

Arrowsmith Program Cognitive Exercise Outcomes

The chart below outlines the possible academic skills and learning outcomes that may occur as a student increases cognitive function. Each student will have a varying rate of progress and therefore varied outcomes.

| COGNITIVE FUNCTION | SKILLS | POSSIBLE OUTCOME |
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| Motor Symbol Sequencing | Writing | Writing becomes more automatic. Student can think and write at the same time; they do not have to concentrate so hard on writing that they forget what they were thinking about. Written assignments and tests can be completed in the allotted time. Handwriting is no longer messy and irregular. Handwriting becomes more automatic and often preferable to printing. There is more flow of thought to paper in the writing process with more content ending up on paper. Copying material from one location to another (e.g., from the blackboard or a textbook into a notebook) is faster and more accurate. |
| | Reading | Words are no longer misread due to poor eye tracking. Reading speed improves. |
| | Spelling | The student can spell the same word properly and consistently on the same page. There is improved muscle memory for writing words in the correct symbol sequence. |
| | Speech/ Communication | The student no longer rambles and can get to the point. Speech is more concise. They no longer leave out chunks of information which are necessary for the listener to understand what the student is talking about. |
| | Mathematics | Improved accuracy in written mathematical computations. The student no longer makes written or eye tracking errors. |
| | Science | Less careless errors in written scientific formulas. |
| Symbol Relations | Time Mathematics/ Science | The student can learn how to read an analog clock. The student understands math concepts and scientific formulas. The student understands the meaning or "why" of procedures. |
| | Comprehension | The student understands cause and effect relationships or the reasons why events happen. The student is able to participate in a discussion now being able to fully grasp the meaning of what is being discussed in the moment. |
| | Reading Comprehension | The student no longer has to read material over and over again to understand what is being said. |
| | Socially | The student is able to consider several alternatives logically at the same time in order to plan and make decisions so they present as having more mental flexibility and less personality rigidity or stubbornness. He/She is better able to understand and communicate his/her own thoughts and feelings to others. |
| | Vocabulary Writing/Speech | Understanding the deeper level of the meaning of words. Conceptual versus narrative – interrelating ideas and concepts vs. stringing together a series of details. |

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| Memory for Information or Instructions | Memory | Instructions no longer have to be repeated several times. The student is better able to remember what he/she has to do and can follow through with assignments. |
| | School | The student will remember what the teacher asked him/her to do for homework. People with this problem tend to compensate by taking notes in order to help him/her remember information or by developing rigid habits without which their lives fall apart. They no longer need to rely on these compensations but can remember the auditory information/instructions. |
| | Studying | Remembering information for an exam becomes easier and the student is able to retain it through to the exam and after. The student does not forget the information gradually throughout the study time. |
| | Vocabulary | Remembering definitions of words. |
| | Reading Comprehension | Remembering all of the information read leads to better comprehension. |
| | Writing/Speech | Remembering all of the thoughts intended to impart in speech or written work. |
| | Spelling/Math/Science | Remembering rules. |
| Predicative Speech | Memory | In any learning situation the student is able to actively recode information through internal speech in order to retain the information solidly in memory. In other words, the student is able to recapitulate or 'put things in his/her own words'. |
| | Speech/Writing | The student can elaborate in both speech and in written expression. The student has a sense of the appropriateness of where words go sequentially in a sentence. Increased fluency in sentence expression. |
| | Math/Science | Procedures in mathematics and science can be learned without a breakdown of the steps of the procedure. |
| | Socially | The student has the ability to say things to himself inside his/her head to control his/her behavior. The individual can go through a process of active internal rehearsal of what he/she should do in various situations. The student is capable of thinking out the possible consequences of an action beforehand. |
| | Reading Comprehension | The student has the ability to understand sentences through the meaning conveyed by the positioning of the words in the sentence. |
| | Vocabulary | The student has the ability to learn vocabulary through context - by understanding the meaning of the word by how it is used in a sentence. |
| Broca's | Reading | It is easier to learn and enlist phonics skills in the reading process. |
| | Speech | The student is able to think and talk at the same time. The student is less likely to lose his/her train of thought. This results in a gain in confidence in speaking to others in new situations. The individual no longer mispronounces words. Strengthening this area improves the ability to learn the spoken aspect of a foreign language. |
| | Spelling | The student is able to spell using sound-symbol correspondence. |
| | Vocabulary | New words can be learned through improved ability to read. Improved word retrieval aids vocabulary building. The student's spoken vocabulary improves because he/she can now pronounce words whose meaning previously was only recognized in silent reading. |
| Auditory Speech Discrimination | Hearing | The student no longer mishears words in a conversation, discussion, lecture, TV program or series of instructions and therefore can now correctly interpret the information heard. |
| | Listening | While taking notes the student no longer mishears words and writes down the wrong words. A student has less trouble understanding someone who speaks with an accent. |
| | Spelling/Speech | Words are spoken and spelled correctly due to an improved ability to hear them correctly. |

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| Symbolic Thinking | Planning & Organizing | The student can develop strategies for studying. The student can work out an active plan to organize him/herself. |
| | Setting Goals | The student can create long term goals and plans and follow through on these. A student is often viewed as being more trustworthy because they are stable in long range planning. |
| | Thinking | There is a stronger process of active probing or searching for an answer and increased active mental initiative in problem solving. The student can generalize learned information appropriately to similar situations. The student sees the differences between situations and responds appropriately to the unique elements in each situation. The student is able to self-correct and learn from mistakes. |
| | Focused | The student is better able to keep his/her attention focused on a language related task to completion. The student can see the main point or overall idea of a symbolic activity (e.g., a discussion, a story, a movie, a math question) and does not get sidetracked by irrelevant details. |
| | Vocabulary | The student will learn new words as a result of increased attention and drive for information. |
| | Reading Comprehension | The student has the ability to see the main point of written material. |
| | Writing/Speech | More focused writing and speech with an increased ability to stay with the main point without getting sidetracked by irrelevancies. |
| | Math/Science | The ability to organize all cognitive areas to problem solve. |
| Symbol Recognition | Visual Memory | This is the capacity to recognize and remember a word or symbol visually that has been seen before. |
| | Reading | Reading is no longer a slow process. The student's word recognition level (words he/she can see and say immediately) improves. Reading speed is faster because the student no longer has to rely on sounding out words, but can recognize the words from visual memory. |
| | Spelling | The student is better able to edit written work and recognize spelling errors. |
| | Vocabulary | The student can learn vocabulary words as a result of an improved reading ability. |
| | Math/Science | The student can visually memorize symbol patterns in mathematics or in chemistry. |
| Lexical Memory | Memory | A student can remember four unrelated words in a series. The student can follow oral information. |
| | Vocabulary | Auditory acquisition of new words is improved. The student can use paired associative learning (for example: a road is a street; a dog is an animal). |
| | Reading | Improved ability to match printed words with the sounds of those words. |
| Kinesthetic Perception | Agility | There is less awkwardness of body movement with decreased clumsiness. The student is less likely to cut himself/herself with a knife or hurt himself/herself when using tools. |
| | Writing | Writing is maintained on the line with less pressure exerted on the pen. |
| Speech Kinesthetic | Speech | Clearer speech; less likely to get tongue-tied. Clear articulation of words. |
| Artifactual Thinking | Socially | The student can interpret non-verbal information such as facial expressions and body language and as a result he/she can change his/her behavior according to the signals people are sending. Also the student acts appropriately in social situations because he/she perceives the significance of the non-verbal information. The student can interpret subtle cues to stop talking excessively about a topic. The student now considers all the existing elements in a situation before acting and therefore behavior is appropriate to the specific situation. The student thinks through a situation and is less impulsive. |
| | Focused | The student can develop plans and long term strategies to deal with situations. |

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| | Emotions | The student can register and interpret his/her own emotions. The student can register others' emotions to be able to empathize and sympathize with them. |
| Narrow Visual Span | Reading | The student can now see whole words in a single visual fixation. Reading is less fatiguing and less jerky. Reading speed increases. Navigating in the dark is less problematic. |
| Object Recognition | Visual Memory | The student recognizes items more readily when shopping and when looking for things as they can remember the picture of the object. The student can remember visual cues such as landmarks to help in the process of remembering the location of places. |
| | Socially | The student can recognize and remember faces and will not miss details in facial expressions both of which cause social and interpersonal problems. |
| Spatial Reasoning | Mapping | The student can visualize a pathway of movements inside his/her head; he/she can work out a map inside his/her head of how to get from one place to another. When map reading the student no longer has to rotate the map to orient towards the direction he/she is travelling. The student has a map of how space works inside his/her head. The student can go from a two-dimensional diagram to construct a three-dimensional object. In driving a car the student has less trouble planning moves ahead of time. Games such as checkers or chess become more enjoyable since the student can imagine several moves ahead in their head. Performance in sports activities requiring a spatial plan of movement improve. There is an ability to imagine different ways to arrange furniture in a room. |
| | Workplace & Home Life | The student's workspace tends to be less messy and more organized. The student does not have to leave things in piles within line of sight but can organize things spatially and remember where they are filed/stored. The student no longer forgets spatially where he/she has left objects. Things do not get lost as often. |
| | Math/Science | There is less difficulty in constructing geometric figures and molecules. |
| Mechanical Reasoning | Life | The student has less difficulty in imagining how machines operate and can effectively handle and use tools. The student can build/construct objects/machines. |
| | Science | Improved ability to understand physics. |
| Abstract Reasoning | Life | The student is able to carry out in proper sequence a series of steps in a task such as computer programming, using tools, cooking or sewing. |
| | Science | Procedures in science can be learned without a breakdown of the steps of a physical procedure. |
| Primary Motor | Body | Improved speed, strength and control of muscle movements on one side of body or the other. There is less awkwardness in the body. |
| | Writing | Improved control of the writing instrument. |
| Quantification Sense | Math | The student can calculate change, estimate time, understand relative quantity, learn math facts and perform mental calculations in his/her head. The student is able to make progress in mathematics and no longer resorts to counting on his/her fingers when solving math questions. Factoring, at a high school level, is no longer confounding. The student has a sense of the magnitude of number which is important for time scheduling, budgeting and time signature in music. |