I-1: Convince students that hard work leads to success ("I Can")

Teach Lessons on Malleable Intelligence

Why Do I Need to Teach Lessons on Malleable Intelligence?

Some of your students may enter the classroom doubting their ability to perform what is asked of them, a perspective based on previous academic experiences. They may have adopted a theory of "fixed intelligence" instead of believing that intelligence and academic success are functions of hard work and are therefore accessible to them. Teachers in low-income communities must break through that perspective, instilling the theory of "malleable intelligence," which assumes that:

- intelligence is not a fixed trait that one simply possesses
- intelligence can be cultivated through learning
- with effort and guidance, anyone can increase their intellectual abilities

Because student belief in malleable intelligence is absolutely critical to success, teachers must explicitly discuss and message ideas of malleable intelligence with students, an approach that is supported by recent research. (Note: At the secondary level this may be more challenging, as students may have a longer history of doubting their abilities.)

Students Who Believe in Fixed Intelligence:	Students Who Believe in Malleable Intelligence:
Will not see how their work will lead to achievement and may be reluctant to exert effort	Will believe intelligence is a function of effort and will work to achieve
Believe they struggle because they are inherently incapable.	Believe they struggle because they need more experience or should try harder—not because they are inherently incapable.
Are easily discouraged when faced with difficult tasks.	Engage fully in new tasks and are less likely to become easily discouraged when faced with difficult tasks.
View the difficulties they face as an attack on their ability and therefore prefer to protect their self-esteem by pursuing low-risk, easier tasks.	Are willing to stretch their skills (since easy tasks waste their time rather than raise their self-esteem).
Avoid high-risk tasks (and become withdrawn), create a distraction from it (and cause behavior problems), or "self-handicap" by withholding effort.	Are willing to exert effort to master something. (If your intelligence can be increased why not do that? Why waste time worrying about looking smart or dumb, when you could be becoming smarter?)
Under-perform, so they can explain that they hadn't tried their hardest, preserving the possibility that they could perform well if they had tried.	Can more readily accept struggle as "situational" rather than feel defined by it.
Attribute failure to forces outside their control. (In turn, they may	Feel good about their intelligence and therefore enjoy putting their knowledge to good

attribute success to "luck" and take less responsibility for challenges.) Failure is a confirmation of their low self-esteem.	use (for example to help other students learn).

The Research Behind Teaching Your Students Malleable Intelligence

A recent study by faculty at Columbia University indicates that actually *teaching* your students about malleable intelligence theory - sharing this information with them on how the brain works - can increase their levels of academic achievement.

The study in question focused on two groups of junior high school students receiving direct, one-on-one tutoring time and individual instruction. The control group was not given access to this information on malleable intelligence, while the experimental group of students read articles on this theory and the research that supports it, and discussed with their mentors how the brain works and expands over time to accumulate knowledge. The results from the study showed that students who believed their intelligence was malleable held many other positive attitudes about learning as a goal and working hard to achieve success, and therefore they chose more positive, effort-based strategies to attack any difficulties they encountered in their academic work. The study revealed a strong correlation between these positive attitudes/work methods and the success of the students in terms of their mathematic abilities.

For another measure of difference between the control and experimental groups, researchers asked the teachers of each group of students to assess changes in their students' classroom motivation over the period of the intervention. (Note: as the intervention occurred outside the classroom, teachers did not know which students were in which group and had received this information.) Teachers cited a positive change in the effort and interest in 27% of the students in the experimental group, compared to 9% of the students in the control group. Typical comments from teachers showed that those students who were taught about malleable intelligence were not only more likely to have increased their performance levels in the classroom, they were also more likely to be more interested and engaged in learning.

How Do I Teach Malleable Intelligence?

How can you do it in your own classroom? Below are some resources and strategies to stimulate your thinking about how to teach malleable intelligence and to reinforce students' understanding of the brain and intelligence theory (some will need to be adapted for your students' age level).

- Have students read an article, written on their reading level, that describes research backing the theory of malleable intelligence in student-friendly terms.
- Distribute a handout, titled "BrainWize – Brain Growth Research (see "Tools" section of I-1) that describes specific experiments performed on rats, human infants, taxi drivers in London, and learning a second language as an adult.

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- Distribute handouts on "Brain Facts" with short bullet-point items about how students can "get smarter by exercising your brain," as well as handouts on how memory works and how students can develop their memory skills (explaining to them how to use "chunking," a visual image, acronyms, etc.).
- Have students fill out worksheets to relate their previous knowledge to malleable intelligence, by describing their favorite activity and responding to questions on how they got better at it over time.
- Experiment with students to "discover" results of hard work. Present students with a test, without offering them the opportunity to study. Assume grades will be unimpressive. Then offer your students a comparable test, but specifically devote class time to review and prepare. Watch the effect of studying become tangible.
- See the I-1 Tools section for some examples of tools you can use to teach malleable intelligence.

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Malleable Intelligence Article

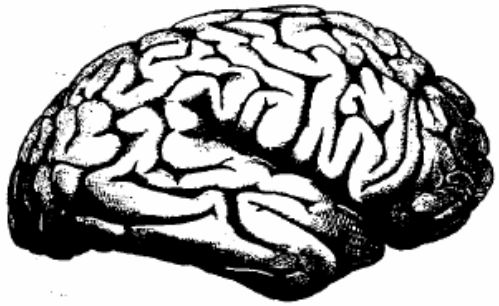
You Can Grow Your Intelligence

New Research Shows the Brain Can Be Developed Like a Muscle

Many people think of the brain as a mystery. They don't know much about intelligence and how it works. When they do think about what intelligence is, many people believe that a person is born either smart, average, or dumb–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. And 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 the muscles become larger and stronger with exercise. And when you stop exercising, the muscles shrink



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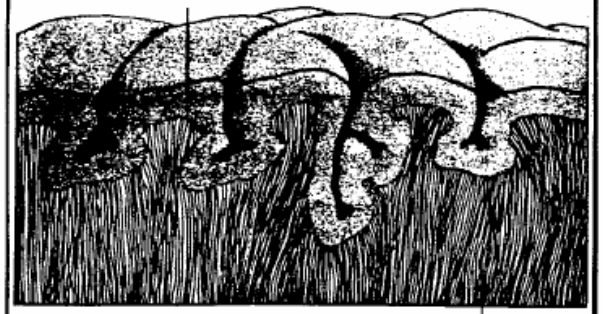
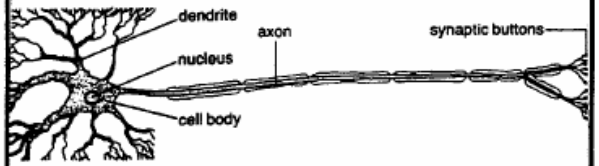


A Section of the Cerebrum nerve fibers (white matter)

When you learn new things, these tiny connections in the brain actually multiply and get stronger. The more that 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 speaking a foreign language or doing algebra–seem to become easy. The result is a stronger, smarter brain.



A Typical Nerve cell

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.

While the animals who lived alone just ate and slept all the time, 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 get along with the 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 toys.

The 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.

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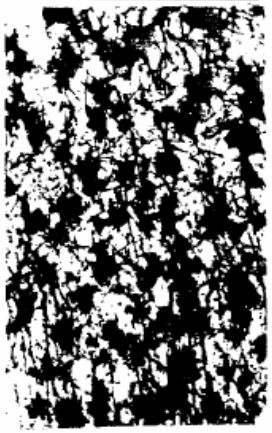
Nerves in brain of animal living in bare cage.



Brain of animal living with other animals and toys.

Children's Brain Growth

Another thing that got scientists thinking about the brain growing and changing was babies. Everyone knows that babies are born without being able to talk or understand language. But somehow, almost all babies learn to speak their parents' language in the first few years of life. How do they do this?

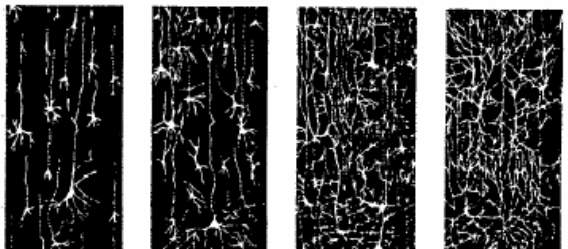
The Key to Growing the Brain: Practice!

From the first day they are born, babies are hearing people

Later, when they need to tell their parents what they want, they start practicing talking themselves. At first, they just make goo-goo sounds. Then, words start coming. And by the time they are three years old, most can say whole sentences almost perfectly.

Once children learn a language, they don't forget it. The child's brain has changed–it has actually gotten smarter.

This can happen because learning causes permanent changes in the brain. The babies' brain cells get larger and grow new connections between them. These new, stronger connections make the child's brain stronger and smarter, just like a weightlifter's big muscles make them strong.



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The Real Truth About "Smart" and "Dumb"

No one thinks babies are stupid because they can't talk. They just haven't learned how to yet. But some people will call a person dumb if they can't solve math problems, or spell a word right, or read fast--even though all these things are learned with practice.

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–because their brain "muscles" have gotten stronger!

The students everyone thinks is the "smartest" may not have been born any different from anyone else. But before they started school, they may have started to practice reading. They had already started to build up their "reading muscles." Then, in the classroom, everyone said, "That's something that grownups find very hard to do. They just need to build up their "reading muscles" too.

What Can You Do to Get Smarter?

Just like a weightlifter or a basketball player, to be a brain athlete you have to exercise and practice. By practicing you make your brain stronger. You also learn skills that let you use your brain in a smarter way--just like a basketball player learns new moves.

But many people miss out on the chance to grow a stronger brain because they think they can't do it, or that it's too hard. It does take work, just like becoming stronger physically or becoming a better ball player

Malleable Intelligence Handout

BrainWize – Brain Growth Research

Here are descriptions of different research studies that all showed how learning changes the brain.

Babies' Brains: Newborn babies have plenty of neurons, but the cells have very few connections between them. Because they are learning so much in their first few years, babies develop many new connections between their brain cells. By the time you become an adult you will have a trillion or more of these connections!

Clever Cabbies: London cabbies have to learn the locations of many different places, because their streets don't have numbers. Researchers measured the hippocampus – the area of the brain that remembers information about places – in London cabdrivers and compared them to other people's. The cabbies' were bigger, and the longer they were on the job, the bigger this area of the brain became! This shows that learning and practicing this skill made that area of their brain grow.

Learning Languages: Most people think that learning a second language once you are an adult is very hard. But researchers had adults use special exercises to practice hearing different sounds. Using a PET scan to measure the activity in the brain, the researchers found that when people did the special exercises, areas of their brains that they had never used before became active. This shows that you can retrain your brain and develop new abilities all through your life.

Musical Mastery: When people play an instrument, they use a special area of the brain to coordinate the movement of their fingers. Researchers found that when the people practiced playing an instrument, the area of the brain that controls the fingers grew larger! This shows that when you learn and practice a new skill, you can build up that area of the brain.

New Neurons: Scientists used to think that we had a fixed amount of brain cells and that we could

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never grow new ones. But in the past decade, research has shown that the brain grows new cells every day! The cells are grown in the hippocampus, an area important in memory, and they travel to other areas of the brain. They also found that the brain grows more new cells when you are learning new information and skills! So, by learning and practicing, you actually add brain cells as well as new connections.

Remarkable Rats: Twin rats were raised in two different environments: either in a bare cage with food and water, or in a cage with lots of toys and exercise equipment to explore. In the bare cages, the "cage potato rats" just ate and drank and laid around, while in the enriched environment, the "summer camp rats" were busy exploring and learning, exercising their brains. It turned out that the summer camp rats became much smarter than the cage potato rats – they were better at learning new things. And their brains were heavier, too: they had more connections between the neurons in their brains. This research shows that active mental exercise builds up the brain and makes it smarter. Even old rats were able to develop their brains in the enriched environment, proving that you're never too old to grow your brain!

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Two Strategies for Exploring Students' Views of Intelligence

Strategy #1: In order to shape your students' view of intelligence and whether or not they believe in the value of hard work to "get smart", it may be helpful to diagnose students' perceptions of why they were able to succeed on an assignment. Below is a sample student survey that could be modified for a variety of assignments, such as a test, a project, an oral presentation, etc.

Student Name: _____

	Not at all a reason	Not much of a reason	A reason	A good reason	A very important reason

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If you did well on this test, is it because:					
You studied hard?	**1**	**2**	**3**	**4**	**5**
You studied the right things?	**1**	**2**	**3**	**4**	**5**
You are smart?	**1**	**2**	**3**	**4**	**5**
I explained things well?	**1**	**2**	**3**	**4**	**5**
You studied the right things?	**1**	**2**	**3**	**4**	**5**
Someone helped you?	**1**	**2**	**3**	**4**	**5**
The work was easy?	**1**	**2**	**3**	**4**	**5**
If you did poorly on this test, is it because:					
You didn't study much?	**1**	**2**	**3**	**4**	**5**
You didn't study the right things?	**1**	**2**	**3**	**4**	**5**
You are not smart?	**1**	**2**	**3**	**4**	**5**
I didn't explain things well?	**1**	**2**	**3**	**4**	**5**
You weren't helped by anyone?	**1**	**2**	**3**	**4**	**5**
The work was hard?	**1**	**2**	**3**	**4**	**5**

Strategy #2: Some teachers might be surprised at the thought of spending class time discussing the theory of malleable intelligence or the value of hard work. However, identifying whether students view their intelligence and ability as something they can improve through hard work, or something they can never change, will help you identify students most in need of a "mind shift."

Conversation starters:

- Do you agree or disagree with the following statement? You have a certain amount of intelligence, and you really can't do much to change it.
- What does it mean to be smart? (in science? in math? in English?)
- Could a student who has a lot of trouble with _____ ever become really good at it?
- What would a student who doesn't do well in _____ need to do if he or she wanted to do well?
- If a student didn't think he was as smart in _____ as he would like to be, is there anything he could do to become smarter? If yes, what could he do? If no, why isn't there anything he could do?

These two strategies were modified from: Stipek, Deborah. *Motivation to Learn: Integrating Theory and Practice.* Boston: Allyn & Bacon, 2002.

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