writing also — and the process of reading is underway.

For reading, the teacher asks for a favorite song, that she writes in cursive and then has the children follow the words as they sing. This establishes an emotional-relational connection, so important to the memory process, since memory is closely linked to emotion in the relational limbic system. There is a lot of movement and rhythm play in each learning process.

I can vouch for the effectiveness of this approach by recalling my own experience of learning the alphabet. It took singing the alphabet song to help me finally learn my ABCs. I still find myself singing it when I have to file papers in alphabetical order.

In contrast to the Danish system, I remember my first reading book having a lot of words like "the" "and," "yes," "can." Just recently a child brought me a book she was working on in kindergarten. The name of the book was: *Yes I Can.* Now, what kind of image do words like these elicit? To learn something new it is imperative that we tie it into something familiar and — at this young age — something with a concrete image. Teachers give students three letter words because they appear simple, but in reality they are far more difficult than "dinosaur" because they hold no internal image or emotion.

BLOCK LETTERS AND WRITING BLOCKS

Another unnatural challenge has to do with learning to print block letters as the first step in writing. Printing is a highly linear process that takes us away from the more continuous rhythmic flow of language, both as it is experienced in the mind and as it is expressed through the hand — as in cursive script. In many European schools they never teach printing, and find children have no difficulty going from writing in cursive to reading block printed text, usually at the age of eight. I am surprised there hasn't been more research done on the comparative effects of the ways writing is introduced in different school systems worldwide. Educators in Germany have told me they are finding that students are now having more difficulties with language since they have switched over to teaching block printing as the first step to language.

Part of the problem is the lack of hand development, and asking children to perform the complex process of printing, way too early. In order to print the child must first crawl for a good long time with hands forward, to develop the bones in both the hand and to gain upper arm strength. As the child matures, they need to further strengthen the upper arm and hand by pulling themselves up on furniture, ladders, rocks and trees. They must also lift and manipulate objects of different weights and textures like blocks, sticks, pots and pans, etc. If you look at an X-ray of hand development, you will notice that the very intricate bones of the area near the wrist — the carpals, are not fully developed until about age twenty. The more developed these bones, the easier to hold a pen or pencil to print. If the child has had a lot of sensory-motor activation of the hand, printing can more easily be taught at about ages eight to ten.

If you hold the carpal area of your hand while doing cursive writing and printing, you will notice how much more bone movement is required for printing. The development of the hand is intimately linked to brain development — the rich supply of nerve receptors that develop are not only essential for grasping, they are important for conscious perception.[45, 46]

In the American school system we follow the British lead and teach children to print at age five. At this early age, children have to work very hard at printing since it defies the natural development of the hand as well as brain functions. I believe this premature introduction is a major causative agent in the writing blocks many students and adults experience. After age eight, when the hand is developed enough to accommodate the discrete and linear operations necessary for printing, we then teach them cursive. It is a crazy game that only serves to maintain high stress levels in the child and leads to "learned helplessness." This learned helplessness occurs when the person decides that whatever they do will be wrong, so they make only a marginal effort, or just give up.[47]

This is not the only example of learned helplessness resulting from a pedagogical strategy that sacrifices long term gains for short term, illusory results. The excessive use of lower level skills tests, usually of rote memory, and usually timed — as often as two or three times a week right up through college is a graphic example. Rote memory is a straight line process requiring none of the depth of understanding that comes from whole brain activation. In short, rote memory does not require thinking. These tests induce learned helplessness by promoting situations and habits where students only study for the tests, and students with test anxiety end up in a state of perpetual stress.[48]

Under these circumstances there is no time or space to develop deep understanding of concepts, test out new ideas through verbal and written action, or develop deductive reasoning skills. The long-term educational effects are as predictable as they are unfortunate. The National Science Foundation analyzed not only the six most widely used national stadardized tests, but also the tests designed to accompany the four most commonly used science and math textbooks in fourth and eighth grade and high-school classes.

These tests were found to focus on lower-level skills (primarily rote memorization and application of routine formulas), instead of problem solving and reasoning which curriculum experts say should receive the greater emphasis. The study also noted that since states judge schools and determine teacher assignments based on students' test scores, these tests inadvertently set the agendas of many teachers.[49]

Research done by Herman Epstein shows that formal reasoning has not been a natural outcome of our current educational process. He discovered that at age eleven, only five percent of the population is at a formal reasoning level. Only one quarter have reached this level by age fourteen, and in adults he found only half are fully functional formal thinkers.[50]

FROM KNOWLEDGE TO MEANING

The final goal of any learning experience should be the creation of meaning. Real knowledge occurs as we take in our rich sensory environment and piece it together in our own unique way to give us a picture of our world. This becomes our reality. Each new experience refers to this picture; each new experience reorders and expands it.

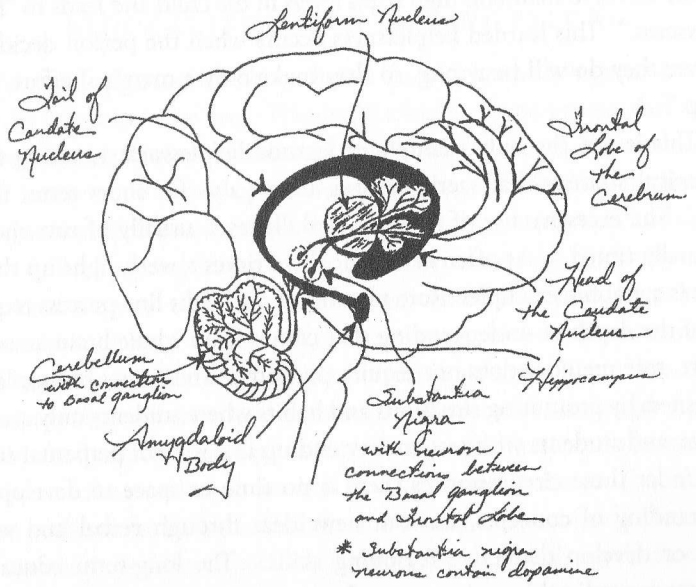

Figure 5.7: Thinking and Memory Orchestrated by Neural Connections from Key Movement Centers of the Brain

From this reality, we are able to make decisions and take actions that explore, test and anchor our beliefs and our understanding. The process by which we integrate our experience into a growing understanding of the world should be the prime concern of the educational system. Demonstrating that understanding, through work assignments that require thinking, should be an indispensable part of any learning experience.

Skills manifest as conscious physical responses demonstrating knowledge acquisition. Thinking itself is actually a skill dependent upon the whole, integrated body/mind system. The whole system must be active in order to take in information, select what is important about that information, integrate it with existing patterns and finally, to anchor it with movement. Thinking and learning are anchored by movement.[51, 52] Actions such as doodling, eye movements, speaking aloud to oneself or to others, writing things down, are familiar movements that occur during thinking. Without movement of some kind, you don't get conscious thought. The final outcome of this process is meaning.

USE YOUR HEAD — AND YOUR BODY

Real learning — the kind of learning that establishes meaningful connections for the learner — starts with movement in response to a stimulus, then creates a context or experience to understand the sensory input. Finally, learning is not complete until there is some output, some physical, personal expression of thought. Much of learning involves the establishment of skills that enable us to express our knowledge. Speaking, writing, computing, drawing, playing music, singing, moving gracefully in dance and sports: the development of our knowledge goes hand in hand with the development of the skills that support and express that knowledge.

As we build these skills we use the muscles of our bodies, establishing neuromuscular routes as well as their ties to cognitive routes. Learning is not all in your head. The active, muscular expression of learning is an important ingredient of that learning. This point may seem obvious when you think about it, but not many people are used to thinking about muscles in this way. We tend to relegate muscles to the domain of the body, not the mind. But it is through expression that we advance and solidify our understanding. This can be seen in the research showing that students who take drama, or music where a lot of expression is encouraged, do far better on standardized tests than students without experience of these arts.[53, 54]

Usually this expression takes the form of speech (or sign language in the