

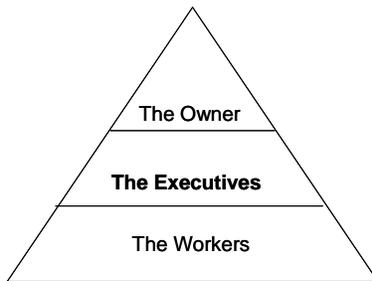
Executive and Other Cognitive Processes

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The purpose of this document dealing with the topic of Cognitive Processes is to provide you with a “plain English” summary of the mental activities that are involved with information processing. While most teachers think in terms of “skills” or “competencies,” it is just as important for them to think in terms of “underlying cognitive processes,” because it is those mental activities that allow learning to take place. Rather than talking about the “stuff” that we teach (the content), our discussion will focus on “the processes of learning,” (the how).



In order to facilitate our discussion, the cognitive processes will be classified as falling into three groups; the Owner, the Executives (those that provide management and oversight) , and the Workers. All are needed, all are highly interrelated, and often they all must operate cooperatively and concurrently in order to complete a task.

We will attempt to focus on three issues; what the process is called, how it might be manifest in an adult education program, and what you can do to help student who displays difficulty in that area.

The Brain’s “Owner” – The “I” inside you

Central Monitoring

While a variety of types of executive or management functions are going on, there is a need to coordinate and manage those functions from a centralized perspective. This “Owner” functions as the monitor of the other entire executive and management functions, or “super CEO.” It shifts from being in the background, to sometimes being very much in the forefront. It is the part of your brain that you cannot shut off, in fact, the more you try to avoid it, the more it comes to the forefront. It is the voice inside of your head that is always there, watching and talking to you using a special inner language that no one else can hear. It is sensitive to your emotional status, and while usually logical, analytical, fair, objective, open, and active, it can become illogical and self-protective due to negative internal influences. It is sometimes called “metacognition,” which is a term used to describe the process of “you thinking about your thinking.” You might think of it as the “me” or “I” that is always there while you are conscious.

Since we have labeled this function as “The Owner,” the related issue of “personal ownership” warrants discussion. The term “ownership” is often used to describe the extent of personal involvement or personal investment in a project or activity. The possible levels of perceived ownership can range from detachment to obsession, with the ideal falling somewhere in the middle, personalizing value and potential gain from engagement. In the background of that question is the assumption that people will act in ways that will benefit them. “What’s in it for me,” is more than an irrelevant phrase – it has a lot to do with the “I” that makes critical decisions.

When you wake up in the morning, your “owner” reappears. Whether your alarm startles you awake, or if it is because you feel the cat nibbling on your ear, a part of your brain awakens and

becomes the focal point for your ideation. It orients you in time and place, and it provides the most important central reference point for everything you do; you. From an educational perspective, each student sitting in front of you has a fully operational “I” that stands ready to work with you or against you. Winning over that “I,” and getting them to work with you can greatly enhance your effectiveness as their tutor or instructor. Everything related to what both you and your student does is processed through their “I.”

What it might look like:

- When that student in the back of the room with the headphones becomes totally engrossed with the music on his iPod, their mental “owner” may totally lose track of where they are and what they are supposed to be doing. It is as if they are drifting off into a type of sleep, in effect becoming totally disengaged from the activity that is going on in your class.
- Asked why Frank comes to class, he responds, “I’m here for you to teach me to read.” He could have answered, “I’m here to learn how to read,” or “I need you to show me how to read.” How do those statements differ? Can you identify the implied ownership in each of the statements?
- Mary comes to classes because her mother threatened, “to kick me out” if she did not “go out and do something useful.” Mary really didn’t want to, but she did need a place to sleep, money for cosmetics, and someone to pay her cellular phone bill. She had heard that the GED class was a place where there were many other people with whom she had a lot in common. As soon as she walked into the class she recognized a few of her friends and they immediately started making plans for Friday night.

Mary is using the class ineffectively because she has not made the right investment in it. Her “I” has not internalized the correct benefit of participation. Frank has not internalized the need for his taking ownership for change, and has failed to take ownership of his responsibility for benefiting from the instructional services. The student with the headphones does not understand the critical expectations of the “teacher” and is not receiving important feedback about his behavior.

The fact that “central management” was placed at the highest level of the three examples implies the level of sophistication, and importance, that it represents. “Ownership” sounds simple, but it is an extremely sophisticated concept.

Note: You might be interested in another professional development activity that is available – a discussion of the interrelationships between insight and behavior. That professional development activity is titled The Get It – Do It Model and looks at “ownership” from the perspectives of insight and action.

What you might do:

- ☐ You might make it a practice to sit down for 15 or 20 minutes with each new student and talk with them about why they are coming to your class, your expectations for them, the “culture” of the classroom, your availability for assistance or just “to talk”, etc. Try to imagine the barriers that might arise (hesitation about asking you a question because you appear busy), so that they know ahead of time how and what they can do. The atmosphere of your presentation is critical, it needs to be positive but realistic.

The Brain's Executives (The Administrators and Managers)

The role of the Executive Functions are to plan, manage and coordinate the many brain activities needed to set goals, establish strategies, attain those goals, organize resources and activities to carry out plans, monitor the entire process, and ensure that the desired outcomes are achieved. This capacity can be likened to that of a company's chief executive officer who must receive input from an array of departmental and regional managers, organize it, and monitor and adapt the corporate resources utilized. Other useful metaphors might be a pilot of plane or the conductor of a symphony. Neuropsychologists are not in full agreement as to exactly where these processes are located in the brain, but most acknowledge that multiple executive functions are mediated by effective functioning of the frontal lobes. They also suggest maturational and developmental differences that manifest as behavioral differences or variability in "maturity."

The executive processes described in this section involve activities that are utilized in planning, management and monitoring. While they can be looked at as separate functions, they work in an integrated manner when complex tasks are presented, thus, you will often find them to be active concurrently or as part of a sophisticated sequence of processes. They also share characteristics and you should expect to see overlap in functions. There are no clear lines that mark where one process ends and another begins. Each represents a part of a complex array of inter-related functions.

Focus and Attention

Attention is the act of bringing concentration and the resources of cognitive processing to a specific task, while excluding other irrelevant or distracting information. Thus, it initially represents two complementary activities – letting the good stuff in, and keeping the bad stuff out. To make things more complicated, focus and attention need to be present, but they also need to be sustained in the face of both fatigue and competing stimulation. Think of the process of focusing as having three components.

1. Awareness

Awareness represents a heightened sense of expectation that precedes attention. It results in the person being more sensitive to internal and external events. It represents a heightened readiness to engage.

What it might look like:

- If you are expecting a phone call, you will have an increased sensitivity to a phone ringing or a person calling your name, i.e. "at the end of class we will be going around the room and each of you will be expected to give a suggestion...."
- If you are aware of a pattern wherein math is taught at a regular time, just before that time you will terminate what you are doing, and will "get ready" for shifting to studying math.

What you might do:

- If groups of students are engaged in an activity, the teacher might turn on a radio 5 minutes ahead of end of the class to send a message that the topic of instruction will be shifting shortly and that students should start to end their current activity.
- You might hang a graphically simple but effective poster in the room that highlights the steps that a student should follow in order to have a productive session, for example, 1)

place your homework on the top left side of their desk for the instructor to review, 2) pick up their day's assignment, 3) make notes in their assignment book, etc.

2. Focusing Attention (Concentrating)

Attention is the process of directing mental energy onto a specific object or activity. All of you have probably had experience with the concepts of “mental fog,” “slippage,” or “drift.” Those are all terms that describe the loss of focused concentration. You might also think of attention as being an attribute that can be exercised and strengthened, or you might look at it as an attribute that is weak because it was never exercised, yes, flabby focus. Regardless of how you look at it, it is easy to recognize the mental act of moving a specific activity onto your mental desktop or work area, so that other cognitive processes can be started (the worker functions).

Attention requires a number of things from your brain and body, discipline and energy in particular. When you are tired, or when your body is not getting adequate nutrition, you may find it harder to focus. In fact, (and this is not an endorsement of any type), there is a nutritional supplement that is marketed under the name Focus Factor. We failed to mention earlier that all of the things that we are talking about are biochemical/electrical events – in effect entirely dependent on the “chemical soup” in your brain. Not enough of chemical X or the existence of chemical Y (any inferences for clients with substance abuse issues are not accidental) and different functions will work or not work as well as they might. So, think of rest and nutrition as important things to discuss with your students.

While we are talking about things that might negatively affect attention and concentration, we should bring up the topic of stress. It's highly likely that heightened levels of stress can result in reduced capacity to focus and to concentrate. While a little bit of it may be helpful, lots of stress is something to be avoided because it can have serious negative consequences on many aspects of cognitive functioning.

What it might look like:

- Mr. Smith works at Acme Plastics during the first shift and hurries to the Community Center for his GED classes at 6 PM. He often has to fight to stay awake.
- Millie is having marital problems and her husband is prone to temper tantrums and threats. She has a lot of difficulty concentrating on the teacher's presentation.

What you might do:

- You might make provisions so that students can bring a “power snack” with them, or have a “student area” where they might relax or “clear their head.”
- You could make sure that all of your sessions last no longer than 15 minutes, at which time you might “shift gears” and change your approach, give a break, or approach the same topic from an entirely different approach.
- Be a willing listener, and know whom you might refer clients to if the issue becomes too sensitive. Be helpful, but know your limits.

2. Sustaining Attention (Sustained Concentration)

As we said, attention is the process of directing mental energy onto a specific object or activity. Focusing initially is one thing, staying with it until it is done is another. Why is that a problem? It can be a problem for several reasons, the physiology of some individuals seem to predispose them to losing focus (ADD) or the analogy of “running out of gas” may be applicable, as some

students will simply run out of mental energy. Some students may have become accustomed to having answers of marginal quality accepted, and may feel agitation or frustration when they have to stay with an idea or topic. There are many reasons why the topic or issue that is the focus of your student's initial attention gradually, or in some cases instantaneously slips, slides or disappears from their mental radar screen. Sustaining attention takes effort and for many students is hard work. At the same time, learning involves the mastery of complex material, and some content simply needs to be kept active for extended periods so that all of the related details can be processed (more on this when we talk about data swapping).

Think of sustained concentration as the shop floor manager who keeps the employees on task, who is alert for possible distractions and "cuts them off," or who sees employees as getting "off task" and moves them back to the assembly line. There is the act of actual attention, and there is the act of monitoring attention and making the subtle adjustment to keep it active and viable.

What it might look like:

- Fred started reading the paragraph on page 1272 of his GED book, but only got three sentences into the story before his mind shifted to his need to make arrangements to get tickets to next weekend's football game.
- Maud knows that she needs to read a story for tomorrow's class, but it is 11:30 pm and she simply feels very tired. For the 6th time she starts to read the story, but each time she finds herself "waking up" and not remembering a thing that she has read.

What you might do:

- Break a long assignment into parts, telling the student how much they have to "bite off" at any one time.
- Sit with the student as they read, watching their eyes and posture for signs that they are drifting off. At first make the assignments short, and gradually lengthen them. Talk to the student about developing a mental "manager" whose job it is to keep an eye on their concentration. Have a talk with the student about sleep and nutrition.
- Play an interesting book on tape in class, stopping the tape periodically (gradually increase the length) and ask students to recall facts, paraphrase what they heard, etc.

Attention Shifting

How are a Ford, a bushel basket, a pair of scissors, and a can of beets alike? Can you identify multiple groupings? Scissors, a Ford and a Can of Beets are metal, a Ford, a bushel basket and a can of Beets can contain things. Many people with executive deficits find it hard to shift attention and inflexibly hold on to their original perceptions and behaviors, even when the usefulness of these associations has long expired.

Learning is not linear, that is, in most cases it does not start at point A and go in a straight line to point Z. Most problem solutions zigzag erratically, have diversions, and often end up in places that were not expected at the outset. The mental processes that are being used will shift, and the content that is being manipulated will likely be modified or changed – flexibility is the rule rather than the exception. A part of your brain needs to make these shifts in attention in an orderly manner while at the same time keeping track of what they were and where they might be found in case they are needed again. This Executive function has a lot in common with the process of Active Working Memory, but think of it as being the managing part of the process – it makes sure that the two work together. Think of Attention Shifting as representing a road map, there are a lot of different roads

that you can take to get to city X. Some people only know one route, other people know of several routes and they can pick and choose between them in the case of poor road conditions or closings.

What it might look like:

- Andy started to work on his math assignment, but Mary, who was sitting next to him, asked him to help her with a different problem.
- Tony knows that he has an essay due during his English class immediately after lunch. He keeps his notebook on his lap and adds to his essay whenever he gets a chance between other assignments.

What you might do:

- Get in the habit of asking questions that require students to focus on the important elements of any situation by starting those questions with “who,” “what,” “when,” “where” “how” and “why.”
- Emphasize the importance of keeping work organized and clearly written, so that if students have to switch to something else, they can easily find where they left off.
- Use post-um notes that students can use to provide directions or hints as to what happened before, what is the status at the point of distraction, what needs to be done next, etc.

The Brain’s “Factory Workers” – General Cognitive Processes

These are the important mental processes that are used in analyzing information, developing concepts, elaborating upon current knowledge and all of the internal brainwork that is classified as “Association.” This processes listed below are just some of the mental processes that go on automatically as information gets organized, analyzed and stored for later use. Each is like a muscle; it gets stronger with use and exercise. You might think of them as tools in an individual’s toolbox, that they can take out and use as a problem or task necessitates. The job of the instructor is to fill each students toolbox with effective tools.

Information Manipulation

Nearly all higher-order cognitive operations require the real-time manipulation of information held in short-term memory. To prepare for any event, the planner needs to be able to keep track of and manipulate a large number of variables or sources of information. They need to consistently put information on the front burner, take a look at it, and then shift it to the back burner as new information is analyzed and evaluations of usefulness take place.

Planning and Foresight

Preparing for a vacation, completion of a task, or completion of a process requires foresight and analysis of the conditions and needs that may impact the outcome. A student with poorly developed executive skills is often unable to “break out of” the present and form a mental pictures of what a future that is different might look like or what the finished product might look like.

Monitoring and Error Correction

These processes are engaged when results do not correspond with expectations. This effect could be seen, for example, in a woman who drives to a special bakery to buy a pie for a dinner party and finds it is closed. She might go to another bakery on the other side of town without considering that the trip would not allow her to get back home until after the event is scheduled to start. A student

might work on correcting an answer on the math test, but fail to verify its accuracy and in effect gain nothing from the time spent.

Decision Making

Consider a man who is having trouble making ends meet. He could cut expenses or increase income, either path requiring him to weigh options, arrive at a decision and see it through. Students with executive difficulties cannot settle on a choice, particularly in situations where the correct response is not obvious or previously learned. They may blindly follow other people's suggestions, which is why they can be easily exploited. Decision making involves gathering information, holding it in memory, evaluating alternatives, making choices, prioritizing alternatives, and many other important associative skills. Decision making is a skill that is important for overall management and direction setting.

Inhibition

Automatic responses can be ineffective or even harmful. Imagine you have just won a major award; your immediate reaction would be to tell everyone the news. But waiting until other finalists are properly informed of their loss requires inhibition. Inhibition regulates both input and output processes and is an important process related to understanding and expression. Think of it as a faucet that can be turned on a bit more or less in order to maintain the correct flow of information.

Social Reasoning

Failure to appropriately process social cues can have devastating consequences. Every social engagement involves visual, auditory and motor clues or signs that need to be interpreted. You might look at "reading social cues" as being an input process similar to "reading text" or "understanding words."

Abstract Thinking

Discerning relationships among stimuli utilizes abstract thinking. Imagine being asked to group into two sets of objects a pair of scissors, a water glass, and ax and a wheelbarrow. You might decide that the scissors and the water glass go together because they are used indoors, whereas the ax and wheelbarrow are used outdoors. But this is only one possible grouping; there could be many others. Your mind needs to be able to deal with this degree of ambiguity and abstraction. Students learn to identify many possible answers, and then identify the best fit for the specifics of the situation.

Immediate Recall

Immediate recall is the ability to quickly recall a series of informational items. This does not involve much cognitive processing of the information, simply repetition of the sequence of items. Repeating a phone number is an example of immediate recall.

Working Memory

The retention and manipulation of information in short-term memory is an extremely important mental task. It requires moving information into and out of storage for the purpose of cognitive manipulation. In the process, information may be changed or new information developed. Working memory is at the heart of "multi tasking," where multiple simultaneous problems may need to be addressed.

Sequencing

Many things occur in a pattern or sequence, and that sequence has importance in determining if the stream of events proceeds correctly. It is also important for the brain to recognize this underlying pattern, with that pattern including the position of each event in time. Two simple examples of this are your ability to make sense out of the pictures in a comic strip, or your ability to “get the punch line” of a joke. Events happen within the context of time and recognizing, and remembering the sequence in which things happen provides the information for other mental functions such as developing cause-effect relationships.

Perceptiveness of relationships, characteristics, and patterns: and identifying rules to explain them and their incongruities.

The processes of memory play an important role in supporting other mental processes. Recognition of differences is an initial stage of thinking that eventually leads to higher level cognitive processing such as Pattern Recognition, Characteristic Association, Rule Generation and Rule Violation. These reflect the brain’s ability to turn observed events or sequences into “laws” which become the yardstick against which future events are measured or future patterns imply meaning beyond their simple characteristics.

Spatial Awareness

Just as sequencing requires perceptiveness of time, Spatial Awareness requires perceptiveness of position in space, or in other words, location or change of position relative to a reference point. When you sit at the table, your mind remembers where you set your coffee cup, you know what is behind you without needing to look, and you have a sense that you cannot reach the platter and will need to ask someone to pass it to you. Close your eyes right now and you clearly have a sense of how far the steering wheel is in relation to the trunk of your car, how far your kitchen is to your bedroom, and even how far you are from Pittsburgh. Your mind measures (and remembers) things not only in the context of time, but also in the context of space.

Time awareness

A key basic function of memory and thinking is time. We often have to solve problems that involve time, for example when something happens in relation to the past or future, in relation to a sequence of events, or in relation to the present using relative descriptors such as an hour, a day or a decade. The perspective of time is often critical to meaning, and identifying meaning is the function of the associative stage. Maintaining a perspective of time is essential for setting up schedules, procedures, understanding causality, and understanding many other “academic” topics.

Associating meaning to things you see, noises you hear, visual symbols or auditory codes.

“Knowing” is a goal, but it is usually not the final objective in terms of functioning. Usually, there is a need for some type of expression and in many cases that expression takes the form of speech. A longstanding sign of higher level functioning is the capacity to effectively develop ideas and express them in the form of visual or auditory codes. Mastery of the codes of English Language, rules of grammar, mathematical symbols or even the basic code of phonics are all high level cognitive processes that are needed in everyday life. Many learning problems are in fact coding or decoding problems, the simplest example being the extent to which your functional capacity will diminish were you to be dropped into a country whose language you did not understand or whose symbolic code you were unable to write. Complex ideas are frequently reduced to some written code, or set of acronyms but if you don’t know the code, your understanding falters.

Shifting between coding systems

Life would be much easier if there was only one coding system, but it would also be much less effective and interesting. An important mental skill is the ability to shift from one coding system to another, for example, from reading something, to writing text about it and then annotating the text with a drawing, and then explaining the drawing to someone else. The process of shifting in and out of various coding systems happens so often and in so many contexts that it is often overlooked. To be truly functional, a student needs to be fluent in many coding systems and have the capacity to shift into and out of each of them with ease.

Recognizing words, and converting ideas into words

Receptive and expressive vocabularies are important mental skills. Yes, they are a type of coding-decoding process but they are so critical that we are treating them separately. Receptive vocabulary reflects knowing the meaning of words when you hear them. Expressive vocabulary is going into your memory banks and finding just the right word to convey a specific meaning and then integrating the word into a fluent sentence. Generally, a person's expressive vocabulary is not as well developed as their receptive vocabulary. Both are essential cognitive skills, in fact, the importance might be obvious by the fact that "vocabulary" is an essential part of almost all IQ tests.

Estimation and projection of future events. Evaluating the usefulness of an idea in meeting a need or achieving a goal.

Inherent in many cognitive processes is the concept of judgment or evaluation, the ongoing refinement of a thought, possible action, or proposed concept through projection of consequences or adherence to "rules" formulated through experience. Hypothesis building and testing is a process that utilizes many other processes making it an advanced cognitive skill. It is the engine behind "what if" thinking, and that is the raw material of a great deal of executive management.

Do you note the overlap in many of the jobs performed by the "Factory Workers?" You might look at each of them as being a hybrid, containing similar elements, but each remaining unique enough to retain independence. You might also look at the "workers" as being "cross-trained" so that each is capable of picking up parts of the other or augmenting what the others do. That interchangeability, and flexibility is the hallmark of "higher level cognitive processing."

The list is far from complete, but it should give you an introduction to the skill of looking beyond the overt goal (getting the correct answer to a math problem) and studying the mental processes that are used and which either promote or hinder movement toward the goal. All of the proceeding are mental skills that will be found as part of what the Information Processing Model refers to as the Associative Stage.