

How Our Brains Work

What's So Important About the Brain?

Our brain can serve as a map for showing us how we learn and why we behave the way we do. Neuroscience provides a wealth of information that can help us and our students become better thinkers and healthier people.

Why Introduce Students to Brain Research?

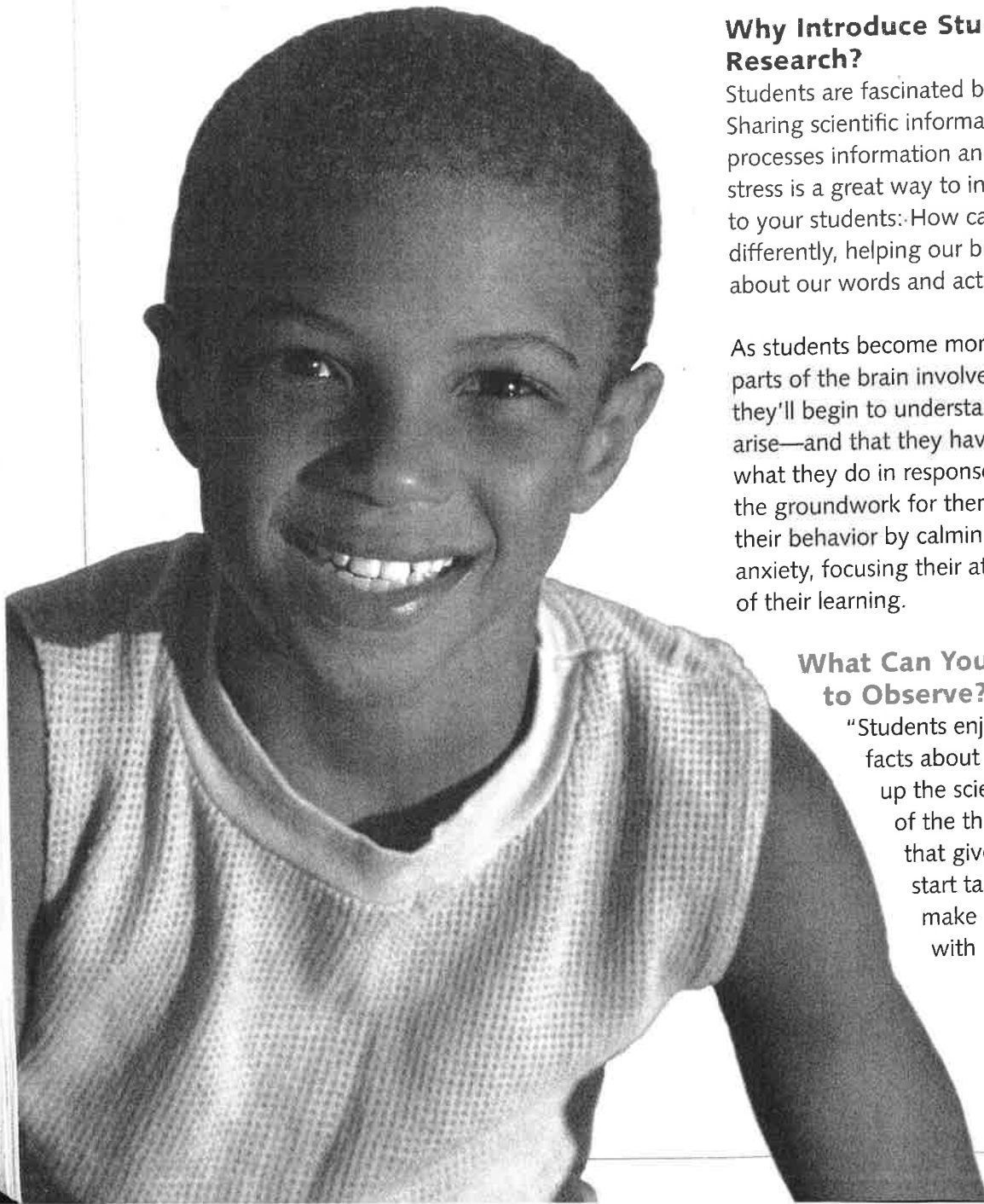
Students are fascinated by facts about their brains. Sharing scientific information about how the brain processes information and is wired to react under stress is a great way to introduce a challenge to your students: How can we learn to react differently, helping our brain make wise choices about our words and actions?

As students become more familiar with three key parts of the brain involved in thinking and learning, they'll begin to understand how their feelings arise—and that they have the ability to change what they do in response. This understanding lays the groundwork for them to monitor and regulate their behavior by calming themselves in the face of anxiety, focusing their attention, and taking control of their learning.

What Can You Expect to Observe?

"Students enjoy learning and sharing facts about their brains. They easily pick up the scientific names and functions of the three parts of the brain and that gives us a common language to start talking about the choices they make in learning and in interacting with peers."

—Third-grade teacher



Linking to Brain Research

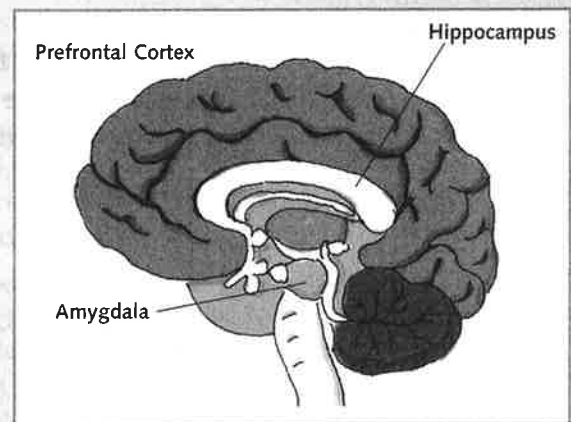
Meet Some Key Players in the Brain

The limbic system controls emotions and motivations from deep inside the brain. A key player of the limbic system is the amygdala. The amygdala is a pair of almond-shaped structures that reacts to fear, danger, and threat. The amygdala regulates our emotional state by acting as the brain's "security guard," protecting us from threats. When a student is in a positive emotional state, the amygdala sends incoming information on to the conscious, thinking, reasoning brain. When a student is in a negative emotional state (stressed or fearful, for example) the amygdala prevents the input from passing along, effectively blocking higher-level thinking and reasoned judgment. The incoming stimuli and signals are left for the amygdala itself to process as an automatic reflexive response of "fight, flight, or freeze."

The hippocampus is another limbic system structure. These twin crescent-shaped bodies reside in the central brain area, one behind each ear, in the temporal lobes. The hippocampus assists in managing our response to fear and threats, and is a storage vault of memory and learning.

Information from the limbic system is fed to the prefrontal cortex—the learning, reasoning, and thinking center of the brain. This highly evolved area of the brain controls our decision making, focuses our attention, and allows us to learn to read, write, compute, analyze, predict, comprehend, and interpret.

Learning about these key players helps students understand how their brains respond to stress and prepares them for creating a calm mindset for thoughtful decision making, led by the prefrontal cortex.

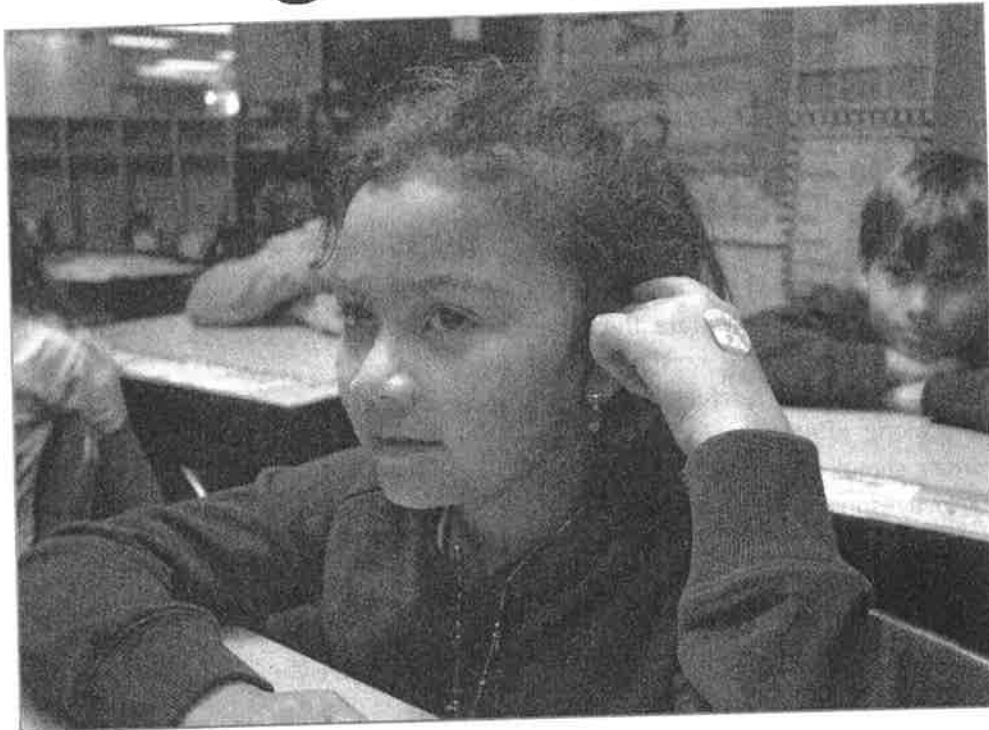


Clarify for the Class

Make a model to show how the brain processes information under stress. Fill a clear plastic bottle with water, an inch of sand, some glitter, and metallic mini-confetti. To demonstrate the way the amygdala on alert scatters information, shake the bottle and mix up the solution. The settling solution represents the calming mind—eventually the bits of information flow in a clear direction, some of them to the PFC for thoughtful decision making.

Discuss: Name a time when you felt so worried or anxious your mind was working like the shaken bottle. What helped you think more clearly?

Getting Ready



Where is it?

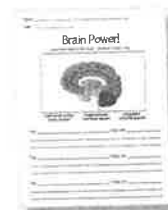
A student points to the location of the amygdala, deep inside the brain.

GOALS

- Students identify the amygdala, the hippocampus, and the prefrontal cortex (PFC) on a diagram of the brain.
- Students will give a simple definition of these three parts of the brain.

MATERIALS

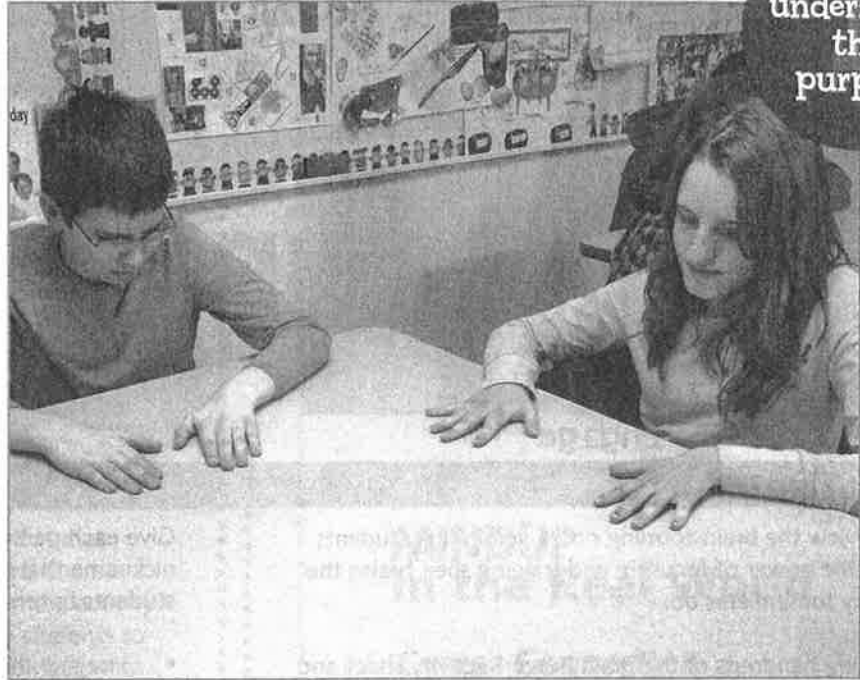
- chart paper
- MindUP poster "Getting to Know and Love Your Brain"
- Brain Power! activity sheet (p.152)



CREATING THE OPTIMISTIC CLASSROOM

Classroom Management Nurture students' sense of independence and control by doing the following:

- Teach students where in the room to look or go for supplies or resources before asking for help.
- Encourage discussion in partners or small groups.
- Allow students to generate questions before lessons and reflect on learning afterward.
- Encourage self-assessment and self-monitoring.
- Provide choices, whenever possible, in tools and avenues for learning.
- Celebrate times when students have worked hard to learn something new or succeeded in honing their skills.



How did my brain do that?
Students build background about their brains, learning how their brain activates muscle responses in their fingers.

MINDUP Warm-Up

Brain Exercise Discussion

Display photos of a few famous athletes and ask students to name others. Invite students to brainstorm what these athletes have in common. List on chart paper their responses, such as working hard, eating well, and committing to regular practice.

Point out that in order for athletes to succeed, they need to exercise their minds as well as their bodies. Successful athletes learn to focus their attention, manage distractions, and continuously improve their skills in their sport. Have students reflect on Olympic events or other sporting events they've watched and how they've seen top athletes focus (e.g., baseball players may study a pitcher and time their swings before they go to bat, runners may visualize their course before they begin a race, and so on).

Explain that by participating in MindUP lessons, students are going to learn ways to exercise their brain—the more they exercise it, the stronger, smarter, and more confident it becomes!

Discuss: The word “brainstorm” means to allow ideas to tumble out of your brain—it's one kind of activity for strengthening your thinking skills. What types of activities do you already do on a regular basis (such as crossword puzzles, concentration, or number games) to exercise your mind?

Leading the Lesson

The Brain in Action

Engage

What to Do

Review the brainstorming notes, reminding students of the power of focusing and training their brains the way top athletes do.

Using handouts of the Brain Power! activity sheet and the "Getting to Know and Love Your Brain" poster for reference, introduce the three key parts of the brain involved in thinking and acting: the prefrontal cortex, the amygdala, and the hippocampus.

- The brain operates like an orchestra with thousands of instruments, each playing its own tune but all working together to create a beautiful piece of music. Today we're going to learn about three parts of the brain that are important in thinking, in dealing with our feelings, and in learning new things.

Have students pronounce the terms with you and discuss the role and location of each part. Let them point to their own head as a model (PFC—right behind the forehead; amygdala—deep inside, behind each ear; hippocampus—just behind the amygdala on both sides.)

Explore

Give each part of the brain you've discussed a role or nickname that is related to its function and is easy for students to remember.

- Imagine the prefrontal cortex is an orchestra leader who directs the different instruments to produce a harmonious, unified musical sound.
- Imagine the amygdala is the musicians themselves, whose playing expresses their feelings in response to music but who must also collaborate and follow the directions of the conductor.
- Imagine the hippocampus is the sheet music, which the musicians can refer to in order to help them remember the notes they must play.

Invite students to give examples of times when their amygdala alerted them to real danger (e.g., reacting to a ball flying toward you, the sound of screeching tires, or the smell of smoke) and when it made them nervous or worried about something stressful, but not dangerous (e.g., performing a piece of music for the first time).

- How did your reaction affect your ability to think and plan?

Why It's Important

Using analogies like the orchestra and visual models to establish the locations of the brain parts captures students' interest, reinforces concepts in several different ways, and helps them build a foundation of background knowledge for future lessons.

- Reactions to stress and to danger are both controlled by the amygdala. It's important to understand that while the amygdala can help keep us safe, sometimes it signals danger when there is none—and that shuts down our ability to think clearly by blocking information to the PFC.

From the Research

Students are more likely to remember and really understand what they learn if they find it compelling or have some part in figuring it out or discovering some part of it for themselves. (Willis, 2006)

Reflect

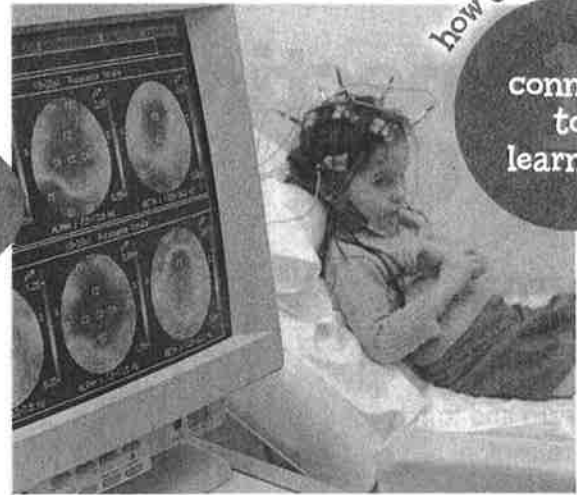
To review, have students pair up and retell in their own words the function of each brain part. Then have them fill in the name of each part on the activity sheet and explain its function. Encourage students to add notes and words that help them remember what each part does.

Share a few scenarios to ensure that students can identify the brain parts and their functions.

- Try to imagine this situation: You are walking to school and suddenly you see a small squirrel run out in front of a car. How does your body react? What are you thinking? How does your body feel?
- Was it your brain's wise leader (the prefrontal cortex), your brain's security guard (the amygdala), or your brain's memory saver (the hippocampus) that came into play?

Conclude this lesson by sharing with students that future MindUP lessons will help them calm their amygdala when there's no danger, strengthen their ability to focus by getting information to the PFC efficiently, and store important ideas in their hippocampus.

Providing real-life scenarios about different types of reactions to everyday situations gives students useful examples to attach meaning to. This review lays the groundwork for the next lesson, which connects mindful and unmindful behaviors to the roles of the amygdala and PFC.



how our brains work

connect
to
learning

MINDUP In the Real World

Career Connection

If you're fascinated by the brain and how it works, you might consider a career as a neuroscientist. A neuroscientist is anyone who studies the brain and central nervous system. Within the wide-ranging field of neuroscience, there are many specialized jobs; for example, a *neuroanatomist* studies the structure of the nervous system, while a *neurochemist* investigates how neurotransmitters work. If operating on the brain sounds exciting, consider the work of a *neurosurgeon*, or, if you're concerned about diseases that affect the brain, become a *neuropathologist*. A *neuropsychologist* explores brain-behavior relationships.

Discuss: What type of "brain work" most appeals to you? What would you enjoy learning about the brain?

Once a Day

Take a break to self-assess: Do your responses reveal the dominance of your amygdala (reaction) or your PFC (reflection)? If your amygdala is being activated, what is triggering its response? What would you like to change about your style of reaction?

Connecting to the Curriculum

Journal Writing

Encourage students to reflect on what they've learned about how their brains think and learn and to record questions they may wish to explore at another time. They may also enjoy responding to these prompts:

- Draw a picture of yourself when your amygdala was activated. Below your picture, describe the situation in words. Explain whether your amygdala reacted to real danger or alerted you to a situation that wasn't an actual threat.
- Draw a picture of yourself when you are feeling calm and thinking clearly. Below your picture, describe the situation in words. Tell how your PFC was working.
- Make a comic strip with your amygdala talking to your PFC. What would one character say to the other?
- Which do you think helps your hippocampus work better to remember information and ideas—the amygdala or PFC? Tell why you think so.

Learning about the brain supports students' connection to their own learning process and to the content areas and literature.

SCIENCE

Did You Know...? Brain Facts!

What to Do

Invite volunteers to read fascinating facts about the brain on the "Getting to Know and Love Your Brain" poster. Encourage students to become "brain experts" by having them research new facts about the brain on the Internet or in books. Have students write their facts on large sticky notes and post the facts around the poster's perimeter (or you may want to have them connect the facts to specific points on a brain illustration with lengths of yarn and sticky tack).

What to Say

Did you know that your brain never stops thinking, even when you're asleep? Or even that you can solve problems when you dream? Can you share some amazing things you know about the brain and how it works? Now let's see if this poster tells us any new information—Then we'll go on a brain-fact hunt to add even more facts that we find to this poster.

Why It's Important

Inviting students to become experts about the brain puts them in the driver's seat of their own learning. That self-motivated learning will build background for future lessons and keep their engagement high.

PHYSICAL EDUCATION

Amygdala on the Move

What to Do

Have students line up on one side of the gym and explain that they are little bits of information trying to get to the other side of the gym where the prefrontal cortex can use them to make better decisions. Then choose two students to be in the center of the gym as the amygdala, assigned to determine whether the bits of information scatter, freeze, or move calmly to the prefrontal cortex.

What to Say

I'm going to shout out the words "flight," "freeze," or "MindUP" in a random order. The amygdala will either run around wildly (taking flight), freeze rigidly, or calmly direct the bits of information toward the prefrontal cortex.

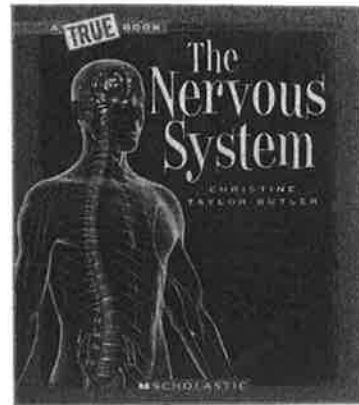
Why It's Important

Acting out the role of the amygdala and showing how information gets processed when it's calm and when it's on alert give students a powerful kinesthetic way to review concepts from the lesson.



how our brains work

extend
the
lesson



Literature Link The Nervous System: A True Book

by Taylor-Butler, Christine
(2008). Danbury: Children's Press.

How do nerve impulses travel throughout the body? How do they affect our actions and emotions? This colorful book is packed with facts and appealing visuals that reveal how the nervous system shuttles messages back and forth between the brain and the body.

As you explore this book with students challenge them to link new ideas to what they already know about the brain.

More Books to Share

Lichtenheld, Tom. (2003). *What Are You So Grumpy About?* Boston, MA: Little, Brown, and Company.

Simon, Seymour (2010). *The Brain*. New York: Scholastic.

Weierbach, Jane and Elizabeth Phillips-Hershey. (2008). *Mind Over Basketball*. Washington, DC: Magination Press.



LANGUAGE ARTS

Brain Tunes

What to Do

Challenge students to write a song or rap about one or more parts of the brain. Have them work with a partner or small group to review what they've learned about three main parts of the brain and then think about how they can create a rhyming message about the topic. Give students time to write and then practice singing or chanting it. Invite students to perform their songs for their peers and teach them the lyrics.

What to Say

One of the best ways to teach yourself or someone else about the brain (or any other topic) is through a song. Let's think of the roles each of the three brain parts plays—that ever-ready amygdala, the thoughtful prefrontal cortex, and the memory-collecting hippocampus. You may want to write about one or all of them and the work they do to help us think, learn, and act.

Why It's Important

Making a mnemonic connection to the parts of the brain through song increases students' investment in their learning.

SOCIAL-EMOTIONAL LEARNING

Quick Stress Release

What to Do

Show students two options for getting rid of worries and clearing their minds: Laugh for 15 seconds before taking a test or starting a challenging task. (Invite students to make funny faces, or twist their bodies into silly shapes.) Invite students to stand and "shake" like a wet dog. After shaking a few times, have them take three deep, slow breaths.

What to Say

Let's start building a toolbox of things to do if you get worried and your thoughts get jumbled or your brain freezes. We'll try two quick activities we can do anytime we are likely to get nervous or worried—before we take a test or when trying to solve a conflict with someone or just having something on our minds.

Why It's Important

Everyone needs tools for dealing with stress—the simpler and more enjoyable your mind-clearing tips and tactics are, the more readily students will use them. As you move through the lessons, ask students to share effective strategies they've discovered on their own.