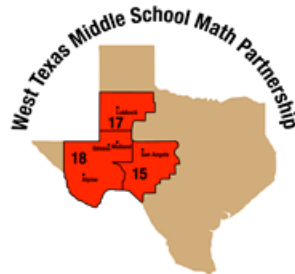


BUILDING SELF-EFFICACY FOR SELF-EFFICACY BUILDERS

Learning Guide and Materials



Tara Stevens, Ed.D.

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West Texas Middle School Mathematics Partnership

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The West Texas Middle School Math Partnership

The West Texas Middle School Mathematics Partnership (WTMSMP) is a partnership consisting of four institutions of higher education (IHEs), an independent school district and three Texas Educational Service Center Regions (ESCs). The partners serve 15,168 teachers with 199,584 students spread over 84,000 square miles of West Texas. The ultimate goal of WTMSMP is for the student population of this region, comprised of a large percentage of disadvantaged and Hispanic youth, to reach higher levels of mathematical achievement as a result of interactions with math teachers who possess a deep conceptual understanding of elementary mathematics, have a strong belief in their ability to teach mathematics to diverse student populations, and have the self-determination to influence colleagues and administrators.

Disclaimer

The opinions expressed on this website are those of the WTMSMP personnel and associates and do not necessarily reflect those of NSF.

UNDERSTANDING SELF-EFFICACY AND ITS ROLE IN MATH ACHIEVEMENT

“If I have the belief that I can do it, I shall surely acquire the capacity to do it even if I may not have it at the beginning.” (Mahatma Gandhi)

“They are able who think they are able.” (Virgil)

“Whether you think you can or you can’t, you’re usually right.” (Henry Ford)

“A man who doubts himself is like a man who would enlist in the ranks of his enemies and bear arms against himself. He makes his failure certain by himself being the first person to be convinced of it.” (Alexandre Dumas)

“Self-belief does not necessarily ensure success, but self-disbelief assuredly spawns failure” (Bandura, 1997, p. 77).

These individuals, well known for their intelligence and accomplishments, are referring to self-efficacy; the belief one possesses about his/her ability to use his/her knowledge and skills effectively to solve a problem. Although persuasion and feedback have an important influence on one’s self-efficacy, encouragement from others that is not supported by an individual’s own mastery of a task will have little impact on one’s beliefs. Thus, self-efficacy develops through a combination of mastery and accomplishment, vicarious experiences provided by social models, physiological feedback (e.g., feeling relaxed while completing a task), and social persuasion. However, mastery experiences tend to be the most powerful.

“Successful efficacy builders do more than convey positive appraisals. In addition to raising people’s beliefs in their capabilities, they structure situations for them in ways that bring success and avoid placing people in situations prematurely where they are likely to fail often.

They measure success in terms of self-improvement rather than by triumphs over others” (Bandura, 1994).

The purpose of this manual is to help you develop the skills to become successful efficacy builders. Although the majority of this training will focus on the skills and strategies used by successful efficacy builders, I am first going to take a small amount of time to tell you why you should invest in this type of professional development.

Consider the highly idealistic and obviously fictitious case of Jimmy and Johnny, identical twins sharing the exact same environment and experience as well as genetic makeup. Jimmy and Johnny’s parents interacted with them in exactly the same manner and provided each with exactly the same feedback and persuasion. Jimmy and Johnny shared the same friends, and their friends interacted with them in exactly the same way. Jimmy and Johnny had the same teachers throughout their elementary school years and, as you probably guessed, these teachers all provided exactly the same feedback and persuasion to Jimmy and Johnny. In the 6th grade, the identical twins, Jimmy and Johnny, were assigned different mathematics teachers due to a computer error. Jimmy’s teacher, Dr. Corn, and Johnny’s teacher, Dr. Apple, were both excellent mathematics educators (i.e., both had Ph.D.s in mathematics, with identical preparation), and the twins’ parents decided that the separation would cause no harm. That is, they believed that one teacher would not provide any advantage over the other. Therefore, Jimmy and Johnny’s parents were surprised to discover that Johnny’s grades and standardized test scores were somewhat higher than those of Jimmy at the end of the school year. The twins’ parents were further astonished by Jimmy’s proclamation that he planned to become a psychologist someday, when he had always, like his identical brother Johnny, expressed an interest in becoming an electrical engineer.

Assuming that Jimmy and Johnny are exactly the same in every way, we must consider that differences in Drs. Corn and Apple influenced the differences in the twins’ grades and career interests. Because Drs. Corn and Apple received identical mathematical preparation, we will

look to their classroom behavior to investigate the present issues. The subsequent table outlines the instructional strategies utilized by the teachers.

Dr. Corn	Dr. Apple
Identified clear instructional objectives.	Identified clear instructional objectives and relevant student goals to achieve those objectives.
Assigned meaningful problems that addressed each instructional objective.	Incrementally assigned meaningful problems that addressed each instructional objective.
Provided general feedback that was not specific to the instructional objectives (e.g., Good job! Everyone is working hard!).	Provided feedback specific to the instructional objectives (e.g., You now know how to plot x and y, which means that you are ready to move on to the next objective!).
Utilized person praise (e.g., I'm not surprised you got an "A" because you are so smart!).	Utilized process praise (e.g., I'm not surprised that you got an "A" because you spent time really thinking and working to understand the problems!).
Utilized praise that was overjustified or controlling (e.g., I am very proud that you did so well on this difficult assignment! I'm sure that you will keep up the good work!)	Utilized praise that minimized perceptions of external control (e.g., You must be pleased after doing so well on this difficult assignment!).
Provided opportunities for students to work collaboratively.	Provided opportunities for students to work collaboratively and carefully selected student teams to allow students the opportunity to work with slightly advanced peers.
Prepared students for high stakes testing by emphasizing the consequences of failure.	Prepared students for high stakes testing by emphasizing the importance of learning the content.

Both Drs. Corn and Apple utilized lesson objectives, assigned meaningful activities, provided persuasion and feedback, encouraged collaborative work, and attempted to motivate their students for high stakes exams. However, the strategies employed by Dr. Apple resulted in higher levels of mathematics self-efficacy in her students. Therefore, Johnny developed a stronger belief in his ability to successfully utilize his skills and knowledge to effectively solve mathematics problems. Because he possessed this belief, he spent more time working on difficult mathematics problems (i.e., he displayed perseverance and did not give up easily), he chose more challenging tasks when given a choice, and considered the conceptual issues related to his mathematics assignments. Thus, Johnny developed a greater interest in mathematics.

Could such a dramatic difference in student outcomes occur as a result of subtle differences in teacher behavior? You might be doubtful as Jimmy and Johnny reside in an ideal, fictitious world, which one might relate to a laboratory setting where much of psychological research is conducted. However, educational psychologists, who study the application of psychological principles with the goal of improving education, often conduct their research in schools and classrooms. In fact, the research that supports the important role of self-efficacy in predicting achievement and educational outcomes was conducted in real world, educational settings. This research suggests that, yes, dramatic differences in student outcomes can result from self-efficacy beliefs, and students' self-efficacy beliefs can be influenced by teacher behavior.

Research has informed us that...

Bandura, A. (1993). Perceived self-efficacy in cognitive development and functioning.

Educational Psychologist, 28, 117-148.

Zimmerman, B.J., & Bandura, A. (1994). Impact of self-regulatory influences on writing course

attainment. *American Educational Research Journal, 31, 845-862.*

As self-efficacy increases, achievement increases.

Pintrich, P.R., & DeGroot, E.V. (1990). Motivational and self-regulated learning components of classroom academic performance. *Journal of Educational Psychology*, 82, 33-40.

Students with higher levels of self-efficacy utilize more advanced cognitive strategies and perform better on exams and coursework.

Simply put, students with high self-efficacy believe that they can solve the problem, which indicates that they will persist in the face of difficulty and seek more difficult challenges in comparison to peers who do not possess such beliefs.

Pajares, F., & Kranzler, J. (1995). Self-efficacy beliefs and general mental ability in mathematical problem-solving. *Contemporary Educational Psychology*, 20, 426-443.

Stevens, T., Olivárez, A., Jr., Lan, W., & Tallent-Runnels, M. K. (2004). The role of mathematics self-efficacy and motivation in mathematics performance: Issues across ethnicity. *Journal of Educational Research*, 97, 208-221.

Mathematics self-efficacy mediates the relationship between general mental ability and mathematics achievement. This means that the effects of ability on achievement depend on students' levels of self-efficacy (e.g., if ability is high but self-efficacy is low, then achievement will likely be lower than expected or if ability is low but self-efficacy is high, then achievement will likely be higher than expected).

Furthermore my colleagues and I found that...

Stevens, T., Olivárez, A., Jr., & Hamman, D. (2006). The role of cognition, motivation, and emotion in explaining the mathematics achievement gap between Hispanic and White students. *Hispanic Journal of Behavioral Sciences*, 28, 161-186.

Mathematics self-efficacy, sources of self-efficacy, and emotional feedback (e.g., anxiety) were all stronger predictors of mathematics performance than general mental ability. The model evaluated provided a good fit for the sample of White children but not for the sample of Hispanic children. Thus, further research is necessary to better understand how beliefs influence all students' performance.

These findings emphasize the value of positively impacting self-efficacy development, and researchers have shown that teachers can be effective in this task. For example, Siegle and McCoach found that the...

Siegle, D., & McCoach, D.B. (2007). Increasing student mathematics self-efficacy through teacher training. *Journal of Advanced Academics*, 18, 278-312.

Modification of teachers' instructional strategies subsequent to minimal training was linked to increases in their students' self-efficacy.

Increases in self-efficacy have also been linked to other positive educational outcomes. For example, my colleagues and I found that...

Stevens, T., Wang, K., Olivárez, A., Jr., & Hamman, D. (2007). Use of self-perspectives and their sources to predict the mathematics enrollment intentions of girls and boys. *Sex Roles: A Journal of Research*, 56, 351-363.

Mathematics self-efficacy predicts children’s intentions to continue their enrollment in mathematics courses. Although self-efficacy was important for boys and girls, the relationship between self-efficacy and enrollment intentions was significantly stronger for boys in comparison to girls (interest was significantly more important in predicting enrollment intentions for girls in comparison to boys).

From this brief review of literature, you can see that sensitivity to students’ culture and gender is relevant in our work and that, unlike Jimmy and Johnny, students in our classrooms differ considerably in their early experiences and opportunities, beliefs, preferences, interests, and educational background. Even so, all children can benefit from the development of self-efficacy beliefs. In this manual, you will find suggestions for creating classrooms where students have the opportunity to be positively influenced by the four sources of efficacy. These suggestions will be discussed in contexts that represent the diversity of children learning mathematics. My colleagues and I will facilitate a discussion of cases to assist you in your experimentation with the application of self-efficacy principles.

If you should have any doubts in your ability as a successful efficacy builder consider that “To succeed, one cannot afford to be a realist” (Bandura).

The outline below defines the four sources of self-efficacy and identifies strategies for encouraging each source in the classroom. The tables provide application examples that proceed from least to most effective.

1. Mastery experiences – the student succeeds in a task.
 - a. Educators can heighten students’ experience with mastery by:
 - i. Breaking down tasks/assignments into smaller, attainable units.
 - ii. Identifying specific goals and objectives and helping students to monitor their progress.
 - iii. Encouraging students to make self comparisons when monitoring progress.

Self-Efficacy – Teachers promote student mastery through the use of objectives.
1. The teacher does not identify clear instructional objectives
2. The teacher identifies clear instructional objectives.
3. The teacher identifies clear instructional objectives and relevant student goals to achieve those objectives.

Self-Efficacy – Teachers promote student mastery through the use of feedback.
1. The teacher provides feedback not specific to the instructional objectives to convey competence.
2. The teacher provides feedback specific to the instructional objectives that conveys competence solely through social comparison.
3. The teacher provides feedback specific to the instructional objectives to some (i.e., 1 or 2) students to convey competence.
4. The teacher provides feedback specific to the instructional objectives to most (i.e., 75% of class) students to convey competence.

2. Persuasion and feedback – the student receives specific information concerning aspects of his/her performance and understanding.

- a. Educators can improve their feedback to promote student self-efficacy by:
 - i. Using persuasion and feedback in a genuine, sincere manner.
 - ii. Recognizing that feedback occurs within a context.
 - iii. Avoiding the viewpoint that feedback is only a reinforcer (in fact, when used as a reinforcer, it can be harmful to intrinsic motivation and interest, see Deci & Ryan, 2000).
 - iv. Understanding that feedback that is used to praise, reward, or punish tends to be least effective. Feedback should be informational.
 - v. Understanding that feedback that provides information concerning a task and how to improve upon the task is most effective.
 - vi. Understanding that feedback is most effective when focused on successful rather than unsuccessful responses.
 - vii. Understanding that feedback works best when specific goals are set.
 - viii. Understanding feedback is more effective when it is focused on underlying processes rather than traits.
 - ix. Recognizing that the effectiveness of feedback varies across groups (e.g., girls may prefer process praise to person praise and boys may prefer person praise to process).

Self-Efficacy – Teachers persuade students through the use of praise that does not harm student autonomy.
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1. The teacher predominately uses person praise (e.g., ability).
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2. The teacher predominately uses general statements of praise that do not convey either person (e.g., ability) or process (e.g., effort).
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3. The teacher predominately uses process praise (e.g., effort).
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Self-Efficacy – Teachers persuade students through the use of praise.
--

1. The teacher uses praise that is overjustified or controlling.
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2. The teacher uses praise in a nonspecific manner.

3. The teacher uses praise that minimizes perceptions of external control or is endogenous.

3. Vicarious learning – students have the opportunity to learn from peers’ successes and failures.

a. Educators can provide opportunities for vicarious learning that promotes mathematics self-efficacy by:

i. Utilizing collaborative and cooperative group-work designs that emphasize personal responsibility and interdependence related to group outcomes.

ii. Creating groups of students with similarities, although some may be slightly further ahead in their studies.

iii. Identifying appropriate models for students (e.g., similar students or adults who have succeeded in math).

iv.

Self-Efficacy – Teachers promote student vicarious learning through instructional design.

1. Provides no opportunities for students to work collaboratively.

2. Provides opportunities for students to work collaboratively.

3. Provides opportunities for students to work collaboratively with peers who are slightly advanced.

4. Physiological feedback – the student experiences a moderate and manageable level of arousal when presented with mathematics problems.
 - a. Educators can encourage positive mood and appropriate levels of arousal by:
 - i. Deemphasizing examinations and emphasizing learning.
 - ii. Encouraging thoughtful or “sufficient” (Harris, personal communication, 2009) answers rather than correct answers.
 - iii. Presenting interesting tasks that maintain student attention.

Self-Efficacy – Teachers provide information to encourage appropriate physiological states in students.
1. The teacher provides information concerning tests, performance, and/or the consequences of failure that encourage student anxiety.
2. The teacher does not provide information that heightens anxiety or relaxation.
3. The teacher provides information concerning tests, performance, and/or the consequences of failure that encourage student relaxation.

Self-Efficacy – Teachers promote appropriate physiological states in students through their emphasis of appropriate learning goals.
1. Teachers emphasize performance over learning (e.g., the importance of passing a test rather than mastering a task).
2. Teachers emphasize neither performance nor learning.
3. Teachers emphasize learning over performance (e.g., the importance of mastering a task rather than passing a test).

DISCRIMINATING SELF-EFFICACY FROM SELF-ESTEEM

The discussion of self-efficacy can lead to some confusion with other “self” concepts. Because many educators are constantly reminded of the value of self-esteem, you may be wondering how self-efficacy and self-esteem differ. First, self-efficacy is a belief, whereas self-esteem is a value. Self-esteem is typically based on outcomes and results in positive or negative feelings concerning one’s performance. In contrast self-efficacy forms through various sources (i.e., mastery, persuasion, vicarious experiences, and physiological states) and relates to more accurate estimates of one’s abilities. “Self-efficacy questions are concerned with capabilities to execute specific tasks, or courses of action, the outcomes of which may or may not have any bearing on self-esteem” (Lane, Lane, & Kyprianou, 2004, p.249). Therefore, self-efficacy tends to be a good predictor of performance, whereas self-esteem functions poorly in this role.

The following personal examples will help you to see a clear distinction between the two concepts. The first example is one of low self-efficacy and high self-esteem. I started piano lessons at the age 4 and in the shadow of my older sister. My self-efficacy for sight reading new pieces was low, which developed from observing my talented older sister who was especially strong in this domain. Today my sister plays for her church and has been hired for weddings and funerals. Her self-efficacy is high and she accepts new challenges. In contrast, I play only for myself due to my lack of confidence that I can play, without obvious errors, new music selected by others. When I purchase new music, I purposely don’t challenge myself and look for pieces that I know are at my skill level. Despite my low self-efficacy, I love to play the piano and greatly appreciate this aspect of my identity. When asked to report my interests and hobbies, I always list “piano” and feel that this adds personal value. So, suppose you were trying to decide who to select to play the piano for your wedding, my sister or me. Today, we have both played for over 20 years and the wedding march is well within both our skill levels. Well, my sister will be more likely to play without error. I’ll be more likely to feel good about myself while playing.

The second example is one of high self-efficacy and low self-esteem. I have been running for about 12 years and have learned a lot about training schedules, nutrition, and the

prevention of running injuries over that time. I've run a few races and have had the experience of successfully increasing my mileage to reach specific goals. My friends often make positive comments about my motivation and self-regulation and I feel comfortable and happy while running. In other words, my self-efficacy for running is high. I know that I have the skill and knowledge to succeed in my running activities. Interestingly, no matter how far I run or how fast, I don't feel good about myself as a runner. That is, my self-esteem for running is low and I am unable to appreciate my accomplishments in this domain. In contrast, my husband knows little about running and rarely spends any time engaged in such activity. Even so, he would frequently joke with me that he could still run faster and farther than me, despite his lack of devotion to any particular workout schedule. Thus, his self-esteem was high. He possessed a high degree of self-worth for his running with little to no actual mastery and feedback related to this activity. If my husband and I were both running a 10K, who would you bet on to finish first? Through the years, my husband has joined me for a handful of runs; all of which have ended in walking after a significant reduction in the length of my typical running route. In other words, I would put my money on self-efficacy.

From these examples, you should get the sense that self-esteem is based on affective variables whereas self-efficacy is based on cognitive ones. Feeling good about ourselves and activities is great, but self-esteem just doesn't predict much about our actual performance. Consider the work of More, Baker, and Jeffries (1995) who found that self-efficacy was superior predictor of college students' personal goals and performance in comparison to self-esteem. The following is a passage from their results section.

"Hypotheses 1a and 1b specified that self-efficacy would be a better predictor of personal goals and performance, compared to self-esteem, in the first trial, and that this effect would remain over subsequent trials. Step 1 of Equations 1 to 3 indicates that self-efficacy is the stronger predictor of personal goals in the first trial and in subsequent trials (see Table 2). Although self-efficacy is significant at $p < .01$ in each trial and accounts for approximately half (44% to 53%) of the variance in personal goals, self-esteem is not significantly related to personal goals in any of the trials. Step 1 of Equations 4 to 6 indicates that self-efficacy is the stronger predictor of performance in the first trial and subsequent trials (see Table 2). Although self-efficacy is significant at $p < .01$ in each trial and accounts for 6% to 14% of the variance in performance, self-esteem is not significantly related to

performance in any of the trials. Hence self-efficacy is a better predictor of personal goals and performance, and this effect remains constant across the trials.”

Notice that More et al. (1995) found that not only was self-efficacy a strong predictor of academic outcomes but that the relationship between self-esteem and academic outcomes was not statistically significant. Thus, self-esteem is a consequence of academic achievement, not a requirement of it (Burr & Christensen, 1992; Young, 1993). So why have schools been recognized as an environment influencing self-esteem development since the early part of the 20th century and why have educators been encouraged to facilitate their students’ self-esteem? Feeling good about oneself and his/her accomplishments is associated with general well-being and positive affect. The desire to improve another’s self-esteem is a valuable effort as long as the effort is not expected to improve actual performance.

Although you may not remember the exact definitions of self-efficacy and self-esteem or the differences between the two, I hope that you will take one important piece of information from this brief presentation. Your role as an efficacy builder is not to make students feel good about their mathematics ability. Your role is to help them understand, assess, and develop their beliefs about their ability to do math. These beliefs will likely lead to successful performance and successful performance will result in positive feelings of self-worth.

BUILDING SELF-EFFICACY FOR SELF-EFFICACY BUILDERS

Teachers have a lot to think about while teaching. Not only must they understand the content they are teaching, they also need to be aware of how the content should be taught. In other

words, during instruction, educators are drawing from content and pedagogical knowledge. Add to this the cognitive demands of classroom management and the occasional student crisis (e.g., restroom break, sudden illness, etc.) and we must acknowledge that teachers have little cognitive capacity left to process new information. This statement is supported by researchers who have found that the average person can process about 7 plus or minus 2 pieces of information at any one time. This explains why a phone number is seven digits long (without the area code). We all know what happens if we look up a new phone number and get interrupted prior to making the call... we typically lose the number because we are now trying to process more than 7 pieces of information. Therefore, we are all limited in our working memory capacity.

This issue is important to consider when educators are asked to develop a deeper understanding of content and strategies to promote self-efficacy and provide culturally sensitive instruction. If we give teachers too much information to process as they teach, they won't be successful. In fact, we might even distract them to the point that their initial performance level declines. Does this mean that efforts to expand educators' knowledge base and intervention strategies should be avoided? The answer to that question is, "absolutely not." Instead, we must go beyond simply providing teachers with new information and also assist them in implementing it.

Even though we have limited cognitive capacity, we can encode and recall phone numbers with little effort through our use of cognitive strategies. Perhaps at the simplest level, we use repetition to "move" a new phone number into our long term memory. As we use that new number again and again, dialing the number becomes automatic. That is, we no longer have to think about it and working memory is freed to allow us to process other information simultaneously. That is, if we are interrupted on our way to the phone, we have no problem dialing the number once we have addressed the new issue. Although I won't take the time to burden your working memory capacity with definitions and descriptions of other cognitive strategies that encourage the development of long term memory and automaticity, I will

highlight a few relevant implications. Subsequently, I will provide an implementation plan that will help you to apply the new information and self-efficacy strategies that you are learning to your classroom practice in a manner that considers the challenges of our limited processing capacity.

Implications

- Successful teachers will recognize that although the new material that they are learning is easy to understand, the related multiple applications are cognitively demanding.
 - Few would argue that a phone number is a simple concept, yet look at how easily one can be forgotten when the demands on cognitive processing are high.
- Successful teachers will apply their new knowledge in incremental steps.
 - New information and strategies won't be automatic in the beginning. Without automaticity, the newly learned material will likely take most if not all of the teacher's attention, which will adversely affect his/her teaching.
- Successful teachers will consider their own progress and avoid comparisons to other professionals.
 - The amount of time it takes to successfully implement a new step will vary across teachers. Teachers will differ in their existing levels of mathematics conceptual knowledge and self-efficacy. Teachers will also vary in how they use feedback. Thus, some will be making considerable modification and others will be making little.
- Successful teachers will seek the assistance of others to develop a greater number of cognitive strategies for implementing the new material.
 - The recommendation that social comparison be avoided should not prevent teachers from learning from their peers.
- Successful teachers will share their experiences with their peers.
 - Explaining, analyzing, and evaluating one's experiences encourages self-monitoring, modification, and feedback from others.

I hope you will notice that the “successful teachers” described above are self-efficacious. Recognizing that the new material is easy yet cognitively demanding allays anxiety and frustration in implementation. Applying new knowledge in incremental steps and avoiding social comparisons promotes mastery and allows teachers to see their success and progress. Seeking the assistance of others allows for vicarious learning. Finally, sharing experiences with peers provides opportunities for important feedback and verbal persuasion.

Just as it takes time for students to develop self-efficacy beliefs for mathematics, teachers will need ongoing experience and feedback to become self-efficacious self-efficacy builders. Additionally, teachers who are comfortable with the content that they teach as well as their ability to engage students in this content will be more efficacious self-efficacy builders.

Teacher Self-Efficacy and Self-Efficacy Building

Teachers high in teacher self-efficacy tend to have students with higher self-efficacy (Anderson, Greene, & Loewen, 1988). Before developing and introducing new strategies to influence the

mathematics self-efficacy of your students, be certain that your personal efficacy for teaching mathematics is high. Developing your skills at becoming efficacy builders may help you to see yourself as a more effective teacher. Additionally, learning more about mathematics, which is a goal of the WTMSMP, will help you to positively influence the self-efficacy of your students.

What is teacher self-efficacy?

“Teacher efficacy is the teacher’s belief in his or her capacity to organize and execute courses of action required to successfully accomplish a specific teaching task in a particular context” (Tschannen-Moran, Woolfolk Hoy, & Hoy, 1998, p. 233).

Building students’ self-efficacy is only one type of specific teaching task. Teachers must understand the content that they teach, how to teach that content, how to keep students engaged in that content, and how to manage students’ behavior when students are not engaged.

Why is teacher efficacy important?

Teacher self efficacy is related to the following student outcomes:

- Achievement (Armor et al., 1976; Ashton & Webb, 1986; Moore & Esselman, 1992; Ross, 1992)
- Motivation (Midgley, Feldlaufer, & Eccles, 1989)
- Students’ self-efficacy (Anderson, Greene, & Loewen, 1998)

Teacher self-efficacy is related to the following teacher behaviors:

- Planning and organization (Allinder, 1994)

- Openness to new ideas and new methods (Berman, McLaughlin, Bass, Pauly, & Zellman, 1977; Guskey, 1988; Stein & Wang, 1988)
- Persistence with struggling students (Gibson & Dembo, 1984)
- Less frequent referrals to special education (Meijer & Foster, 1988; Podell & Soodak, 1993; Soodak & Podell, 1993)
- Less criticism in response to student error (Ashton & Webb, 1986)
- Enthusiasm for teaching (Allinder, 1994; Guskey, 1984; Hall, Burley, Villeme, & Brockmeier, 1992)
- Commitment to teaching (Coladarci, 1992; Evans & Tribble, 1986; Trentham, Silvern, & Brogdon, 1985)

Taking the time to honestly reevaluate your teacher self-efficacy and to build it has clear benefits. Once you feel confident in your mathematics teaching, utilize the implementation schedule below to assist you in directly influencing the mathematics self-efficacy of your students.

Implementation Schedule

Incrementally introduce the following strategies into your teaching by targeting one step at a time. Notice that no time is allotted to suggest how long you should spend on each step. Your

progression through the steps will depend on your own evaluation. That is, when your evaluation indicates that you have mastered a step, then move to the next. A good indicator for mastery is the ability to complete the task without thinking about it or without effort.

Task
STEP 1
Deemphasize examinations (and high stakes testing) and emphasize learning
Encourage thoughtful or “sufficient” answers rather than correct ones.
Use persuasion and feedback in a genuine, sincere manner (i.e., mean what you say or avoid saying it).
STEP 2
Identify clear instructional objectives at the start of every class period.
Break down tasks/assignments into smaller, attainable units.
Provide informational feedback specific to the instructional objective.
Provide feedback that focuses on underlying processes rather than traits (e.g., emphasize effort over ability).
STEP 3
Encourage students to make self-comparisons rather than social ones.
Use praise and feedback to inform rather than control (i.e., avoid using praise as a reward or encouragement. Use information, which can be phrased positively).
Focus feedback on students’ successful responses.
STEP 4
Develop group work opportunities that emphasize personal responsibility and

interdependence related to group outcomes. (Work to assign tasks within the group that are attainable for individual students.)

Purposely assign students to groups to ensure that the students are at similar but varying levels of understanding.

Identify and discuss appropriate models for students (e.g., similar students or adults who have succeeded in math).

IMPLEMENTATION WORKSHEET

STEP 1

Working Dates	Task	Example	Practice and Personal Notes	Evaluation
			<i>Document what you did to practice, what worked and what did not.</i>	<i>Document your progress by recording your successes.</i>
	Deemphasize examinations (and high stakes testing) and emphasize learning	<p>Teacher states, “Remember that TAKS is next week. This is a great opportunity to see how much you’ve learned this year.”</p> <p>Teacher states, “The objective we are working on today is very important. Learning this will help you to understand how much money you will need to spend to purchase a new car.”</p>		
	Encourage thoughtful or “sufficient”	Teacher states, “Don’t be afraid to share your answer. Even responses		

	<p>answers rather than correct ones.</p>	<p>that aren't exactly right can show that you are learning."</p> <p>Teacher states, "Incorrect answers give us something interesting to talk about so that we can learn."</p>		
	<p>Use persuasion and feedback in a genuine, sincere manner (i.e., mean what you say or avoid saying it).</p>	<p>A student earns a "B" on an assignment when she typically would have earned an "A." The teacher wants to encourage the student to put more effort forth on the next assignment, but stops herself from saying "good job" because she does not mean it. Instead, the teacher focuses on the aspect of the assignment that was completed without error and states, "You must have really thought about the first five problems as you didn't make any of the errors that most new learners make."</p>		

STEP 2

	<p>Identify clear instructional objectives at the start of every class period.</p>	<p>Teacher states, “By using a single number to represent a set, of numbers we can describe a lot of numbers quickly and easily. This is called central tendency. For example, we might want to know how the class did on the last assignment. Instead of listing everyone’s score, which would be a lot of information that wouldn’t tell us much, we could use several formulas to generate a number that best represents what everyone scored. Today, we will learn three objectives. First, we will learn to calculate the mode; second, we will learn to calculate the median; and third we will learn to calculate the mean.”</p>		
	<p>Break down</p>	<p>The teacher quietly gives</p>		

	<p>tasks/assignments into smaller, attainable units.</p>	<p>students a checkmark as they successfully calculate the mode. In the middle of the class session, the teacher asks students to independently calculate the median for three datasets and submit their work for grading. At the end of the class session, the teacher assigns problems that involve the calculation of the mean.</p> <p>The teacher makes a point to share feedback for each task/assignment separately as students who might not succeed in solving the more difficult problems will still have the opportunity to recognize what they do understand.</p>		
	<p>Provide informational feedback specific to the instructional objective.</p>	<p>Teacher states, “You now understand one way to describe central tendency. You’ve already met the first objective as you can calculate the</p>		

		<p>mode. Now, let's compare the mode to what we calculate for the median."</p> <p>Teacher states, "You have already made a lot of progress today. You understand the first two objectives and are ready to work on the third."</p>		
	<p>Provide feedback that focuses on underlying processes rather than traits (e.g., emphasize effort over ability).</p>	<p>Teacher states, "Priscilla, I noticed that you checked your addition twice when calculating the mean. This effort helped you to achieve a perfect score on today's assignment."</p>		
<p>STEP 3</p>				
	<p>Encourage students to make self-comparisons rather than social ones.</p>	<p>Teacher states, "Your score on today's unit test is 10 points higher than your last week's score."</p>		

	<p>Use praise and feedback to inform rather than control (i.e., avoid using praise as a reward or encouragement. Use information, which can be phrased positively).</p>	<p>Edward typically fails to submit his homework. At the start of class, Edward hands the teacher a completed homework assignment. The teacher initially wants to praise Edward to encourage him to continue to turn in homework but realizes that this is an effort to control. Instead, the teacher assesses Edward's work and writes a note detailing Edward's strengths related to the assignment.</p>		
	<p>Focus feedback on students' successful responses.</p>	<p>In reviewing for an upcoming exam, the teacher discusses a list of skill deficits. Although this is necessary, the teacher does not also identify the skills that the students will likely proficiently demonstrate on the upcoming exam.</p>		
<p>STEP 4</p>				

	<p>Develop group work opportunities that emphasize personal responsibility and interdependence related to group outcomes. (Work to assign tasks within the group that are attainable for individual students.)</p>	<p>The teacher organizes the class into groups of three and provides a single dataset. She assigns the task of calculating the mode to the first student, the median to the second student, and the mean to the third. The students must determine the most appropriate estimate of central tendency for the data and task (e.g., the median is typically reported for income due to the effects of extremely large salaries on the mean).</p>		
	<p>Purposely assign students to groups to ensure that the students are at similar but varying levels of understanding.</p>	<p>The student asked to calculate the mode has done this task successfully but not consistently. The student asked to calculate the median can calculate the mode consistently but not the median. The student asked to calculate the mean has calculated the</p>		

		mode and median consistently and has demonstrated an ability to calculate the mean across most situations.		
	Identify and discuss appropriate models for students (e.g., similar students or adults who have succeeded in math).	Teacher states, "You remind me of my students in last year's 3 rd period class. They understood central tendency so well that the high school basketball coach asked several of them to keep the team's statistics. At the end of the season, he gave them gift certificates to Sonic."		

SELF-EFFICACY CASE STUDIES

Teachers understand that applying new strategies in their classrooms is more difficult than learning about them. Defining self-efficacy is very different than knowing what it looks like in a classroom full of middle school students. Identifying strategies to increase student self-efficacy is very different from applying those strategies effectively to have a positive impact on every student. Even so, most teachers are hesitant to “experiment” with new strategies in the classroom (and should be hesitant) before achieving a thorough understanding of implementation and possible associated consequences (both positive and negative). Use the cases below to begin your progression from basic knowledge of self-efficacy to application and analysis of self-efficacy in your classrooms.

Case Study 1

Teacher’s Perspective

Mrs. Honey is excited that she will finally be teaching a freshman accelerated Algebra II class. Mrs. Honey is told by the school’s mathematics curriculum specialist that this group of students advanced so quickly through the content of Algebra I that last year’s teacher was able to cover some of the Algebra II content. The curriculum specialist noted that a new student with particularly high standardized test scores from Kansas is also joining the group. Mrs. Honey has been looking forward to the challenges of working with advanced students and plans on implementing her knowledge about mathematics self-efficacy to help these students fully achieve their potential. To accomplish this, Mrs. Honey reasons that the students have all experienced mastery for mathematics. So, she decides to provide persuasion and encouragement through making an announcement on the first day of class that the students will skip every chapter already covered in the prior school year. Mrs. Honey wants to be certain that the students understand how successful they have been. She also wants the opportunity to teach more advanced content.

1. Should Mrs. Honey assume that all accelerated students have high levels of self-efficacy?
2. Do you think Mrs. Honey’s self-efficacy building strategy will be effective?
3. What potential problems might Mrs. Honey face?
4. What additional strategies could Mrs. Honey implement to build the mathematics self-efficacy of her students?

Student Perspective I

Ken enjoyed the fast pace of last year's Algebra I class and is excited to learn that this year's Algebra II course will be taught in the same fashion. Ken often compares his math progress to that of a friend in another accelerated class, as they meet after school to complete homework. Because Ken is typically ahead of his friend and working on later algebra chapters, Ken believes his mathematics knowledge and skill is better than that of his friend. He often offers to help his friends with challenging problems and because he is an effective tutor, his help is often sought out by others. Ken is pleased to learn that Mrs. Honey is planning on keeping an intensive pace so that he can maintain his academic "lead" over his friends.

1. Does Ken have high mathematics self-efficacy?
2. What strategies could Mrs. Honey implement to build Ken's mathematics self-efficacy?

Student Perspective II

Ann just moved to a new school from rural Kansas. She immediately learns that she will be placed in an accelerated mathematics class. With only 20 students in her entire grade at her former Kansas school, Ann is not familiar with accelerated courses and is used to attending class with advanced, average, and below average students. Although Ann knows that she was the top performing girl at her former school, she wonders how she will compare to her new classmates. She is terrified after learning that the class will skip the first chapters of the textbook as, unlike her peers, Ann has not learned this content. She doesn't want Mrs. Honey, or her new peers, to think that she is unintelligent and decides to not inform Mrs. Honey of her concerns.

1. What do you think will happen to Ann's mathematics self-efficacy?
2. What strategies could Mrs. Honey implement to build Ann's mathematics self-efficacy?

Case Study 2

Teacher's Perspective

According to Anywhere Middle School administrators, Mr. McSpadden is one of their most successful mathematics teachers. Last year, Mr. McSpadden's students had a 90% passing rate on the TAKS. Mr. McSpadden attributes his success to the strategies he uses to motivate students. Each year he selects a popular theme and asks each class to adopt a related, unifying name. For example, with the new Star Trek movie, Mr. Spadden selected this as the theme. He named his desk, the Enterprise, and each class was considered its own starship for which students assigned a name. Throughout the school year, the starships competed for points, which were displayed using a large graph at the back of the classroom. Points were assigned based on class progress, behavior, and test scores. Students rotated into the position of "captain" for their starships as they demonstrated proficiency at using new skills and knowledge. Mr. McSpadden presented new content incrementally to ensure that all students had the opportunity to emerge as captains. Each week, starships with the most points were awarded popcorn parties, a no homework pass, or Friday free time.

1. Do you think Mr. McSpadden's motivational strategies are effective at improving students' mathematics achievement? At improving his students' mathematics self-efficacy?
2. What potential problems might McSpadden face?
3. What additional strategies or modifications could Mr. McSpadden implement to build the mathematics self-efficacy of his students?

Student Perspective I

Ella is an excellent student who typically has the highest grades in her mathematics class. When Mr. McSpadden describes the Star Trek theme and competition at the start of the school year, one of Ella's classmates announces to Mr. McSpadden that his class will likely win all future challenges because Ella is on his class starship. Although Ella is pleased that her peers perceive her to be intelligent, she fears that she will not always perform to their expectations. Ella spends considerable time checking and rechecking her homework to ensure that she will earn the maximum points for her starship. Not surprisingly, Ella's

TAKS performance is exemplary. Despite her apparent success, Ella does not like mathematics. When Mr. McSpadden asks if she wishes to attend a summer academy for advanced middle school mathematics students, Ella immediately declines and states she is looking forward to a summer free of mathematics.

1. What do you think has happened to Ella's mathematics self-efficacy?
2. What strategies or modifications could Mr. McSpadden implement to build Ella's mathematics self-efficacy?

Student Perspective II

Zeke believes he is not good at math. He typically works on his math homework after finishing all of the work assigned for his other classes. As a result, he sometimes submits his homework late or not at all. Zeke loves the new Star Trek movie and suggests the name that is selected for his class starship. Zeke loves the thought of receiving a no homework pass each week but is still pleased with popcorn and Friday free time. Zeke now completes his math homework immediately after leaving school and often works with peers before class to ensure that he has the correct answers. He frequently encourages classmates to complete their homework on time so that the class will earn more points. Zeke is selected captain five times during the school year and passes the TAKS at the end of the year by a fair margin when he passed by only 2 points in the prior school year.

1. What do you think has happened to Zeke's mathematics self-efficacy?
2. If Zeke were asked by Mr. McSpadden to attend a summer academy for advanced middle school mathematics students, how do you think he would respond?
3. What strategies or modifications could Mr. McSpadden implement to build Zeke's mathematics self-efficacy?

Case Study 3

Teacher's Perspective

Ms. Holman is starting her first year of teaching and is assigned to teach 7th grade mathematics. During the first week of classes, Ms. Holman notices that a boy in her 2nd period class exhibits difficulty attending to task, disrupts class frequently by talking out at inappropriate times, and interacts with peers aggressively during less structured time periods. Thus, Ms. Holman isn't surprised when she is visited by the school psychologist during her conference period at the start of the second week of school. The school psychologist informs Ms. Holman that the boy in her 2nd period is identified as having an emotional disturbance. The boy, Michael, has moved frequently and missed a considerable amount of instruction due to removals to self-contained classrooms and discipline settings. She also explains that Michael will receive counseling services and a behavior intervention plan will provide the teacher direction in addressing disruptive classroom behavior. In reviewing Michael's history with Ms. Holman, the school psychologist discloses that the student has moved 8 times, his mathematics achievement is two grade levels below that of his peers, and the student's assessed level of ability was in the normal range.

1. Ms. Holman is a new teacher. Research indicates that preservice teachers tend to have an inflated sense of teacher self-efficacy, which is adjusted once they enter the classroom. With the challenges ahead, how do you think Ms. Holman's teacher self-efficacy will develop?
2. What can school administrators and Ms. Holman's colleagues do to assist her in this situation and help her to develop a positive sense of teacher efficacy?
3. What can Ms. Holman do to help her students (including Michael) develop mathematics self-efficacy?

Student's Perspective

Michael is a new student in Ms. Holman's 2nd period math class. Michael is aware that he understands little of what is discussed in his math class, and in comparison to his peers he performs poorly. He views each assignment as a reminder of his inferiority and becomes angry at times when others finish before him and are able to talk quietly. When the teacher returns graded papers to the students' folders,

Michael is sure that others who collect their folder from the basket before him look at his grades. Thus, Michael often pushes his way to the front of the class to ensure that he is able to pick up his folder before his peers. Michael considers math class his worst period of the day and often drifts off thinking of fun things he could be doing. He finds this easy to do, as he typically doesn't understand and isn't familiar with the content discussed by Ms. Holman. Although Michael is behind in his other classes, he has found that in these classes he can become engaged in new tasks and content without sharing all of the background possessed by his peers. As a result, Michael's math grade is his lowest.

1. What do you think has happened to Michael's mathematics self-efficacy?
2. What strategies could Ms. Holman implement to build Michael's mathematics self-efficacy?

KEEPING THE CONVERSATION GOING

When you return to your schools and classrooms, your efforts at improving the self-efficacy of your students will be met with many challenges. Strategies might work well for some students but not others, time constraints will likely affect your ability to implement recommendations, you may begin to doubt your own teacher efficacy, and you may find it difficult to communicate your frustrations and concerns to others in a way that they can understand and support. These challenges are to be expected. Although the WTMSMP content is very basic, the applications are complex and require ongoing analysis and discussion. So, keep the conversation going by joining the WTMSMP online community. While attending the WTMSMP summer course, you will be provided with specific instructions concerning how to access the community and use related tools.