



[Cognitive Enrichment through Exercise]

[Ignite 101]

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Program Overview



This course will provide insight into the delivery of cognitive programming at schools and gyms.

Many schools now understand that “mental health” involves far more than retention of information. Physical activity, chemical balance and nutrition all play a role in our capacity to learn. And the “fun” element increases the desire TO learn.

After nearly a decade of research, IgniteGym has been successfully testing strategies to optimize learning across all abilities. The BEST combination of engagement, activity and learning comes in the form of daily challenges.

Objectives



By the end of this course, participants will:

- Become familiar with the IgniteGym approach to mental health and cognitive fitness
- Be introduced to the 10 Cognitive Domains
- Learn how to participate in cognitive enrichment activities
- Learn how to perceive and utilize failure in a more productive way.
- Learn how to generate an interest and desire to solve problems.

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Mission Statement



Difficulty wakens the genius. – Ovid

Augment the learning process by utilizing the benefits of physical activity in combination with brain-based learning strategies to improve processing speed, working memory capacity, problem solving skills, creativity and imagination

Keys to Success

Keep it fun: maintaining interest in the activity is the single most important factor for long term participation. Too many notable mistakes or incorrect answers will deter even the most gifted individuals. Allow students to participate at level 1 even though they might be capable of participating at level 3. And finally, build on one’s bright spots early and often.

Ignite 101 Course Itinerary

Introduction: Why Ignite? Why brain? Why exercise?

BrainWOD 1– speed math warm up + Math workout

Lesson 1: The Brain

BrainWOD 2: Tabata cards

Lesson 2: The Brain-Body Connection

BrainWOD 3: Alternating-attention warm up + N-back game.

Lesson 3: Thinking

BrainWOD 4: Plate Puzzle relay

Lesson 5: Motivation

BrainWOD 5: Names and faces, wordlist

Lesson 6: Behavior

BrainWOD 6: Mastermind

Lesson 7: Methods

BrainWOD 7: Movement password

BrainWOD 8: Tribond shuttle relay

BrainWOD 9: Ladder Patterns and Sudoku progression sample

Case Studies and Short Answers

Why Ignite?

Fitness is not limited to the physical province. For decades, we've known exercise is a potent antidepressant, and research now strongly supports physical activity as the best way to improve neural networks and reduce cognitive decline as we age.

In fact, rigorous exercise is necessary for creating long-term memories that are easily recalled. It's critical for developing neural networks in infants, and maintaining connections in the brain in the elderly.

Since 2005, we've been researching the brain, motivation and the effects of exercise on both. We can make drastic improvements in brain function after traumatic injury. We can help kids with autism and gifted children alike. We can erase the deleterious consequences of 'chemo fog,' and hold off dementia and Alzheimer's awhile longer. But we need clients to exercise intensely, and to WANT to come to the gym. This is where workouts that are novel and challenging serve best.

While the benefits of weightlifting, anaerobic exercise AND aerobic training on the brain are widely reported, the effects of functional fitness on retention and adherence have yet to be studied beyond our own empirical measurement. But the effect is no less clear: clients who come to our gym LIKE doing their cognitive exercises. And they're more likely to attend their other therapies when physical training is part of their treatment plan.

When the opportunity to have a positive impact is this broad, it becomes a responsibility. Our mission is to help other gyms forge cognitive fitness.

The program is built on 4 pillars:

FUN – Fun piques curiosity and helps maintain interest, a necessary element in an enriched learning environment.

MASTERY – Separate from the Learning process, Mastery requires many hours spent using higher order processes of the brain.

VARIETY – Constant variance exposes the brain to as many subjects, puzzles, problems and languages as possible to develop resiliency or "antifragility".

RE-BRANDING FAILURE – From learning how to self-regulate to understanding mistakes, we teach a more productive approach to failure. Similar to the approach professional athletes, scientists and designers exercise during their work.

Solving the Cognitive Fitness Puzzle

Throughout this course we will endeavor to answer the following questions:

- 1.) Are there objective ways to measure cognitive fitness?
- 2.) What are the best ways to improve cognitive fitness without the use of drugs, or interventions with a psychologist or mental health care professional?
- 3.) What can we do on a daily basis to improve intelligence and mental health?

By creating cognitive programs within fitness facilities, supporting extracurricular learning and building innovative classrooms, we're not only forging a new profession, but we can collectively cultivate a culture that takes a special interest in cognitive enrichment.

Why Brains?

A healthy brain is one that can perform all the mental processes that are collectively known as **cognition**, including the ability to plan, judge, reason, make decisions, remember, learn new things, use intuition and manage stress.

While physical fitness has been shown to enhance cognitive function, the brain still needs to be challenged across a variety of four elements:

- a) Mental processes (we'll outline the ten cognitive domains in this course),
- b) Processing speed,
- c) Accuracy (accurate conclusions) and
- d) Interferences (cognitive load).

When these elements are challenged and trained, cognitive fitness improves.

Cognitive Fitness is the level of ability to remember, learn, plan and adapt. It is enhanced by

certain exercises (physical and mental);
attitudes (how we respond to a challenge); and
lifestyle choices (from deciding what books to
read to choosing a life partner.)

Intelligence

What is intelligence? Are there ways to
measure intelligence besides academic
performance or standardized testing? Is it
implied by your current occupation or
socioeconomic status?

10 Cognitive Domains:

Cognitive Mechanics – evolutionary based

- 1.) Memory
- 2.) Attention
- 3.) Organization, Planning and Logic
- 4.) Sensory Processing and Perception
- 5.) Motor Control

Cognitive Pragmatic – cultural influence

- 6.) Language
- 7.) Computation and calculation

Combination

- 8.) Motivation
- 9.) Creativity and Imagination
- 10.) Social Emotional Functioning
- 2.) Attention
- 3.) Organization, Planning and Logic
- 4.) Sensory Processing and Perception

Intelligence is:

- the ability to acquire and then apply knowledge and skills;
- the ability to learn and understand or deal with new and difficult situations

Researcher James R. Flynn highlights three common beliefs from a culture obsessed with standardized testing:

1. Intelligence is best measured by IQ tests
2. IQ is genetically determined, with the environment playing only a secondary role
3. Individual IQ gains over an individual's lifespan tend to be modest

His report, called "*The Flynn Effect*," oppose these three statements. Flynn postulates that tests measuring Fluid Intelligence (resulting from basic reasoning and problem solving skills used daily) show a much greater increase in IQ scores over time than tests measuring Crystal Intelligence (resulting from information learned in school requiring infrequent retrieval).

He speculates the following reasons, (all of which can be modified by our deliberate efforts) behind the increasing scores in Fluid Intelligence:

- a) An increase in abstract problem solving
- b) Better nutrition
- c) Better education and/or better access to education

Flynn calculates that genetic potential accounts for only 36 percent of IQ variance, with environmental differences making up the remaining 64 percent. While it's true that genes play a role in determining intellect, social-cultural factors combined with effort play an even greater role. Our cognitive functioning is largely modifiable.

Flynn's research highlights the flaws in our current measures of intelligence:

- 1.) IQ tests tend to favor Crystal Intelligence over Fluid Intelligence.
- 2.) Fluid Intelligence can become stronger with age and without formal education.
- 3.) The principal limitation on intelligence is how hard a person is willing to work.

Thomas Edison had it right when he defined genius as, "one percent inspiration and ninety-nine percent perspiration!"

Why Exercise?

Exercise serves a primary role in brain function, learning and memory.

Far more than just a tool to “burn off energy,” exercise is more effective than Prozac in managing stress; more powerful than caffeine in stimulating attention; and more important than any other learning strategy. Your brain can’t learn WITHOUT movement.

These are factual statements proven in laboratories. But they’re also logical arguments, and the barrier to exercise for most is emotional, not logical. Everyone knows they SHOULD exercise. We know we SHOULD get off the couch just as we know we shouldn’t “cram” for exams. But emotion gets in the way.

The methods we teach in Ignite are more typical of a behaviorist model than an exercise prescription. On a client’s first day, we let them play in the gym. We don’t assess their squat, or find their “weak links,” or tell them what they’re doing wrong. We let them find a “bright spot” and have fun, because it’s critical for every client to enjoy exercise. That’s primary.

Throughout this course we will highlight recent research in neuroscience and explore the role of exercise on cognitive fitness. But physical fitness, the gateway to cognition, must ALWAYS be fun.

At the end of this course, you will you be able to answer the question, “What does exercise have to do with improving cognitive fitness on a measurable scale?”

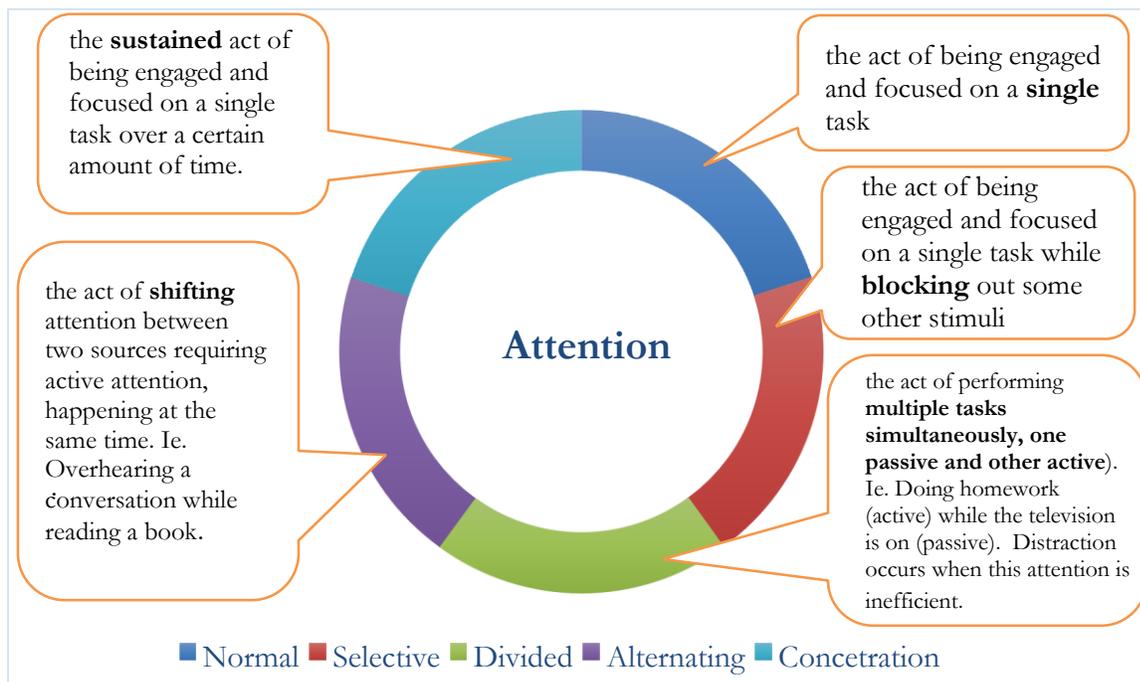
You’ll know how to build workouts, create optimal learning environments, and give clients the habits necessary for building fluid intelligence over their lifetime.

The 10 Cognitive Domains

Attention

Our brains are capable of carrying out a number of attention tasks and are shaped by environmental and developmental factors. When developmental factors such as motivation, past/prior experiences and current knowledge interacts with different environmental situations, our brains begin to adapt by strengthening the attention skills used most often. Simply put, how we spend our days shapes what we pay attention to and how efficiently these processes function.

Attention has two degrees: “passive” (daydreaming in class) and “active” (when teacher calls our name) and can be broken down into five types:



Enhancing Attention

The ability to recognize and then predict which attention skills will be needed to complete a task efficiently is the first step to enhancing concentration, focus and attention.

Attention Reflection

Cognitive Load

Awareness around of frame of mind and priming

Relationship with motivation and memory

Delivering instructions

Use priming to help

Set the stage – increase BDNF

Use a timer and Practice following directions in your environment

Language

The brain uses two separate processes to piece together language: Encoding and Retrieval. Encoding starts with letter recognition (such as shape and sound,) which are then used to develop word recognition and ultimately end with meaning and understanding. This can also include encoding verbal, non-verbal and body language from others. Retrieval, on the other hand, also termed as 'Expressive language', is the brain's ability to express thoughts into words, name things, and execute word finding.

Enhancing Language

Increasing the time spent with words and exposure to a variety of words develops associations and connections within the brain, making it easier to retrieve a word or name.

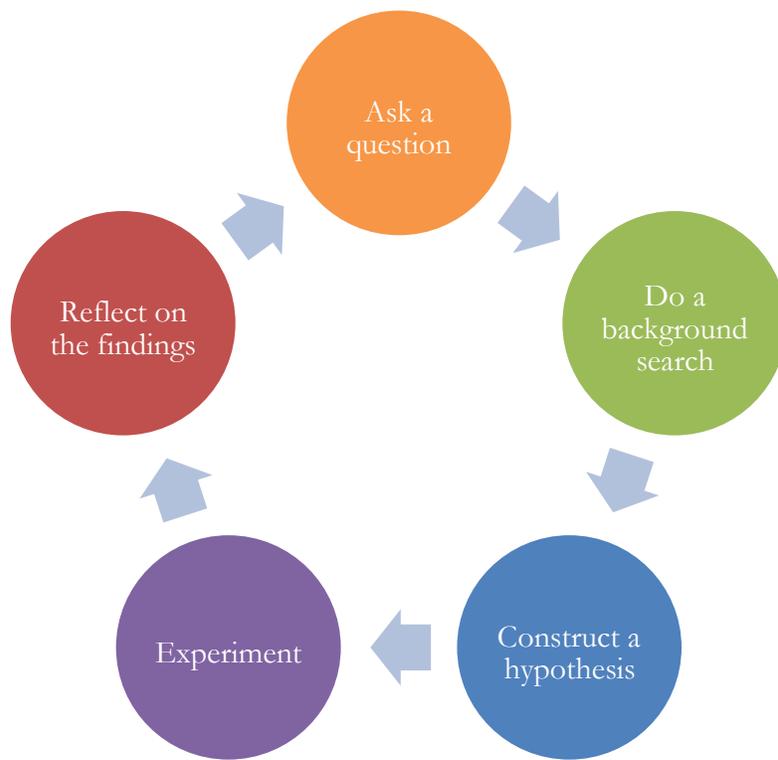
Logic, Organization and Planning

Logic, Organization and Planning are referred to as "higher order" brain functions because they are dependent on other processes in order to be effective. Organization, for instance, relies on working memory to juggle multiple pieces of information while trying to place them in a specified order. All three functions have to work together to carry out definitive actions in response to specific situations.

It's logical for a grocery store to organize similar foods in one aisle to help shoppers plan their route and get all the items on the list. Like an organized grocery store, finely-tuned higher order functions help decrease the time it takes to retrieve information, make decisions and, if need be, explain the reasoning behind those decisions.

Enhancing Logic, Organization and Planning

Invest your time in creating systematic procedures before starting any project or task. Chunking a large project into smaller, more manageable pieces is a valuable approach and can decrease the stress that often comes with feeling overwhelmed by the size of a task. One of the most widely-used and effective procedural systems is the Scientific Method. A problem doesn't have to be a science experiment in order for this procedure to be used.



Memory

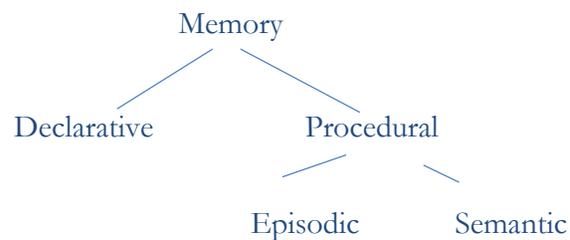
This is one of the most complex processes in the brain, because it involves many different parts of the brain and has three responsibilities: 1. Absorb information; 2. Store information; and 3. Retrieve information.

Absorbing and then storing information is called “encoding,” which calls upon the brain’s pattern recognition system to identify the stimulus then classify it. The third responsibility, retrieval, operates on three different timelines; immediate recall (a few seconds), delayed recall (minutes or hours) and finally remote memory (years).

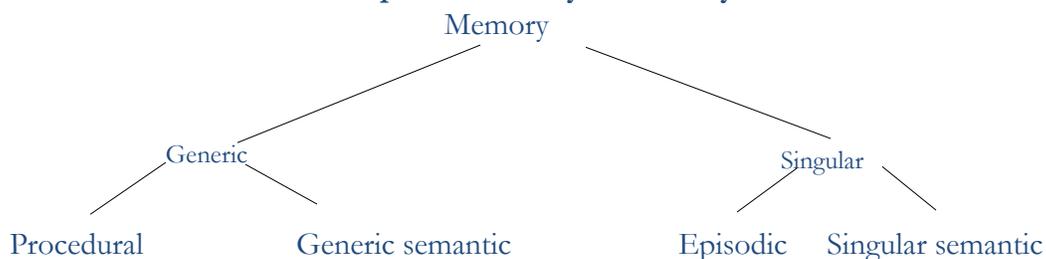
Enhancing Memory

Play around with different memory techniques such as Story retell, Person Action Object and Memory Palace, using a variety of stimuli (words, numbers, pictures, names and faces or a deck of cards). Practice memory retrieval without cues to strengthen memory. For example, a common studying strategy is to read a page of notes over and over until it feels familiar. This gives the brain a false sense of owning the knowledge. When called upon to produce the information on that page of notes, the brain is lost. Without a visual cue, it can’t retrieve the necessary information. The brain needs to practice “free recall”, retrieving information without any visual clues.

Traditional Memory Taxonomy



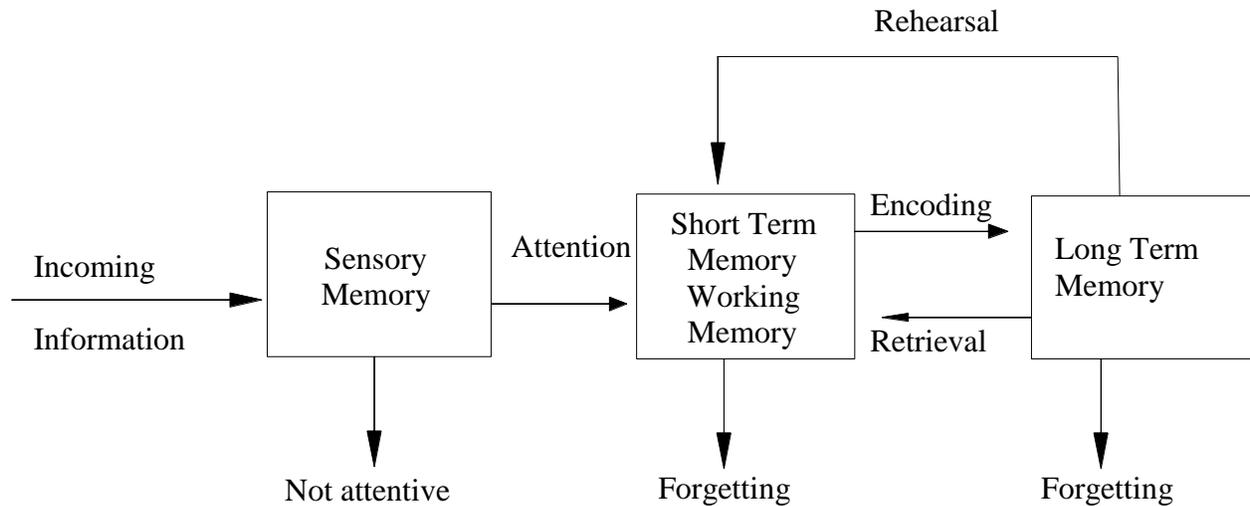
Proposed Memory Taxonomy



Knowledge that Paris is the capital of France is an example of singular memory. There is only one Paris and one France, so this knowledge refers to a single entity. By contrast, knowledge that tomatoes are usually red is an example of generic memory, since there are millions of tomatoes and this knowledge applies to all of them. As a rule, generic memories are accessed much more frequently than singular memories. E.Goldberg, Ph.D. *Wisdom Paradox*

Types of Memory

Immediate Memory
Working Memory
Short Term Memory
Long Term Memory
Retrieval



Multi Storage System

Atkinson and Shiffrin 1968

Memory Methods

Types of encoding:

Association – dependent on priming and existing knowledge

Sensory

Visual-Spatial (location)

Story Creation (Emotional Component) – condensing mind map

Practice the types of encoding and then retrieving under various degrees of stress. Names and faces

Lists

Enumerations

Stories

Parables = movie titles

Mind maps

Learning and Mastery Format

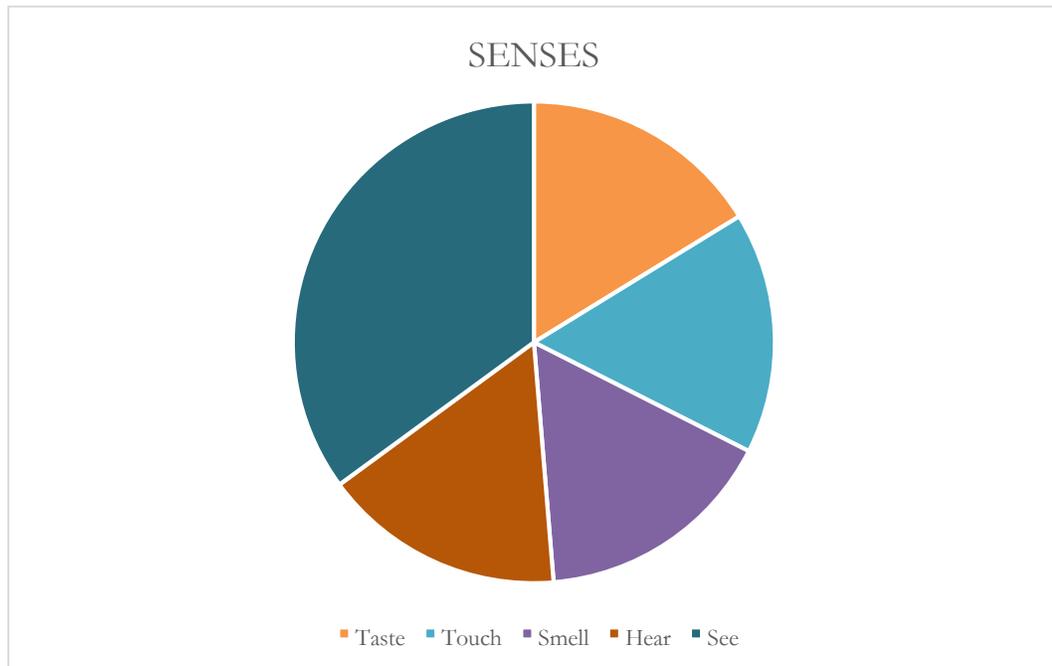
More experiences = more tools in the tool belt. (stored info, “Memory Palaces”)

Studying strategies – mind map

The traps – familiar, peeking, repetition

Sensory Processing and Perception

The five senses – vision, smell, hearing, touch and taste – are the messengers for everything that happens around us. Out of the five, the most valuable to the brain is the visual system. The visual system occupies over 30% of the brain's mass and is the only sense that has an entire lobe dedicated to its functional processing called the occipital lobe.



Enhancing Sensory Processing and Perception

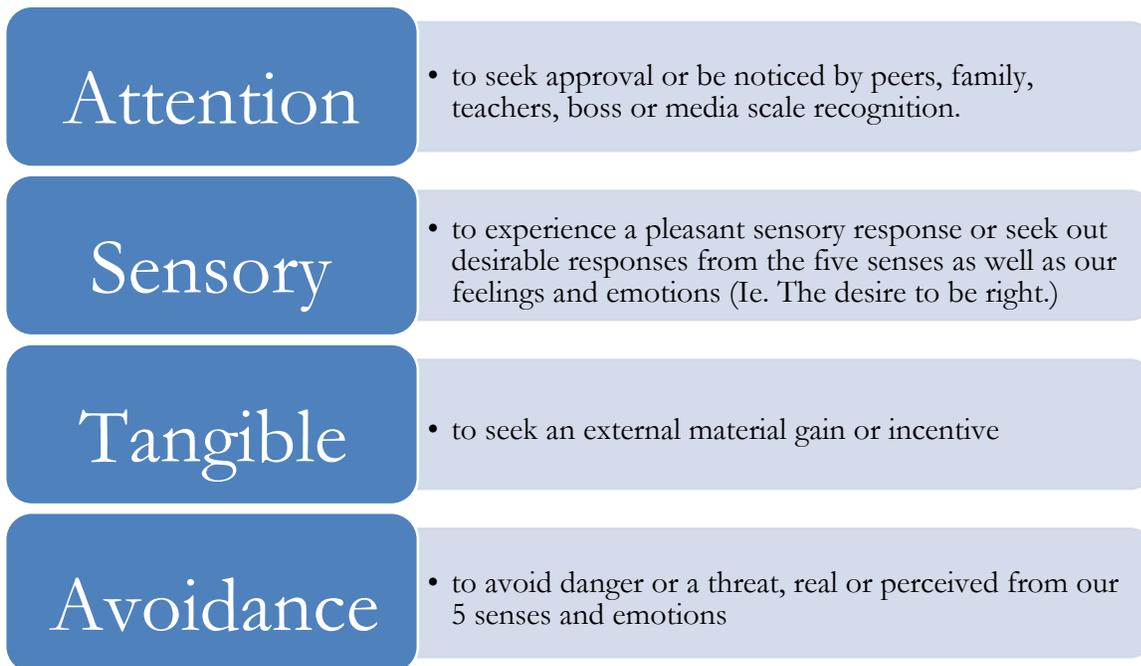
The brain is an amazing machine, capable of overcoming sensory deficiencies like hearing and sight. To enhance each sense, the brain needs to experience new tastes, smells, textures, sights and sounds in a variety of environments. One can improve sensory memory by purposely limiting one sense (ie limiting sight with a blindfold) and guess what is making a certain sound, or what object might have that texture.

Motivation

Motivation explains what we do and why we do it. Its role in the learning process is so paramount that it outweighs IQ scores when measuring future academic and economic success. It has been demonstrated that hard work or 'one's desire to do well' can carry them far beyond the limitations of their natural 'intelligence'. The higher the motivation, the more favorable the outcome. By this definition, motivation is a cognitive skill that can be enhanced.

Every behavior can be traced back to a certain type of motivation, which can be *intrinsic* (driven by personal fulfillment such as curiosity or joy) or *extrinsic* (driven by the removal or addition of an external condition or reward)

The different types of motivation are:



Enhancing Motivation

Appeal to interest through curiosity, novelty, and sensory-engaging experiences. Increase joy through bright spots and positive reinforcement, and contentment through praising effort, showing how to improve, shaping the path, fading away coaching cues, making the activity accessible. Increase love through passion, purpose and play.

Motivation Reflection

Our job is to take an individual's goals and develop a system/action plan/process/progression using the tools of motivation.

Work until you're happy

Lift the constraints

Shift from immature to mature motivation strategies

Using 'rewards'

Ways to design workouts/classes that cover multiple motivations.
Use copy/trace, fill in the blanks, free recall
Discuss cheating
Yelling can trigger emotional functioning instead of logical functioning

Computation and Calculation

The ability to select and apply basic arithmetic operations (addition, subtraction, multiplication, and division) quickly and accurately require well-developed computational skills. Calculating skills are the techniques and methods in which we carry out these operations using mental methods, paper-and-pencil, and other counting tools to help us arrive at the answer.

Enhancing Computation and Calculation skills

Math continues to be one of those skills perceived as ‘fixed at birth’ and is one of the most avoided brain functions, often outsourced to a calculator or computer. Like reading, it’s a subject that requires time, patience and perseverance in order to develop proficiency. Those who have well-rounded computation and calculation skills spend time using a variety of calculating tools, especially mental methods, and expose themselves to a wide variety of problems involving numbers.

Love it or hate it, basic numeracy skills are a vital part to everyday life. Whether comparing prices, calculating tax, reading a statistic, splitting a pizza between six friends or trying to decide if you can jump over that puddle, computing and calculating are life-saving and life-changing cognitive skills..

Motor Control

The brain hosts two types of motor skills: Gross Motor skills and Fine Motor skills. The goal is to automate motor control to allow the remaining cognitive processes to work. When a particular motor pattern is assigned to the motor cortex through rigorous repetition, the brain is able to efficiently and sometimes flawlessly think and move at the same time. This state is reserved for only the well-practiced movements; for example, walking down the street or a light jog. If a motor pattern or movement is not automated or suddenly becomes demanding (walking on ice or jogging while avoiding puddles) our attention has to shift away from other cognitive processes and focus solely on performing movement.

Enhancing Motor Control

In order to become proficient in a particular motor pattern, the brain has to have experienced the motor pattern in real time, not in a simulated environment. To have neat handwriting, one must practice handwriting. Improvements in handwriting can trickle to other fine motor skills; however, there are limits on the transferability of skills. In sports, for example, throwing a football is like throwing a baseball but to become proficient in throwing a baseball you must throw a baseball. Academics place more demands on fine motor skills than gross motor skills, and if fine motor skills

aren't sharp, our thoughts can become bottlenecked, slowed or possibly forgotten. The brain is unable to share whole ideas if it must divert attention to retrieving information from the motor cortex (ie. What side of the stick does the ball go in a lower-case b?) To enhance motor skills the body and brain need to experience lots of practice. Unfortunately there are no short cuts but novelty can make practicing a lot more fun.

Creativity and Imagination

Creativity is another cognitive skill that suffers from the fallacy of inborn ability. This process is one that occurs mostly on a subconscious level as a result of a well prepared and educated mind shaped by a variety of experiences and knowledge. A well-prepared mind boasts three character strengths: adventurous, persistence and bravery. Being adventurous enough to take two seemingly unrelated things and put them together, being persistent enough to work through the problems and challenges until something new emerges or an answer reveals itself, and being brave enough to expose this new combination or solution to the world.

Imagination is a skill used in a variety of cognitive processes like predicting, planning, hypothetical reasoning, visualizing events in the past or future, language comprehension and in design. This skill uses memories and experiences that already exist in two ways: 1.) To dream up fictional events or stories about princesses, dragons and robots that can fly, and 2.) To visualize something real that hasn't yet been seen, has yet to occur or even exist.

Enhancing Creativity and Imagination

The term 'combinatory play' is used to describe the moment when creativity and imagination are at work. Albert Einstein once said, "Combinatory play seems to be the essential feature in productive thought". What he means by 'combinatory play' is the way an individual takes two independent ideas, facts, symbols or objects and allows them to interact with each other. 'Productive thought' in this light, is the end result of that combinatory play period or "incubation". Productive thought does not have to be perfect or even something that works the first time. Failure can be just as productive, in some cases, as success.

Social and Emotional Functioning

Social and Emotional Functioning refers to the ability to develop and apply self-awareness, self-management, social awareness and relationship management skills which enable people to understand and manage their own and others' emotions in social setting. Optimal functioning allows for individuals to better handle stress, make decisions (emotional and logical,) form and sustain positive relationships, explore and engage with the environment, display empathy, feel confident and succeed in school and work environments.

Enhancing Social and Emotional Functioning

Being aware of controllable and non-controllable factors is a good starting place. Controllable factors (what you eat, how much you sleep, if you exercise and how much) if managed well, can greatly improve your ability to self-regulate. Another concept worth understanding is Maslow's Hierarchy of Needs and how emotions play a role in learning.

Cognitive Load

1.) Number of steps or amount of information at one time.

Putting together a piece of furniture, toy etc.

Receiving 4 or more instructions at one time

Receiving 4 or more instructions at one time without a visual reminder

Listening to a long story or conversation.

2.) Multiple tasks

Blocking out distractions like listening to music or carrying on an online conversation while doing homework.

Doing housework; vacuuming, dusting, washing, organizing etc.

Doing yard work; cutting grass, racking, gardening, organizing etc.

Doing work in the morning (physical or cognitive) and doing more work in the afternoon (physical or cognitive)

3.) Learning stage or performance stage

Reading something new

Doing something new

Going someplace new

4.) Broad times

Participating for long periods of time without breaks

Having a deadline or time constraint on the task forcing you to speed up.

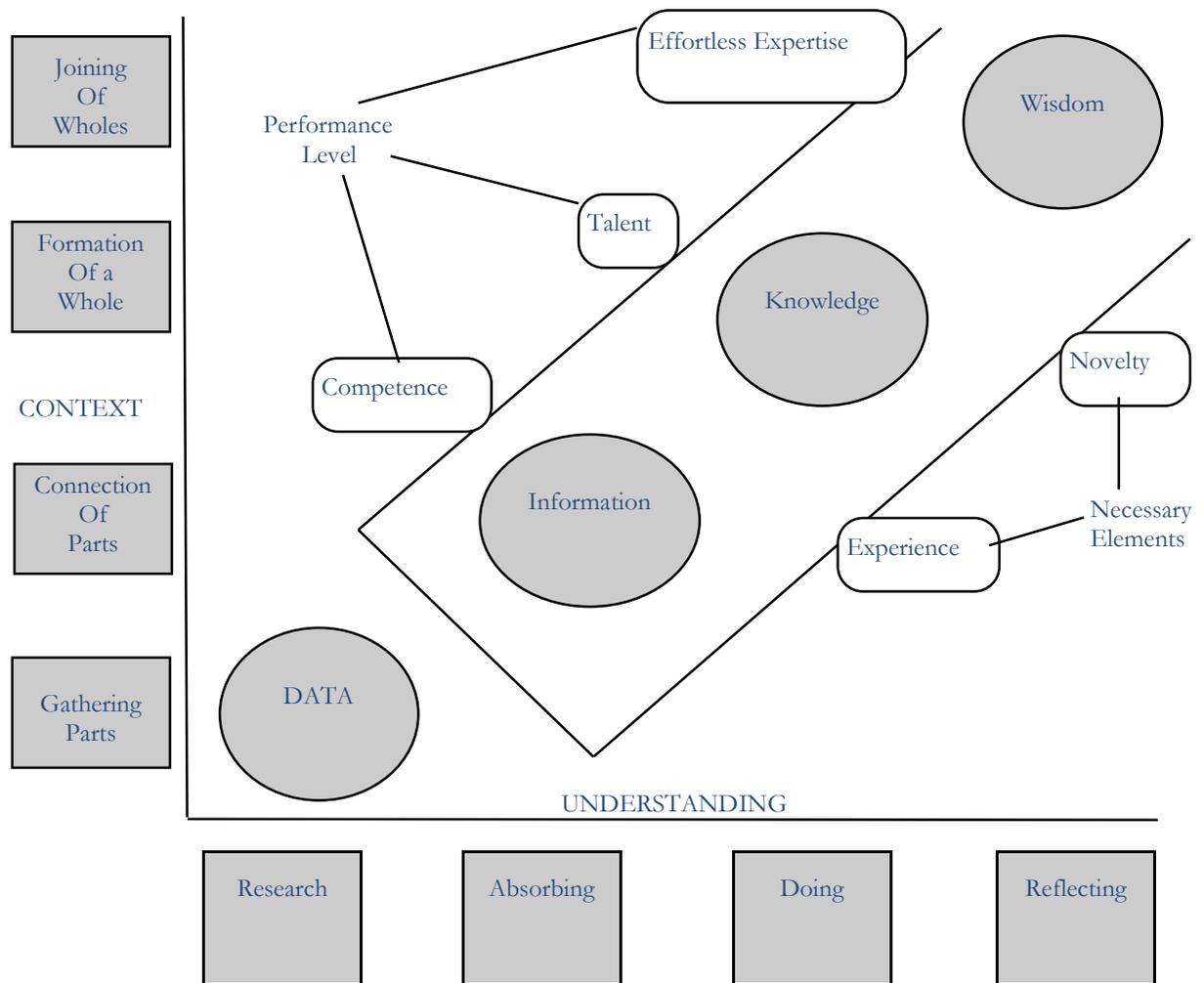
5.) Stress

From feeling "not like yourself"

From having to take breaks or naps throughout the day

From being forgetful or unable to concentrate.

From feeling overwhelmed.

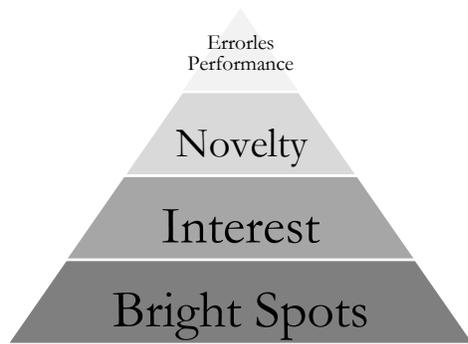


LEARNING CONTINUUM

Ref: Cleveland, 1982
Goldberg, 2006

Methods

1.) Ignite's approach to any physical or cognitive fitness task follows this hierarchy:



a) Start with an individual's bright spots, an area of high familiarity, efficient performance and low constraints.

b) If an individual lacks confidence or the ability to identify a bright spot, inquire where their interests lie. Are they a math person? Do they like puzzles that have shapes? Perhaps they would like to improve their memory.

c) If the individual lacks the ability to communicate their interests, make an informative decision on what might be an appropriate novel challenge. Baseline activities that have a

movement and cognitive component like the Plate Puzzle are usually good places to start.

d) Lastly, if the individual is difficult to motivate, demonstrate a challenge that is impossible to fail. There is value in frequenting the podium, even if the challenges seem ridiculous and irrelevant. (Ex. Challenge 1: Fall down on this mat 3 times then draw a line on the white board.) An individual may perceive that they are incapable of following through with instructions from a coach or teacher from prior experiences and need a bunch of small wins.

Measuring Cognitive Fitness

You can turn any worksheet or puzzle into a baseline activity to measure cognitive fitness.

1. Determine which of the following 10 cognitive domains are incorporated in the worksheet or puzzle.
2. Use the following evaluation matrix:

Evaluation Matrix	Accuracy	Processing Speed	Interference Delay	Interference Other
Pattern Recognition				
Copy/Trace	—	—	—	—
Fill in the Blanks	—	—	—	—
Free Recall	—	—	—	—
Encoding				
Copy/Trace	—	—	—	—
Fill in the Blanks	—	—	—	—
Free Recall	—	—	—	—
Problem Solving				
Copy/Trace	—	—	—	—
Fill in the Blanks	—	—	—	—
Free Recall	—	—	—	—
Reflection				
Copy/Trace	—	—	—	—
Fill in the Blanks	—	—	—	—
Free Recall	—	—	—	—
Create and Design				
Copy/Trace	—	—	—	—
Fill in the Blanks	—	—	—	—
Free Recall	—	—	—	—

3. Design interventions and facilitate lessons in the area of need using the following guidelines:

- 1.) Address any lagging skills, one lagging skill per lesson.
- 2.) Center practice and play sessions around autonomy
- 3.) Challenge performance using cognitive load principles

- 1.) Pattern Recognition – object naming
- 2.) Encoding – categorize, organize and store information
- 3.) Solving – using information to solve a problem
- 4.) Reflection – self evaluating, taking coaching cues
- 5.) Create and Design – use knowledge to create, design or imagine something new

- 1.) Data – meaningless facts
- 2.) Information – meaningful facts
- 3.) Knowledge – owns semantic and procedure knowledge through ‘doing’.
- 4.) Wisdom – demonstrate effortless expertise

Correction Procedures

A	B	C
1.) Visual targets and prompts + verbal cues + doing it together 2.) Visual targets + verbal cues 3.) Delay Recall 4.) Remove visual targets	1. I'll do (#) 2. We'll do (#) 3. You do (#) all by yourself. Start-go to- finish	1. Copy and trace, show and tell 2. Fill in the blanks 3. Rewrite 4. Free Recall 5. Free Recall + Interference

Additional Notes

- Establish movement standards before the workout begins. What will count?
- Do not correct every mistake they are making. Allow an athlete to complete a movement before correcting unless they are in danger.
- If they are doing the exercises “wrong”, praise their effort but name it something else.

Example: Burpees

Instead of jumping up and clapping above their heads, they are only able to stand up slowly one foot at a time. Say way to go, nice “Get ups!”

Activity: Ask them to come up with another name for (this) and (this)-demonstrate a common mistake

4. Retest and note any changes in accuracy, processing speed,