

STUDY SKILLS: Autobiography and Growth Mindset

Task #1: Math Autobiography

Name _____ Course & Section _____

Success in math involves learning to think; to become better at thinking, students must think about thinking! The skill of thinking about how one thinks is called “**Metacognition**”, and this skill has been correlated to success not only in educational settings, but also in work and career, personal life and relationships, and life satisfaction. People who can think about how they think can identify which thoughts, behaviors, and actions are leading them where they want to go, and which are not.

Each student arrives to a math class by a different path. Each one has had experiences which influence attitudes and beliefs about math, making one either strong and confident or anxious and unsure or somewhere in between. To focus on the future, it’s important to reflect on the past.

1) I’ve written my math autobiography with highlights from my entire life below:

(a) My strengths in life are ...

(b) My strengths in math are ...

(c) My attitude about math now is...

(d) My fears, concerns, and hopes about this class (or math in general) are ...

(e) In my entire life, my first math memory is...

(f) In my entire life, my best math memory is ...

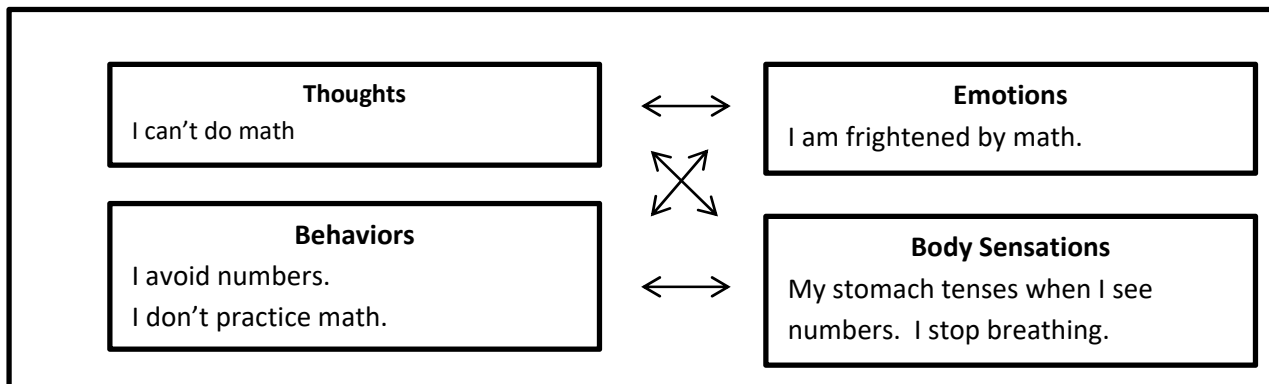
(g) In my entire life, my worst math memory is ...

(h) Other experiences (positive, negative, or neutral) with math that have affected me are ...

Task #2: My Thoughts are In Charge

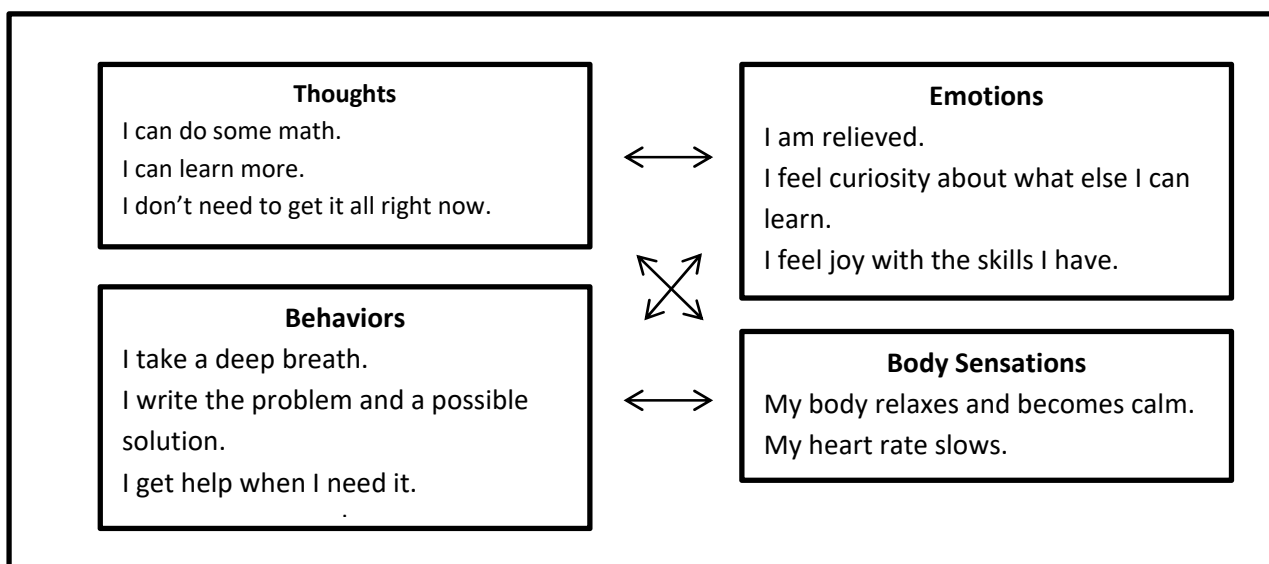
Thoughts, emotions, body sensations, and behaviors are interrelated. Each of them influences the other three.

Read each box, starting with the “Thoughts” box, and notice the effect of *negative* thoughts on emotions, body sensations and behaviors:



2) My reaction to the *negative* chart above is:

Now read each box, starting with the “Thoughts” box, and notice the effect of *neutral* thoughts on emotions, body sensations and behaviors:



3) My reaction to the *neutral* chart above is:

Feelings start with a thought. We can control our thoughts (with practice), but we can only change our feelings and emotions by changing the thoughts that begin them. This is a premise of cognitive psychology.

- 4) Here are four lists associated with negative thoughts. Circle the thoughts, emotions, body sensations, and behaviors you have experienced. (Add to the lists if needed.) If you have a positive outlook on math, you may wish to answer page 8 first, then answer this with what stops you from being your very best.

Thoughts	Emotions	Behaviors	Body sensations
I will fail.	Frustrated	Avoid math.	Heart pounding
I will never do well.	Embarrassed	Blame the teacher.	Sweating
I am incompetent.	Helpless	Tune out in class.	Stomach ache
Math teachers hate me.	Anxious	Waste time.	Crying
I am helpless.	Panicky	Avoid homework.	Shallow breathing
I should be doing better/more faster.	Guilt		Muscle tension
	Anger		Headache
			Clench teeth

Use the circled words to make your personal negative thoughts interrelationship chart:

Thoughts	Emotions
Behaviors	Body Sensations

- 5) Here are four lists associated with neutral or positive thoughts. Circle the thoughts, emotions, body sensations, and behaviors you would like to experience. (Add to the lists if needed.)

Thoughts	Emotions	Behaviors	Body sensations
Practice helps.	Excited	Come to class prepared.	Relaxed
I can get support.	In control	Consult professor.	Calm
I have learned before.	Capable	Do my homework.	Peaceful
I intend to understand.	Proud	Ask questions.	Steady heartbeat
Understanding takes time.	Calm	Form a study group.	Strong

Use the circled words to make your personal neutral/positive thoughts interrelationship chart:

Thoughts	Emotions
Behaviors	Body Sensations

Task #3: Recognize Negative, Counter-productive, or Unhealthy Thoughts

Recognizing your negative thoughts is a step toward changing negative emotions, body sensations, and behaviors. Negative thoughts include mind-reading, exaggeration, polarizing (always, never), paranoia, guilt trips (should), put-downs, permanence, predicting failure, and refusing to consider positive or neutral interpretations. Neutral thoughts describe action, process, or alternate approach that encourage hope, engagement, and courage to face the challenge and struggle productively.

Identify whether each thought is negative or neutral. Circle one for each statement.

6) I will never understand math.	Negative	Neutral
7) I feel dumb and/or stupid.	Negative	Neutral
8) Math is out to get me.	Negative	Neutral
9) This has happened to me before. I have worked through it.	Negative	Neutral
10) Math problems contain tricks meant to stump me.	Negative	Neutral
11) I cannot do math.	Negative	Neutral
12) Maybe I need to ask some questions, or do some examples again.	Negative	Neutral
13) Everyone understands what to do except for me.	Negative	Neutral
14) Because I don't understand this, I will never be able to do math.	Negative	Neutral
15) The learning process is challenging.	Negative	Neutral
16) There must be something I don't quite understand here.	Negative	Neutral
17) I feel like an idiot.	Negative	Neutral
18) I have many resources to help me – MathXL/MyMathLab, notes, examples, the instructor, friends and tutors.	Negative	Neutral
19) Just because these few problems are difficult doesn't mean all the rest will be difficult, too. This is an opportunity for me to figure out what I misunderstood and correct it!	Negative	Neutral
20) I should understand this.	Negative	Neutral
21) I will take notes or ask a question so I can clarify this concept.	Negative	Neutral

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|--|----------|---------|
| 22) Math is a process and it has a way of being harder, then easier, then harder, then easier. | Negative | Neutral |
| 23) The material is new to me. I am not expected to understand it all immediately. I have many resources to help me understand this. | Negative | Neutral |
| 24) The teacher will be upset with me if I ask questions about this. | Negative | Neutral |
| 25) Establishing a relationship with my teacher might make asking questions during, or after, class easier. | Negative | Neutral |
| 26) I can act positively by taking a deep breath and congratulating myself for being courageous enough to take this class. | Negative | Neutral |

Task #4 Identify Positive Self-Talk

Positive self-talk is true inner statements that encourage and motivate you, help you think more freely, and get you on-track. Choose positive self-talk that you believe. If you have a strongly negative inner voice that tells you your faults, prepare to argue and practice arguing with that voice until you win. You will probably battle this voice many times, because the voice changes as we learn to answer it.

27) In the list below, circle or modify at least five statements that you can tell yourself and believe. Or create new statement(s) at the bottom.

- | | |
|--|---|
| I can do math. . | If I keep asking for help, I will get better. |
| I'm good at math. | Organization saves me time. |
| Math is fun. | I really like it when I get a problem right. |
| Math is easy. | I feel good about myself when I get a problem. |
| Math isn't that hard. | It's easier to study when I do it right away. |
| I am smart. | I feel better about math when my notes are neat and organized. |
| I can conquer this problem. | Learning math makes me smarter. |
| Math isn't hard if I study and try. | I understand math more when I do my homework every day. |
| Math is only as hard as I make it out to be. | Math makes my brain more organized. |
| Math is only hard at first. | This problem is not as difficult as I thought. |
| Math can be fun. | The more math I learn, the more money I will make. |
| Math is cool. | Hard work pays off. |
| I am smart enough to learn math. | I am responsible for my grade in this class. |
| I am smart enough to understand math. | I will be a better and smarter student in the end. |
| I can be good at math. | Doing my homework will help get me out of this class. |
| Studying helps a lot! | Math is making me more systematic. |
| I don't have to be "good at math" to do well. | Math is making me more logical. |
| Going to class keeps me on track. | Math is making me more analytical. |
| Math gets easier when I practice doing the problems. | I will not settle for less. I paid for this class – I will pass it. |
| Math gets easier when I use the MathXL/MyMathLab help. | Every time I do my homework, I get better at math. |
| I learn more math when I ask questions. | My hard work in math is paying (or will pay) off. |
| I learn more math when I see a tutor. | When I breathe, I am calmer while I'm doing my math. |
| I learn more math when I ask my friend. | If I keep working, I will do better than I'm doing now. |
| I learn more math when I work with a study group. | The secret of getting ahead is getting started. |
| If I keep practicing, I will get better. | The more problems I solve, the better I get. |
| If I keep doing homework, I will get better. | Organization is key in math. |
| If I keep taking notes, I will get better. | |
| Math comes easier with more practice. | |
| I learn from my mistakes. | |
| If I keep seeing a tutor, I will get better. | |

Task #5: Seven Strategies for Changing Negative Thoughts

Strategy 1: Do Something Differently

Identify a behavior that contributes to your negative math thought.

Behave in a new way to get a different result.

Examples of behaviors that contribute to negative math thoughts include:

- Skipping class
- Not taking notes in class
- Not asking questions
- Procrastinating doing homework (or not doing it at all)
- Not reading the textbook or examples in MathXL/MyMathLab or the book
- Not studying for exams
- Procrastinating and cramming for exams
- Hanging out with people who disrespect going to college or doing math

28) Name one behavior that is not productive with regard to math. How can you change it to get a better result?

Strategy 2: Get a Different Perspective

Tell yourself what you would tell a close friend who has this thought. Create an inner voice that sounds like a good friend who has your best interests in mind. Imagine an inner dialogue where that inner voice encourages you and reminds you of what's important and how to get it done.

29) Suppose you have a sister or brother who said "I am too stupid to do math". What would you tell him or her to convince them they are not too stupid to do math?

Strategy 3: Change the Wording

We want thoughts that motivate us to work harder, because success comes to those who work. Positive self-talk should not be self-deceptive. (For example, “When it’s on the quiz I’ll get this, even though I don’t get it now” is delusional. If you’ve never done it, you won’t be able to do it on a test or quiz. Delusions merely postpone negativity.)

Telling yourself what you *should* do can be positive or negative. Statements like “I should do... *{insert a good study behavior here}*” can get you to work, or can make you feel guilty and paralyze you. Instead, using words like “easier” or “helps” can change an “I should do this...” statement to positive self-talk. Some people create positive self-talk by remembering how they feel or what math can do for them.

Remember, the goal is to argue with your inner voice and win, so that you work harder and succeed. For example:

Negative or counterproductive thought: I don’t feel like doing homework. I’ll be okay if I don’t do it.

More neutral and useful statement: If I don’t do my homework, I’ll start to fall behind and get confused.

OR:

More neutral and useful statement: When I do my homework, I get better grades on quizzes and exams.

Choose two negative or counterproductive statements that your inner voice might say, and re-write them as more neutral and useful, but still true, statements. For ideas, look back at your answers on pages 3 and 4, or at the behavior list at the top of page 6. Your new statement should have no negativity. You may want to read the instructions to Task #3 again.

30) Negative thought: _____

More neutral and useful statement: _____

31) Negative thought: _____

More neutral and useful statement: _____

Optional: You may wish to repeat this exercise for other negative thoughts you have.

Strategy 4: Fake it ‘til you make it

Act as if you already are the kind of person you would like to become.

One behavior is asking questions. Many people avoid asking questions because they are embarrassed or confused or because they fear what others will think. Some people remember teachers who made them feel bad because they asked a question, or teachers who were impatient, or didn’t answer the question. Some don’t know what to ask. They fear that asking a question is bad.

In this class, asking questions is good. Please ask questions.

Asking questions has several positive outcomes:

- If you ask about an alternate method that’s illegal, you avoid making mistakes and losing points.

- Most of the time, other students have the same questions you do – or something related. Class discussion is enhanced and everyone learns more when questions are asked.
- If you ask about an alternate approach and it turns out to be shorter and correct, you won't take so long doing homework, quizzes, or exams. And neither will your classmates!
- If it's been a while since you took math, or you've always been a C student, there are probably background topics you never quite got, but might be important to what we're doing now. Asking about any step you don't understand, or anything that seems like a skipped step can help.
- Here are some common questions: Is this idea legal? Is it quick? Is it easy? Does it apply to this problem? If it were a different problem, would it still work? I didn't understand the third step, would you please explain that again? Can I do this on my calculator? If so, how? What does that word mean? What does that math symbol mean? How did you get ...? Why are the units squared?

32) If you want to be a successful math student, you want to act like a successful math student. List 3-5 behaviors that good math students have.

33) Which of these behaviors do you already do?

34) Which of these behaviors can you begin doing now, or increase what you are doing?

Strategy 5: Ten Minutes of Frustration

Frustration is the emotion we feel when we want something but aren't getting it. A reasonable amount of frustration is good, because we learn to be patient, methodical, and persistent. But if we are frustrated beyond our patience and tolerance, we can lose motivation and quit. It's important to limit our frustration to what we can bear, so that we can continue to work hard – the key to being successful.

When working on a homework problem that's hard, set a timer for ten minutes. Work on that problem until the timer goes off or you figure it out. If the timer goes off, stop work on that problem and go on to the next. If you get to the end of the assignment, ask yourself how it's going. If you're starting to get some problems right, go back to the problems you skipped. Maybe you'll get them this time! But if you're feeling frustrated about the entire assignment, take a break for ten minutes. While you're taking a break, think about different approaches: Do you have a friend, family member, tutor, or study group? Could you find help on the web? What is a question you could ask, which would help you understand more of the assignment?

35) What is your reaction to the "Ten Minutes of Frustration" strategy?

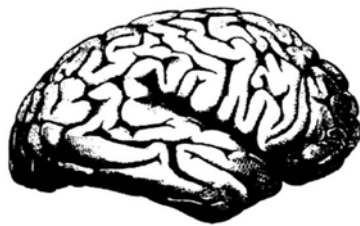
Strategy 6: Reminders

Make a small card or sticky note with one or more positive self-talk statements or strategy reminders. Put it in your math notebook or in your study area to remind you.

36) Write one (or more) phrase(s) for a reminder card or note.

Strategy 7: Be aware of Growth vs. Fixed Mindsets

The following article and questions were created as part of the Carnegie Math Pathways curriculum.



Article: You Can Grow Your Brain

New Research Shows the Brain Can Be Developed Like a Muscle

Many people think of the brain as a mystery. We don't often think about what intelligence is or how it works. And when you do think about what intelligence is, you might think that a person is born either smart, average, or dumb—either a "math person" or not—and stays that way for life.

But new research shows that the brain is more like a muscle—it changes and gets stronger when you use it. Scientists have been able to show just how the brain grows and gets stronger when you learn.

Everyone knows that when you lift weights, your muscles get bigger and you get stronger. A person who can't lift 20 pounds when they start exercising can get strong enough to lift 100 pounds after working out for a long time. That's because muscles become larger and stronger with exercise. And when you stop exercising, the muscles shrink and you get weaker. That's why people say "Use it or lose it!"

But most people don't know that when they practice and learn new things, parts of their brain change and get larger, a lot like the muscles do. This is true even for adults or older teenagers. So it's not true that some people are

stuck being “not smart” or “not math people.” You can improve your abilities a lot if you practice and use good strategies.

Inside the outside layer of the brain—called the cortex—are billions of tiny nerve cells, called neurons. The nerve cells have branches connecting them to other cells in a complicated network. Communication between these brain

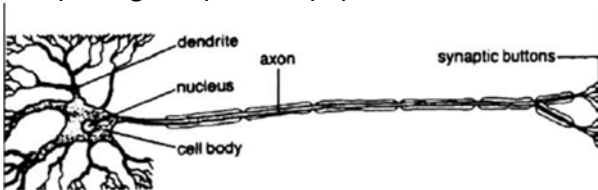


A Section of the Cerebrum nerve fibers (white matter)

cells is what allows us to think and solve problems.

When you learn new things, you actually grow more of these tiny connections and they get stronger. The more you challenge your mind to learn, the more your brain cells grow.

Then, things that you once found very hard or even impossible to do—like understanding history, doing algebra, or completing complicated paperwork—become easier. The result is a stronger, smarter brain.



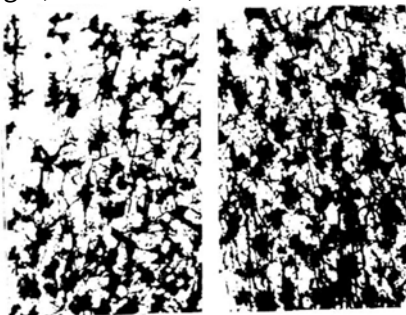
A Typical Nerve cell

How Do We Know That The Brain Can Grow Stronger?

Scientists started thinking the human brain could develop and change when they studied adult animals’ brains. They found that animals who lived in a challenging environment, with other animals and toys to play with, were different from animals who lived alone in bare cages.

The animals who lived alone just ate and slept all the time, but the ones who lived with different toys and other animals were always active. They spent a lot of time figuring out how to use the toys and how to get along with other animals.

These animals had more connections between the nerve cells in their brains. The connections were bigger and stronger, too. In fact, their whole brains were about 10% heavier than the brains of the animals who lived alone without



Nerves in brain of animal living in bare cage.

Brain of animal living with other animals and toys.

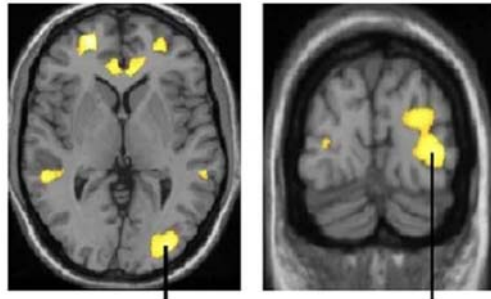
toys.

The adult animals who were exercising their brains by playing with toys and each other were also “smarter” –they were better at solving problems and learning new things.

Can Adults Grow Their Brains?

Scientists have recently shown that adults can grow the parts of their brains that control their abilities—like the ability to do math or even to juggle.

In one study, scientists found a group of adults who were not jugglers. They taught half how to practice juggling in the right way. These people practiced for a long time and got much better at juggling. The other half didn't



practice, and didn't get better.

Next, the scientists used a brain scanner to compare the brains of the two groups of people. They found that the people who learned how to juggle actually grew the parts of their brains that control juggling skills. Their brains had changed, so they actually had more ability.

This was surprising because these people said before the study that they couldn't juggle—just like some people say they're "not good at math" or "not smart at school." But when they kept trying and learned good strategies for practicing, they actually learned and grew their brains.

Two Parts of Your Brain That Need to Grow: The "Knowing" Part and the "Know How" Part

The brain doesn't just learn things; it also learns how to *do* things. Scientists have shown that people can grow two types of intelligence: the "knowing" type and the "know how" type. The "knowing" type of intelligence is what most people think about when they are learning new things in science or English or history. But you also need to learn skills that let you use your brain in a smarter way.

How do scientists know that you can grow the "know how" part of your brain? One example comes from the brains of taxi drivers in London, England. The streets of London are like a terrible maze. They are very hard to get around in. Brain scientists found that the longer the taxi drivers spent practicing driving in the streets of London, the more their brains grew. The "hippocampus" area of the brain—which controls memory for how to do everyday things—was actually larger! This means the more they practiced driving the confusing streets of London, the more the "know how" part of their brain grew. Although you might not realize it, we all grow the "know how" part of our brains whenever we learn to do new, hard things.

People often forget that we need to grow the "know how" part of our brains. If you study a long time but use a bad strategy, you may not learn—even if you try very hard. A few students study by doing the same set of easy problems and skipping the hard ones. Or they just re-read the textbook but don't try to challenge the ideas. After all, it's easier that way. But when it comes time to do the test, they don't do well because they didn't do things that grew their brains and taught them new things. When this happens, they may even say "I must not be smart at this."

But brain scientists have shown that a stronger brain doesn't just happen to you because you put in the time. You have to practice in the right way. If a weight lifter watched other people exercise all day long, he wouldn't get any stronger. You actually have to practice the right way—and usually that means the hard way—to get better at something. In fact, scientists have found that the brain grows more when you use new and different strategies. The brain grows less when you stick to things you already know.

How do you grow the "know how" part of your brain? You do it by seeking out help from others, like teachers or older students who do well. Or by going to the academic support center or getting tutoring. And then you practice successful strategies. At first it can be hard—sometimes people feel dumb for not knowing simple things like how to take notes, how to study, or even how to sign up for their classes. Or they feel not smart if they go to a tutor. But it's actually the opposite. Practicing better strategies makes your brain smarter.

The Truth About "Smart" and "Dumb"

People aren't "smart" or "dumb" in school. At first, no one can read or solve equations. But with practice, they can learn to do it. And the more a person learns, the easier it gets to learn new things. This is because the "knowing" and "know how" brain muscles have gotten stronger.

This is true for everyone, even adults or college students. Dr. Wittenberg, the scientist from Wake Forest University who did the research on juggling, said “We used to think adults can’t form new brain connections, but now we know that isn’t true.... The adult brain is like a muscle, and we need to exercise it.”

People who don’t know this can miss out on the chance to grow a stronger brain. It does take work to learn, just like lifting more weights or becoming a better juggler does. Sometimes it even hurts! But when you feel yourself get better and stronger, you realize that all the work is worth it.

References:

A similar version of this article, written by Lisa Blackwell, can be downloaded from:

www.brainology.us/websitemedia/youcangrowyourintelligence.pdf.

Blackwell, L. A., K.H. Trzesniewski, and C.S. Dweck. “Theories of Intelligence and Achievement Across the Junior High School Transition: A Longitudinal Study and an Intervention.” *Child Development* 78 (2007): 246-263.

Driemeyer, Joenna, Janina Boyke, Christian Gaser, Christian Buchel, and Arne May. “Changes in Gray Matter Induced by Learning—Revisited.” *PLoS One* 3 (2008): e2669. doi:10.1371/journal.pone.0002669.

Maguire, E. A., D.G. Gadian, I.S. Johnsrude, C.D. Good, J. Ashburner, R.S. Frackowiak, and C.D. Frith. “Navigation-Related Structural Change in the Hippocampi of Taxi Drivers.” *Proceedings of the National Academy of Sciences* 97 (2000): 4398-4403.

Nordqvist, C. “Juggling Makes Your Brain Bigger – New Study.” *Medical News Today* (February 1, 2004). Retrieved from <http://www.medicalnewstoday.com/releases/5615.php>.

Questions: You Can Grow Your Brain

37) Think about the article that you just read. What are all the reasons why scientists say that people's math ability can grow and get better with effort and practice? Please summarize them briefly below.

In the article, you learned three things:

- When you work hard and learn new things, your brain grows new connections and you get smarter.
- The more you challenge yourself, the smarter you will become.
- Smart kids are the kids who have practiced more—they have built up their reading and math "muscles."

38) Think about an example from your own life. What is something you weren’t good at first but then practiced using a good strategy and became really good at it? Write about it and explain how you became good at it.

- 39) Not all math students know that the brain can get smarter, even though it may help them have success. And we want to get your help so that we can learn more about how to explain it to them. We're hoping you can explain—in your own words—that the brain gets smarter when people use good strategies and try hard.

Imagine a friend who is struggling in school. This friend used to do pretty well in school but now is having a hard time and is starting to feel dumb. Write a letter to your friend to encourage him or her—tell them about what you just learned about the brain and why they shouldn't be discouraged. For example, you can tell them:

“Dear friend,

I realize that you feel discouraged in your math class because it is becoming a bit challenging for you, but after learning that our brain grows after practicing something hard I strongly encourage you to continue. I have learned that changing our studying strategies, asking for help, using resources, and practicing will help us improve what we do not understand. Life is a challenge and if everything was easy then the whole world would be boring. We have to grow our "know how" parts of our brain which requires a lot of effort. Our brain can become stronger and smarter by practicing what we do not know. So don't give up on your math class; challenge yourself.”

Here are some other general ideas you can share with them:

- A. How they can get smarter if they work hard and use a good strategy.
- B. How they should work hard to build their reading and math muscles.
- C. How they are not dumb, they just need to practice using a good strategy.
- D. How they can ask the teacher or other students to help them learn better ways to study.
- E. Any other tips you have for learning in school and getting smarter.

Don't worry about writing a perfect final draft. We just want to know how you would say this to another student in your own words.

Use the back of this page to write your letter.

In Summary:

- 40) Not every idea works for every person. Which strategies or ideas in this packet seemed most helpful?

- 41) What thoughts or feelings do you have now or did you have while working on this packet? Is there anything you would like to add to your autobiography?