aware to put the disclaimer on the exercise before your start for students to think of happy moments they are comfortable sharing.

For visual representation positive mood induction there are a few different activities that can be done. One idea is to have students bring in a picture that sparks a happy memory. They can store this picture in the classroom. Before tests, assignments or lessons have the students pull out the picture and tell them to recall the memory. This picture could be a real picture or a picture from a magazine. With magazines students could also create collages of things that make happy memories. These collages could also be stored in the classroom in order to have something on hand to pull out and install happy positive thoughts before a challenging task.

Written positive mood induction can be related to both visual and mental or completely separate. Students could create a list of happy memories (once again funny, celebration, relaxation, etc) or could simply be prompted to write a journal about one. The list can be pulled out and reviewed before any project in the classroom. Written induction can also be an activity that works in conjunction with a mental or visual positive mood induction.

This method can be used in any academic area and is proven to actually help raise levels of self-efficacy (Bryan, 1991). Positive mood induction is like adrenaline for the mind. This method can affect both broad and specific versions of self-efficacy. The source of efficacy in this method is mainly physiological/emotive state. Mastery experience, vicarious experience and verbal persuasion sources could also come into affect depending on the source of the positive mood. For instance, a student could choose to remember a moment of success. Overall, the technique supports a higher level of self belief in one's ability to solve a problem. A side benefit from positive mood induction is that students have also been found to have an enhanced level of material recall. So by

incorporating this method into the classroom students will have a higher belief in themselves and recall learned information at a higher rate.

CLASSROOM ENVIRONMENT

The classroom environment has been mentioned to have an affect on self-efficacy throughout this paper. It does have a real role in a students self belief, so it is an important method to install in order to increase efficacy and increase achievement levels in females. Females often are less confident and a threatening classroom setting will only frighten them and decrease their self-belief. The goal of this method is to transform the class into a place where these self-conscious middle school females realize it is okay to ask questions, succeed and practice mathematics (Adami-Bunyard, 1991). This idea combines and utilizes many, if not all, sources of self-efficacy including verbal persuasion, physiological/emotive state, mastery experience and vicarious experience efficacy. Because the technique revolves mainly around feeling good and comfortable in the setting the primary source involved is physiological/emotive state. This method is most important to start off supporting day one of the school year and will be most easily completed then. It will be more difficult to create a non-threatening classroom environment after the class has already has developed its background.

Having students work and communicate in groups will lower the fear of talking in front of the class and can be key to creating this atmosphere. My eighth grade teacher fully understood this concept and utilized different groupings everyday in the classroom to make us feel comfortable with the setting and everybody in the setting. When students do participate and are on task the teacher should continue to encourage this behavior.

Ignoring poor effort will cause students to work harder to be recognized by the teacher by good work instead (Adami-Bunyard, 1991).

Developing a classroom set of rules regarding acknowledging everyone's effort positively will help students not fear rejection and ridicule from peers. If the classroom has overly self-conscious females, simple rules, encouragement and peer work will not always be enough to create a non-threatening unified classroom. With these students sometimes giving quiet time to self-reflect on questions, then discussing with peers, all before discussing with the class will help individuals to have more belief in themselves and their answers. Eventually, this will install belief and encouragement from the teacher will help create this non-threatening atmosphere.

In mathematics especially, it is useful to ask students more open ended type questions. With these questions there is a wider range of answers possible then compared to one word answered questions. Answering open ended questions less risky and feeling like they can answer these will help increase their personal belief in their ability to solve problems (self-efficacy). Class climate is not only developed by the students. In fact a knowledgeable teacher knows and makes use of the idea that "class climate can be changed through appropriate instructional practices" (Papanastasiou, 2008, p. 29). Basically, with the correct environment the student will have the right emotive state to gain self-efficacy.

CONCLUSION:

Coined by Albert Bandura, self-efficacy is a complex term that means ones belief that he/she can complete the task at hand. Three dimensions of self-efficacy can be examined: strength, complexity and generality. These all determine the amount of self-

efficacy a person possesses. Self-efficacy can be gained, or lost, by four different sources. The four sources of mastery experience, vicarious experience, verbal persuasion and physiological/emotive state all are separate sources but often one technique to increase self-efficacy will involve multiple sources. Motivation and attitude are different than self-efficacy but have many ties and overlapping qualities to self-efficacy. So it is important to understand how motivation, attitude and self-efficacy all affect education.

Self-efficacy has been found to affect school work. It works on a sort of circle continuum because as a student succeeds he/she will gain self-efficacy, the gain in self-efficacy increases the energy the student will put forward. Energy put forward by a student only allows further room for success. The adolescent female faces pressures of conformity as they gain heightened levels of awareness of public representations. A female adolescent strives to fit into society. Therefore, they are found to have lower levels of math self-efficacy because of the fact they pretend to be confident and take on societal imaging.

Females and males are achieving similar levels of success in the classroom. The combination of the facts that females tend to focus on long term goals instead of one time assessments and females have lower self-efficacy stands behind the reasoning of lower one time assessment scores in math for females. So, in order to increase female success it is beneficial to increase self-efficacy in the classroom. There are many successful methods to do this that teachers can implement. This paper discussed the implementation, purpose and sources of self-efficacy for nine following techniques:

- 1) Goal Setting
- 2) Multiple Strategies
- 3) Motivation

- 4) Exposure to Success
- 5) Mentoring
- 6) Practice Not Natural
- 7) Communication Style
- 8) Positive Mood Induction
- 9) Classroom Environment

A teacher needs to remember that although they can influence self-efficacy the classroom is not the only place that shapes and forms self-efficacy. Home, friends, extracurricular activities and many other factors all affect a student's self-efficacy. So although these methods should be implemented in the classroom, in order to provide the best education possible, teacher's should realize that there are many other influences; hopefully, the self-efficacy lessons learned by these methods can not only affect the female student in math but all students across all domains. For me, I have personally grown and succeeded from increased self-efficacy. Looking back, I believe a major source of my self-efficacy, especially in math, came from my eighth grade Algebra teacher. My personal growth for self-efficacy has inspired this paper and will inspire me to utilize these techniques in my own classroom.

AFTERWORD:

As I turned around saying my final goodbye to my first mentor teacher, I took a long look around the eighth grade math classroom where I had spent my last six months as a student teacher. Students were cluttering the hall as I left the building and as I walked away from these eighth graders, a flood of memories came back to me about my own eighth grade year. Eighth grade had altered me as a student forever, specifically as a math student. My self-efficacy had grown that year. As a student teacher, was I able to help any students? Did I help their self-efficacy? I certainly hope so. Although, I did not conduct an official study with observations and quantitative data on the increase, decrease and/or change of self-efficacy, I informally reflected on my short time in the math classroom.

While in the classroom, I employed six of the nine strategies discussed in this paper. Below are the six strategies I incorporated into my lessons and how I incorporated them into my student teaching.

- 1) Goal Setting- The students set a goal after the pre-test to receive above an 80% on the post-test. Although the students did not all meet this classroom goal, they received the chance to try over and over until they received 80%.
- 2) Multiple Strategies- During my teaching I used interpersonal, intrapersonal, kinesthetic, musical, linguistic, and logical learning styles. I taught my lessons in a variety of ways to reach the most students.
- 3) Motivation- Motivation to build self-efficacy has to be focused on intrinsic motivation that involves teaching to student's interest. In the beginning of a unit, I had students find a connection between the unit and an interesting career of their choice. This was to increase the intrinsic motivation from the start.
- 4) Exposure to Success- At the beginning of the graphing unit, I used a personal example of a family memory that was successful in the business world because of his high understanding of graphing and how it works. Throughout this graphing unit the students referred to the success and connection between graphing and success in business.

5) Practice Not Natural- Throughout my time in the classroom, I made sure to mention to students that the time they spend on homework will help their final result. For instance, if they choose to do their homework they will understand the topic better.

6) Communication Style- My style of communication during this time fell under a mix between teacher parental and teacher empowerment. These styles will help students maximize their self-efficacy.

Of course, it is important to remember that this classroom was not completely my own. I was not able to fully alter change the format and environment of the classroom because I had to respect my mentor teacher's wishes and set-up.

To me, incorporating these strategies, even if only in a minor way, is a step towards making this a part of my teaching style when I have my own classroom. I can think of a few students who I think I did change their outlook on math, their drive, and their effort. Now after having my own teaching experiences I look back and hope that my eighth grade teacher knows the impact he had on me. For some students this change was due to mastery experience, vicarious experience, verbal persuasion or emotive methods of increasing self-efficacy. These few students that show me informal evidence of increased self-efficacy make me feel successful. In my future classroom, it is my job to help students have experiences like my own eighth grade year. Leaving the classroom today made me realize I can and will make a difference. The students will move on, the teacher might leave but the lessons you can teach will stay with them forever. Self-efficacy is one lesson that can greatly change a student. I have made a pact to myself to teach this lesson to my students and hopefully others do too. Students should believe that they can do math; teachers must help them learn how to believe.

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