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Reaching the Reluctant Learner Pages 32-38

When Students Seem Stalled

Betty K. Garner

The missing link for too many kids who don't "get it?" Cognitive structures.

Tim was one of those 5th graders whom teachers might characterize as their worst nightmare. Being sarcastic and argumentative was a sport for him. Tim enjoyed getting other students to laugh at his smart remarks, but he never did any of the "boring and stupid" work. When he wasn't acting out, he was daydreaming or drawing superheroes.

Second-grader Sean, on the other hand, was an enigma. He passively listened but always had a blank look when his teacher explained new concepts. Sean couldn't do assignments by himself in class, nor could he explain his written responses. "I've tried everything, and he just doesn't get it!" his teacher sighed in exasperation.

At every grade level and in every content area, teachers are challenged to help resistant and struggling learners like Tim and Sean. After working with and observing hundreds of students, I have learned that the explanation for students who just don't "get it"—or don't seem to want to "get it"—is often some underlying cognitive structure.

Cognitive structures are basic, interconnected psychological systems that enable people to process information by connecting it with prior knowledge and experience, finding patterns and relationships, identifying rules, and generating abstract principles that are relevant in different applications. Each individual has to internally develop his or her own cognitive structures. When cognitive structures are underdeveloped, learning is difficult, if not impossible. With effective cognitive structures, even reluctant students can activate their own learning.

For example, because Tim's teacher, Jana, had training in cognitive structures, she recognized his repertoire of avoidance strategies as an indicator of his need to develop his cognitive structures. Jana took time to eat lunch with Tim. She informally assessed how he gathered and processed information. She complimented him on his drawing and asked if he had ever thought of using his creativity to learn.

Tim looked surprised and said, "Nope! Drawing's fun. School's work!"

She responded, "Every time you draw something, you have to identify patterns and see relationships among the parts. What if you looked for patterns and relationships in the work we do in class?"

Tim was doubtful, saying he'd never even thought about looking for patterns in "math and reading and stuff." But for the next few weeks, Jana focused on having Tim and all her students identify patterns in every subject area. Tim discovered that he was good at finding patterns and gradually became a contributing member of the class.

Finding the Missing Link

As an art teacher in a K–8 public school, I saw many students like Tim who were good artists and clever problem solvers, but who hated school. Others, like Sean, sat passively through lessons. Many were driving their teachers crazy because they seemed unwilling or unable to make progress academically, despite remedial or special education services.

My encounters with these students prompted me to investigate what was keeping creative students from becoming cognitively engaged in learning. I did hundreds of in-depth case studies with students ages 5 to 18 who were having learning or behavioral difficulties. I invited students to help me see schooling and learning from their point of view and understand what would make learning easier for them. To identify how students gathered sensory data and used cognitive structures to process information, I used open-ended questioning and interactive assessment tasks similar to those used by Piaget and Feuerstein. Cross-case analysis revealed that underdeveloped cognitive structures were often the problem.[1]

To better understand how cognitive structures operate, I divide them into three categories:

- *Comparative cognitive structures* help us process information by identifying how bits of data are alike and different. These include recognition, memorization, conservation of constancy, classification, spatial orientation, temporal orientation, and metaphorical thinking.
- *Symbolic representation structures* help us transform information into culturally acceptable coding systems, such as verbal and nonverbal language, mathematics, music and rhythms, graphics, and other communication systems.
- *Logical reasoning* structures—such as deductive and inductive reasoning, analysis, synthesis, and evaluation—help us process information at an abstract level and make it possible for us to generate new information.

Comparative thinking structures are prerequisites for developing all other cognitive structures. Most instruction in school involves symbolic representation, but if students lack effective comparative structures, they will have trouble processing information at the symbolic level. Such students will have no idea why schoolwork is so hard and confusing for them. After years of frustration, they frequently quit trying, exhibit behavior problems, or simply disengage.

Comparative Cognitive Structures: Never Too Late

Cognitive structures are so basic that we assume everyone has them. But my case studies revealed that many middle and high school students had yet to develop cognitive structures. Teachers are often bewildered when students can't make "obvious" connections. Because of reduced interaction between children and adults in families and excessive passive exposure to media, students often come to school without these cognitive tools.

The good news is that it's never too late to develop cognitive structures. Teachers can use everyday lessons to help students develop them and overcome their resistance to learning.

People develop cognitive structures through reflective awareness (becoming purposefully and reflectively aware of the information their senses take in) and visualization (mentally representing this information). Students take in sensory data every waking minute and automatically filter it through their values, beliefs, and feelings. To help some students become reflectively aware, we have to teach them how to systematically collect sensory data. Without reflective awareness, each time students see or hear something, it's as if they are seeing or hearing it for the first time.

When we encounter resistance to learning, we need to identify whether cognitive structures are lacking and, if necessary, intervene to help students develop them. These are some suggestions for developing foundational comparative thinking structures.

Recognition

Recognition, the ability to identify a match or fit between two or more pieces of information, is one of the first cognitive structures to develop, as when a baby recognizes its mother's face. Although we often take recognition for granted, it is a sophisticated requirement for most professionals, from doctors to air traffic controllers. We expect students to recognize things like number patterns, shapes of countries, or grammatical and literary patterns.

I recently observed Denise, a 1st grade teacher, priming students' ability to notice and reflect on patterns in writing. Denise wrote four sentences on the board and asked students, "What do you notice?" Within seconds, 22 students raised their hands to respond. "Each sentence starts with a capital letter." "The punctuation at the end of one is different because it's a question." "There are two pronouns in the second sentence." They continued their observations until all had had a turn.

I asked Denise how she did this. She replied,

> *They are like little detectives and notice everything that I was going to tell them. But this way they recognize what they learned before and remember it, because they create connections and find the rules on their own, so that they recognize the patterns the next time.*

Before starting any lesson, teachers can place relevant learning materials or objects where students can see them and ask, "What do you see? What do you notice?" When students become reflectively aware of sensory data, this paves the way for a closer "fit" when they encounter similar data again.

Memorization

Memorization, the ability to store information, depends on other cognitive structures to classify information for access, contextualize it in time and space, label it, and identify specific logical or metaphorical connections. Teachers can help students strengthen this cognitive structure (and others) by encouraging students to reflect on how they make connections, identify patterns, formulate rules, and pull out abstract principles to create meaning. Too often, students confuse imitation, a preliminary form of memorization, with learning. Instead of processing information, they depend on short-term memory and simply imitate what they see modeled.

For example, Phil could memorize his spelling words but could not define them, use them in his writing, or recognize them when reading. His teacher encouraged him to visualize and illustrate the meaning of each word and to classify relationships between his spelling words and other words. Phil began actually using his memory to create meaning for himself.

Conservation of Constancy

This ability to understand how some characteristics of a thing can change while others stay the same is one of the most basic cognitive structures. Although teachers study Piaget's writing on conservation, they rarely realize how crucial conservation is for learning: Curriculum content, activities, and assessments in every subject area are based on the assumption that students can conserve constancies. Students who lack this cognitive structure fail to benefit from their experiences. Because their perceptions are limited to concrete sensory data and literal interpretations, they force information into preconceived notions. Without conservation of constancy, it is difficult for students to think abstractly, plan, problem solve, discern relevance, or transfer information from one situation to another. For example, if students cannot discern what changes and what stays the same at a physical level, they cannot see what changes and what stays the same when a suffix or prefix is added to a word, or how 1/2 and 6/12 can be equal.

Teachers can help students develop conservation of constancy by frequently having them compare how things are alike and different at a physical and abstract level. Frank, a 7th grade teacher, was frustrated because more than half of his students couldn't figure out how to draw a map of a continent to scale. When he envisioned this activity as a way to strengthen both conservation of constancy and spatial orientation, the lesson became engaging and successful.

Frank started by asking students, "What do you notice about this map of Africa?" They responded with things like, "It's big." "Lots of colors and different countries." "Each country is a different shape." The students were totally engaged in this investigation and began to ask questions like, "How does the size of a country affect its wealth or political power?" "How do they get along with one another?" "What languages do they speak?"

Instead of giving students a map of Africa on which to label the countries, Frank had them draw the map to scale, asking them to notice what would change and what would stay the same when they made the map smaller. Students quickly responded, "The size will change, but the shapes stay the same. And where they are in relation to the latitudes and longitudes has to stay the same, too—this is fun!"

Classification

Classification enables students to identify, compare, and order information to create meaning on the basis of relationships of parts to one another and parts to the whole. To classify, students need to apply criteria for whether or not an object belongs to a set. The more effectively students use classification to process information, the more accessible that information becomes for them.

Students begin to develop classification by manipulating real objects. Only after they understand the principle of membership in a set can they classify abstract information. To help students develop classification, I have them work in small groups with an assortment of 20 to 30 small objects (most of which they contribute from their desks or personal belongings). I observe what the students do. A few begin to handle the objects; others just wait for instructions. After a short time, I ask, "How would you make sense of this stuff?" They usually look confused. I encourage them to think about how they might organize the materials. Gradually, they begin putting pencils in one pile, keys in another, and so on.

At this stage of the exercise, I explain, "You've sorted objects according to like kind, which is the most basic way of classifying them. Think of other criteria you might use to classify these objects—up to 15 to 20 different ways." They look at me with disbelief, but gradually they start with obvious criteria, such as materials the objects are made of or color. Then they identify many different criteria, for example, country of origin, purpose, or cost. We discuss how they use classification in school and in everyday life, and I challenge them to think about how those experiences would be different if no classification existed.

Too often, we give students preprinted graphic organizers or preset criteria to classify information rather than letting them discover patterns based on criteria of their own. Thus, we deprive them of opportunities to develop their cognitive structures.

Problems with the classification structure are the reason many students seem to make little progress with content they encounter year after year from 1st grade on, such as punctuation rules. Although these students have been taught rules about punctuation and have completed plenty of exercises and tests, it's likely they have never identified their own criteria for classifying the appropriate use of punctuation marks, so they haven't constructed meaning from the exercises.

Spatial Orientation

Spatial orientation enables students to identify relationships among objects and places. Problems with spatial orientation have far-reaching implications for learning and life. A student who is disorganized, confuses left and right or the cardinal directions, or writes letters backwards probably needs help with this cognitive structure.

We commonly deal with three kinds of space. *Physical space* involves three-dimensional objects and their relationship to us and to one another. If students have difficulty judging spatial relationships in the physical world, they usually have difficulty understanding more abstract spatial relationships.

Representational space uses two-dimensional symbols and graphics to identify relationships. The curriculum is filled with opportunities to help students develop this cognitive ability. Writing uses directional lines to form letters and numbers; math uses representational space in geometry, number systems, and statistics. In physical education, we often symbolically represent game plays. Spatial elements are integral to design in art.

Abstract space uses mental images to transcend physical limitations when representing spatial relationships. For example, when planning a trip, we mentally map going from one place to another. For students to succeed, they need to use abstract spatial relationships to mentally represent things they cannot perceive with their senses. In science class, for example, learners need to be able to visualize molecular structures and planetary orbits. In social studies, they need to picture boundaries and topography.

We can strengthen awareness of spatial relationships by naming specific locations when giving directions ("put the book on the lower left shelf") and modifying simple activities throughout the school day. For example, Kelly gathered her kindergartners around a picture and asked, "What do you notice?" Immediately, hands went up. Students were eager to point to items of interest. Instead, Kelly had students identify the location of an item before describing it. At first they resisted, but gradually, the kindergartners became more comfortable making comments like, "In the middle left of the picture, I noticed a green tree." They described what they noticed about a particular item in relationship to other items: "This tree is smaller than the one on the middle right, and they both have shadows under them." This technique helped students become more reflectively aware of what their senses were telling them about spatial orientation, while also developing language skills.

Temporal Orientation

Temporal orientation enables us to process information by comparing events in relationship to when they occur. This cognitive structure involves more than just telling time. It is essential for planning, organizing, communicating, and record keeping, as well as understanding most content areas. When we tell students to "think before you act," we assume they have temporal orientation. This cognitive structure helps students control impulses by inserting time for reflection between stimulus and response.

When presented with an unfamiliar task, students without temporal orientation are often confused about where to start because they cannot plan ahead or systematically sequence their actions. Teachers can help students develop temporal orientation by encouraging them to appreciate the past and prepare for the future.

Metaphorical Thinking

Metaphorical thinking brings home meaning by emphasizing similarities and overlooking differences. This form of comparative thinking equips students to generate fresh insights through making unusual connections. Creative students often express their understanding as a metaphor.

Language is peppered with metaphors, and students delight in hunting for metaphors and discussing the appropriateness of the imagery they contain. Young writers often enjoy coming up with their own metaphors, which might be more effective than an established author's. In science and math, metaphors help students understand unfamiliar ideas.

What's Still "Out There"?

With immense pressure to raise test scores, it often seems more efficient to simply cover the material as best we can and hope it sticks. It is truly more efficient, however, to equip students for ongoing learning by using the everyday curriculum to fortify cognitive structures. Investing teaching energy in cognitive structures helps students learn how to learn.

Teachers whom I have trained in cognitive structures always express relief and renewed energy when they see their enigmatic learners begin to create and change. One teacher with 28 years of experience commented, "Why weren't we taught this in our teacher training? This is so much more enjoyable and satisfying for me and the kids!"

We can't teach our students everything there is to know or learn because we don't even know what new knowledge is available. Think of a caveman in a dark cavern wondering whether there might be a way to make light after sunset. In those days, that was a crazy thought—but electricity existed, even though no one was aware of it. When our students have the cognitive foundation to learn how to learn, they can discover what else is "out there" in our world, waiting to be developed.

Keeping Cognitive Structures in Mind

Build caring relationships with students. Struggling learners will work with you if they trust you and know you care. Spend time with them. Listen to them.

Encourage students to be reflectively aware. Prompt them to notice what their senses are telling them. Encourage them to suspend judgment and give themselves time to process information.

Urge students to use their imaginations. When students can see (or hear, feel, taste, or smell) information in their minds, they can carry it with them when the information is out of sensory range.

Maximize each lesson. Analyze content, activities, and assessments to identify which cognitive tools the lesson draws on and how the undertaking might develop cognitive structures.

Use open-ended prompts, such as:

- What questions come to mind as you think about this?
- What kind of pattern do you notice?
- What do you wish were easier? Why? (Encourage students to elaborate on their responses—without giving nonverbal clues about whether responses are correct.)
- What do you wonder about?
- How is this like life?
- How would you explain this to someone?

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Endnote

[1] *My ongoing research on cognitive structures is based on the work of Feuerstein (1980); Piaget (1950, 1954); and Vygotsky (2006/1934). It is also influenced by Csikszentmihalyi (1991); Gardner (2006); Jensen (2005); Restak (2006); Sternberg (2004); and others.*

Betty K. Garner is an educational consultant and the author of *Getting to "Got It!": Helping Struggling Learners Learn How to Learn* (ASCD, 2007); PO Box 692, Gig Harbor, WA; Betty garner@yahoo.com.