BEST: International Journal of Humanities, Arts, Medicine and Sciences (BEST: IJHAMS)
ISSN (P): 2348–0521, ISSN (E): 2454–4728
Vol. 7, Issue 8, SAug 2019, 19–30

YOUR MOST IMPORTANT TEACHER

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ABSTRACT

This essay argues that our educational system is fundamentally disoriented, and provides evidence for an alternative approach. The essay describes how we are each our own most important teachers, because each of us is constantly building on knowledge we already have in our minds using our evolving internal tools of knowledge. The classroom that recognizes and cultivates this internal foundation gives its students the tools to create their own knowledge. I summarize extensive research about how we learn (and how we don't learn) and about pedagogical approaches that have shown success in developing optimal self-teachers. We all need these tools. Instead of attempting to cram us full of information and skills much of which we soon forget, our education system should focus on fostering optimal self-teachers.

KEYWORDS: Teacher, Cognitive abilities, Knowledge & Metacognition

Your Most Important Teacher

"Self-taught, are you?" Julian Castle asked Newt.

"Isn't everybody?" Newt inquired.

"Very good answer." Castle was respectful.

Vonnegut, Cat's Cradle, 1963

"Teachers may open the door, but you must enter by yourself"

Chinese proverb

1. INTRODUCTION

A few years ago I had the pleasure of visiting my first grade teacher, "Miss Roberts." She was 97 and, though frail, all there in the mind. I recall distinctly first learning to read Jack and Jill, and first learning arithmetic, under her gentle tutelage. I can picture where I sat the orientation of the desk, the books, my pencil, Miss Roberts looking over my shoulder, guiding me. Both reading and math were revelations to me. The strings of letters and words representing the world and the abstractions of numbers and their logic and manipulation were intriguing new frontiers. I was impelled to seek more.

What was the change in my thought that Miss Roberts facilitated? What capacity did I gain? What was the foundation already in my mind on which that gain built? When I reflect on the foundational period in my intellectual development, I recognize that I took in that for-me new way of thinking and seeing the world, turned it over and over, examined it, adapted it to what I already knew.

My thesis here is that much learning is inherently self-teaching-a teaching OF oneself BY oneself, and that, therefore, we are ourselves our most constant and important teachers.

Figure 1: Author and his First Grade Teacher, "Miss Roberts."

Learning is an internal dialogue, using the tools that we have at our mind's fingertips to figure out what to do with new information, observations, and reflections and to build better tools. Your self is a conversation-your self talking with yourself; your knowledge is the evolving conclusion of this conversation.

Just because we are our most constant and important teachers, does not mean that we are effective or efficient self-teachers. As a species, we can't be too ineffective at self-teaching, or we would probably have gone extinct. But survival does not imply that we can't improve. How do we acquire self-teaching skills? How can we optimize the capacities of the self-teacher? It is critical to examine the characteristics of the self-teaching process and to explore ways to build the skills of self-teachers. It is also reasonable that we organize the educational enterprise with a focus substantially different from its current focus on acquiring information.

Muscles in the human body are built by tearing and rebuilding existing muscle fiber. Tears heal into larger, stronger, and more robust muscle fibers and an increase in the number of fibers. The repair and rebuilding process takes time and occurs most effectively under certain environmental conditions, such as rest and nutrition. Up to some limit, the greater, the deeper the extent of fiber tears, the greater the recovery process, its demands, and the results in strength and endurance. The growth of knowledge bears similarities to the growth of muscle. Substantial growth disrupts current knowledge. The bigger the tear, the disruption, the new information, the greater the reorganization and expansion of what was previously there. The biological comparison may seem farfetched, but mental processes must also be rooted in human biology, even though we may not understand well their biological foundations.

In the remainder of this essay, I describe

- how the process of knowledge and learning begins in infants,
- the root of the processes of knowledge and learning in what is referred to as "executive function," in
- brain biology, and in
- the social environment, and how these processes grow in health, and can go awry.
- I note some approaches to learning that detract from exploration and creativity and may thus be harmful.
- I advocate the teaching of self-teaching as the focus of our societal pedagogy.

This sequence clarifies ways in which this process can be nourished, malnourished, derailed, and strengthened.

2. METHODS

The essay is constructed from a conceptual framework and a search for research to clarify conceptual and causal elements of the framework, and then to evaluate intervention studies for alternative recommendations. Rather than the investigation of specific hypotheses, the essay is an exploration of broad implications of an approach to knowledge and education. Empirical studies and systematic reviews provide an array of evidence. The search is exploratory rather than systematic; however, “negative” studies are weighed to avoid false directions.

3. RESULTS

Two Views of How We Learn

A predominant view of learning often referred to as “positivist” or “empiricist” is that learning is essentially the collection and compilation of information. Harvard professor of psychology, Susan Carey, describes this view as a “common sense epistemology,” in which knowledge arises “unproblematically from sensory experience” and is simply “the collection of many true beliefs.”(Carey, Evans et al. 1989) This conceptualization is captured in the common, but misleading notion of “data” singular “datum,” which, in its Latin root, means “thing(s) given,” In the datum view, the infant mind is an “empty vessel” into which information is poured and accumulates, a “tabula rasa” Latin for the clean slate, a blank onto which knowledge is transcribed.

In the second view, learning is an activity. The activity includes interrelated components, a critical one being the set of rules the learner employs to judge, evaluate, and then process incoming information and sensations; this component is referred to as an “epistemology,” the learner’s theory of how he/she knows ‘things,’ decides what is true or false, right or wrong, beautiful, ugly, and so on. What counts as evidence? How much evidence does it take for me to believe or to doubt specific statements? It is this complex activity that identifies the person as his/her own teacher. The self-as-teacher draws on his/her epistemological rules and applies them to new in- formation or observations in order to decide what to make of this new material. Learning also involves the cultivation, expansion, and modification of the rules themselves. It is the shaping of such rules that I am proposing should be central to the educational process so that students be- come effective or optimal self-teachers.

My proposal accords with several related streams of psychology thought and pedagogical research. The broadest psychological framework from which I borrow is “constructionism” (Cakir 2008) the idea that from infancy onward, the mind is a framework, a structure, which organizes the learner’s concepts, values, principles, and knowledge at any given time. This perspective contrasts with the data/tabula rasa conceptualization, and implies that teaching is optimized when the other-teacher recognizes the existing framework and facilitates new knowledge in response to that framework.

“It can be concluded that students’ prior knowledge, expectations, and perceptions deter- mine what information will be selected out for attention. What they attend to determines what they learn. In order to learn a concept meaningfully, students must carry out cognitive processes that construct relations among the elements of information in the concept.” (Cakir 2008): 202.

Another closely related framework is “metacognition” John Flavell, an emeritus professor of psychology at Stanford University, who first developed this notion, defined “metacognition” succinctly (Flavell 1979): 906) as “knowledge and cognition about cognitive phenomena.” Cognition is the process of thinking and understanding. Metacognitive thought is about thought itself. Flavell reports studies of preschool and elementary school students given a task of remembering objects. Younger students said they understood the metacognitive instructions, but they were generally unable to carry out the task presumably because they did not truly understand. Older students clearly did understand the instructions about the cognitive task of determining what objects were there and then committing them to memory and they successfully carried out these tasks.

Auto-didacts (from the Greek, autos 'self' + didaskein 'teach') deploy with excellence the skills I am talking about: They are people who, in relative isolation from usual teaching sources, reconstruct for themselves an existing body of knowledge or develop a new one. Albert Einstein surveyed the principles underlying the physics at the end of the 19th century, found systemic inconsistencies, and rethought the basic logic of his field, publishing his revolutionary results at the age of 26 years. Kurt Gödel (at the age of 24 years) developed a mathematical system by which he proved basic characteristics of mathematics itself e.g., that one could formulate mathematical statements that were true but not provable. What these men did was to examine relationships among ideas which they already held within their minds and assess connections among these ideas using a logic which they also maintained or developed within, with stunning, radical results, changing our understanding of the world and its logic. I propose that the basic skills used by these geniuses are ones which all healthy individuals are capable of learning and using. But we are most often unaware of the underlying processes, and most often we have not sought to develop them.

To summarize, learning is an active process, a mental act in which the learner uses the knowledge he or she already has, combined with his/her processes of reasoning and whatever new information has been perceived/received to build on what he or she already knows. The new information may simply confirm what is already known either because it is concordant with what is known or because it is evaluated as false and rejected; or it may lead to a modification of what is known. The learner's mind frames the learning process both because it is the foundation onto which new knowledge may be added and because it is the source of reasoning and judgment the tools by which incoming information is assessed and existing knowledge is revised, or not.

3.1. The Beginning: What Infants Know

What does the infant know, how does it know what it knows, what are the underlying principles of its thought and knowledge acquisition? I begin at this beginning not quite the be- ginning because it is likely that processes of knowledge begin before birth in order to show how much is already there very early in our development and to suggest what is then needed to grow into mature phases of human knowledge and self-teaching.

It is difficult to come to know or infer the underlying concepts and principles of knowledge acquisition of anyone perhaps even one's own. But baby metaphysics presents additional challenges, principally the absence of language. We cannot fruitfully ask infants or very young children what or how they think.

Using a research technique is known as "violation-of-expectation method," Prof. Karen Wynn, now at at Yale University, has shown that five-month-old infants have a basic understanding of addition and subtraction.(Wynn 1990) The infant faces a small stage. When observing small numbers of objects in front of them being added to or subtracted from each other, if the result they are shown is incorrect, the infants look for a longer time than if what they observe is correct and expected. What they expect corresponds to their arithmetic knowledge, their awareness of addition and subtraction. Results like these have been consistently observed in dozens, if not hundreds of experiments: experiences that are not what the infant logically expects elicit notably more attention than do experiences that are expected. Other studies have demonstrated that even newborns have an understanding of numbers.(Izard, Sann et al. 2009) Presented with differing numbers of repeated sounds, they will match identical numbers of objects presented visually; they recognize a shared number whether presented auditorily (by a number of repeated sounds) or visually (by a series of identical objects).

3.2. Foundations of Knowledge and Learning: Executive Function

Findings about infants such as these indicate that, substantially before the development of language and the implementation of formal teaching, the very young human child already has a sophisticated, innate foundation of knowledge and reasoning on which new learning builds. A central organizing and controlling center of this foundation and process of knowledge is “executive function.” The cultivation of executive function is a delicate process highly responsive in both positive and negative ways to the infant’s physical and social environment. It is here that there are opportunities for the fostering of strong self-teaching skills.

If executive function is the seat of control of our thought processes, it should be a prime focus for the development of self-teaching capacities. It is here that awareness is key, that agility and the recognition of possibilities for finding and combining internal and external resources can en- hance the self-teaching and learning processes. Also key is recognition and cultivation of the environment and sources of executive function, e.g., the literal nutrients and physical acts beneficial for development, but also the community and interpersonal interactions that foster the cul- tivation of optimal mental and mental-emotional facility.

Reflection on mental arithmetic gives additional insights into our processes of thought. I multiply 15 x 13 in my head. I have a procedure and I am aware of the few steps and keep them in mind sequentially for a desired result. I quickly see that there are two (among many) strategies. 10 x 15 plus 3 x 15, or 10 x 13 plus 5 x 13. This is pretty simple, but illustrative of how we break down bigger problems into simpler ones that we essentially “know by heart.” But what about the Indian “computer woman,” Shakuntala Devi (1929- 2013) who could compute the 13th root of multi-digit numbers in her head in seconds-a feat that might take me hours. How is this done? Did she undertake such feats by consciously breaking down the huge problem into smaller and smaller elements? Were the pieces that she knew “by heart” far bigger problems for the rest of us? Psychologist, Allan Snyder (Snyder 2009) summarizes evidence that all of us are capable of such savant-like feats of calculation; he developed a device that, by temporarily blocking one sector of brain function with magnetic pulses, brings out such “savant” capacities in subjects who do not normally exhibit them. (Subjects return to normal mental function when the pulses are stopped. But, don’t try this at home.) It is thus plausible that savants have this brain sector permanently shut off or that they can control its on/off status.

The human mind is capable of these feats memorizing the sequence of a deck of shuffled cards in 2 minutes, memorizing 20,000 first digits of pi. We can make such a claim because there are humans who do these things; so the capacity is there. Well, perhaps not the minds of ALL humans; people are born with varying physiological and neurological capacities measured on multiple dimensions in addition to “intelligence.” And some of us are mentally disabled, others unusually abled. But perhaps many of us have capacities substantially greater than we commonly recognize. There are strategies which become like the back of one’s hand to experts and practitioners (i.e., those who practice), and are quickly available to novices/amateurs who dare to consider. Your capacity to learn is mutable.

The capacity to learn and to solve problems rests on what psychologists refer to as “executive functions.”(Diamond 2013) Executive functions are the capacity of the student/thinker/problem-solver to focus attention and exclude attention to extraneous matters, to draw on remembered and observed informational and other resources, and to creatively synthesize resources to address a chosen problem. Three major elements of executive function: attention-the direction of one's focus to a topic, a question, working memory-the gathering of internal mental resources for the solution of the question, and creative solution-the manipulation of resources for solution.

Attention

When we are not solving problems or figuring things out, our attention may be drawn to things that move, change the sound environment, or affect our attention in other ways, e.g., by touch. Just look around you, then focus on something, then focus more, it's all there for you to choose a focus. Focusing means that we deliberately do not pay attention to matters that we do not think relevant to the chosen focus. Attention requires discipline. Attention is a skill that requires at the same time inattention, sometimes referred to as "inhibition." In the course of solving a problem, I may decide that I need to direct attention to something I had not thought about when I began my focus, but this also is a deliberate redirection of attention, referred to as "shifting" and "flexibility." Many creative solutions require redirected attention. But redirection may also lead to dead ends. Attention is a powerful skill that, while present even in infancy (Garon 2008), can be cultivated, refined, and developed. There are also pathologies of attention, e.g., attention-deficit/hyperactivity disorder (ADHD), in which a person's neurological pathways make attention a challenge.

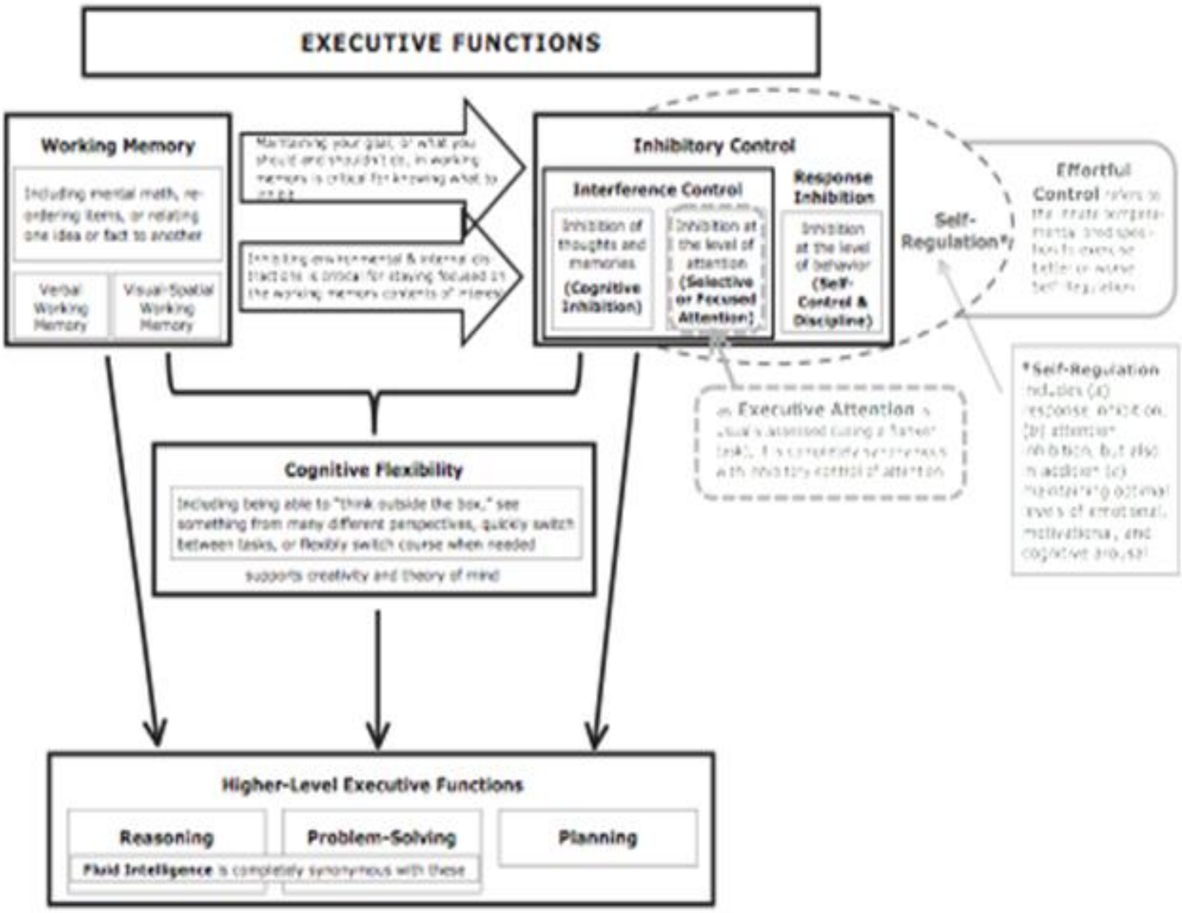

Figure 2: Diamond 2006. Elements and Process of Executive Function.

Working Memory

Working memory is the information, ideas, judgments, and other "stuff" that one has in reach in one's mind when working on a problem. In the course of working on a problem, the student may also draw on deeper memory, involving a search and retrieval of information one knows or believes one has but, whose specifics are not immediately recalled. Psychologists conceive of working memory as consisting of two storage systems phonological, including verbal information, and visuospatial, consisting of images. Much of what I know takes the form of propositions, like sentences, statements. Working memory can draw both from memories already stored and from information recently acquired. "WM (i.e., working memory) is critical to our ability to see connections between seemingly unrelated things and to pull apart elements from an integrated whole and hence to creativity because creativity involves disassembling and recombining elements in new ways."(Diamond 2013)

Creative Solution

Creative solution takes advantage of attention, focus, and memory, and applies reason, judgment, and intuition to explore connections among resources and seek solutions. Creative solution is the function that uses the resources of working memory, including methods of analysis, to solve the question at hand, whether it be what to do with newly received information or how to solve a problem that has been posed by oneself or someone else. Creative solution is the analytic engine of thought and learning.

Executive function is the heart of the knowledge and learning process and thus a plausible target for the cultivation of self as teacher. This core of mental function can be starved by various deprivations or excesses-physical, emotional, and social, but it can also be nourished and strengthened in multiple alternative or complementary ways. These are central of the facilitation of self-as teacher; an array of known approaches is described below.

3.3. Biology of Knowledge

The process of learning has a biological, neurological and physiological foundation. Perception, learning, memory, and so on require anatomical structures and physiological processes. There is evidence that specific aspects of knowledge, e.g., mathematical processes, have distinctive locations in the brain (Looi, Thompson et al. 2016). This biology is more or less universal, i.e., found in all human societies and in all healthy human beings, so that no matter where a child is born, it will be able to acquire the language, concepts, and knowledge of the local culture. A biological foundation of knowledge is present before birth. The infant must come into the world equipped with a mental structure for learning-the rapid acquisition of knowledge, knowledge-building skills, other mental qualities, further skills, and contents, as well as physical and social abilities that allow getting around in the 'new' world. The infant acquires knowledge rapidly and for quite a time hundreds of days, thousands of observing hours, minutes. Moreover, much learning happens before acquisition of language which becomes apparent around the age of 18 months. Language confers vast benefit for learning, since knowledge can be conveyed without the need to be observed by the learner. Language also has a biological foundation, so that MIT Professor Steven Pinker has referred to the "Language Instinct."(Pinker 2003)

There are at least two reasons why the biological foundation is critical to an understanding of the processes of knowledge and learning, and thus, self-teaching. One is that the body and especially the brain is the equipment, the "hardware" on which the mind operates its structures, neurons, synapses, and transmitters. Biological variations, including 'missing' and 'malfunctioning' parts may have mental consequences. The second reason is that from conception through processes of embryology, maturation, and aging, the physical components and organization of the brain and body develop, and with this development, new capacities, including capacities of thought, expand. Development occurs in an environment which may inhibit or promote growth. Recognition of biological foundations can explain capacities and their limits and may offer opportunities for intervention to remedy failures or promote growth.

The emotions and their regulation-"emotional intelligence"-are also critical in multiple ways to the development of knowledge. First, underlying the development of learning is a passion, need, and desire for knowledge. Self-confidence also seems to be innate, though it may be undermined. Professor Jack Shonkoff, Director of Harvard's Center on the Developing Child, writes (p. 152):

"The vast majority of young children think they are just wonderful, capable of doing almost anything, and headed for success (Harter and Pike, 1984; Stipek, 1992). Most kindergarten children, for example, will tell you that they are the smartest child in their class (Stipek, 1993). Even when they approach tasks on which they have previously failed, young children usually predict that they will succeed (Stipek and Hoffman, 1980; Stipek et al., 1984)."

While this drive may be built into human beings because it is evolutionarily necessary, motivation can be undermined both by mental and psychiatric illness or by an environment that does not provide its basic needs and resources (Phillips and Shonkoff 2000). Neurologist, Oliver Sacks famously portrays the inner worlds of patients whose unusual neural wiring systematically distorts their reality.(Sacks 2009) Psychiatric conditions, such as depression, anxiety, etc. may also distort reality.

3.4. The Social Environment and the Growth of Knowledge

The process of the development of learning and learning capacities is not automatic, even in a healthy child born with normal neurological, emotional, and mental function. It can be interrupted or disturbed by an adverse environment and strengthened by a nourishing environment. As Shonkoff, among many other researchers, has demonstrated, healthy mind and brain development require a stimulating and physically, socially, and emotionally rich environment in which the child interacts.(Phillips and Shonkoff 2000) Deprivation of these resources, and especially exposure to various forms of physical or emotional neglect and abuse, can severely limit or distort the development of physical, brain functions that underlie intellectual and socio-emotional development and the capacity to learn. Such deprivation easily arises as a consequence of poverty and the lack of resources available to low income populations under multiple stresses. A series of studies of "adverse childhood experiences" demonstrates a wide array of health and mental health consequences of childhood experiences such as parental violence, severe substance abuse, and criminal behavior.(Dube, Felitti et al. 2003)

Poverty and the lack of parental resources can also limit the development of learning. In the early 1980s, psychological researchers Professors Hart and Risley of the University of Kansas recorded thousands of hours of verbal and nonverbal interactions between infants and their parents in the Kansas City region over a 3 year period; parents were either professionals, working- class, or on welfare.(Hart and Risley 1995) By the age of 3, children of professionals had twice the vocabulary of children from families on welfare, with children from working-class families between the other two groups. The interactional skills of the welfare children were also limited; what they heard from their stressed parents were negative statements such as "shut up," while the children from professional families heard statements of encouragement. Such large differences indicate that low-socioeconomic status families are likely to experience substantial challenges in learning. Long term studies indicate that these challenges persist and have long-term consequences, indicating a need for early childhood education for these children.

3.5. What Works

We know that intellectual capacity and development begin in humans at a very early age, probably before birth. We know that humans use the tools and knowledge they already have to filter and build new knowledge. We know that biological and social conditions are critical to intellectual and emotional development and that deprivation can have lasting harmful impact. We know that some cognitive frameworks and pedagogical approaches enhance intellectual development, while others may impede development. Given these basic conditions, how can human intellectual and emotional development be best cultivated, promoted, and strengthened?

Professor Bonawitz, currently at Rutgers University, led a small group of researchers in an enlightening experiment (Bonawitz, Shafto et al. 2011). In a city science museum, she invited visiting 5 year old children (or their parents on their behalf) to explore a new toy which did a few things, like turning its parts in different directions and making different sounds. Bonawitz randomly assigned each child to one four alternative procedures. In the “pedagogical” procedure, the experimenter invited the child to look at the toy, and she explained things that the toy did. She said, “This is how the toy works.” In the “interrupted pedagogical” procedure, the experimenter invited the child to look at the toy and began to explain what the toy did, but then she stopped and said, “Sorry, I have to do something,” and she left the child alone with the toy. In the “naive” procedure, the experimenter brought out the toy and said, “Look at this toy, let’s see what it does” and she played with one of the toy’s functions. In the “baseline” procedure, she brought out the toy, looked at it, said, “Wow, see this toy. Look at this!” and placed it on the table in front of the child. In all the procedures, the experimenter concluded her introduction by saying, “I’m going to let you play with it. Let me know when you are done.”

The researchers compared the children in the four groups on the amount of time the child spent playing with the toy and the number of features of the toy the child discovered. In the pedagogical procedure, children spent an average of 119.2 seconds-approximately 2 minutes; in the interrupted procedure, children spent 179.6 seconds; in the naive procedure, children spent 132.7 seconds; and in the baseline procedure, children spent an average of 205.7 seconds-the longest time of the four groups. (For all children, attention is surprisingly brief.) In the pedagogical procedure, children discovered an average of 4 things the toy did, and, at the other extreme, in the baseline procedure, children discovered an average of 6.1 functions of the toy. Essentially, the more the experimenter told and showed the child about the toy, the less time the child spent examining it and the less the child discovered about it.

If the goal of teaching is the encouragement of exploration and discovery, then, to put it simply, some information may be better than none, but less is much more than more. Instruction can be an obstacle to engagement and exploration rather than an encouragement. This experiment has powerful implications for pedagogical practice.

Learning is affected not only by the way in which the teacher frames tasks for the learner, but also by the underlying perspective of the learner regarding his or her learning abilities. Professor Carol Dweck at Stanford University has distinguished two contrasting views held by individuals regarding their own capacities to learn and to build their own knowledge. Many people regard their intelligence as fixed, so that their capacity to learn is essentially immutable and cannot be enhanced; they may believe that they can learn, but they do not believe they can improve their ability to learn. For example, many people believe that they are not capable of learning math or a foreign language. Dweck refers to this perspective as the “fixed mindset.”(Dweck 2014) Others consider their intelligence as subject to development and growth; Dweck calls this perspective the “growth mind set.”

Dweck has conducted a series of studies of students in classrooms to ascertain the consequences of these contrasting perspectives. Students who believe their capacities mutable are much more active in developing their own knowledge than those who believe that their mental capacity is fixed. Dweck and her colleagues have also conducted experiments in which they teach one group of subjects about brain and mind development and mutability, along with learning skills, while they teach another group only the learning skills, but not the idea that learning abilities are mutable. Thus, the fixed and growth mindsets are induced in study subjects. Those taught about the growth mindset become more active learners and achieve greater learning as well as greater satisfaction in learning than the study subjects who are taught only the learning skills. The effects of the fixed and growth perspectives are long lasting. The fixed view of the mind is a self- fulfilling prophesy that hinders the capacity to grow. Not only does one's conception about one's capacity to learn affect how well one does in fact learn, but that conception can be taught to strengthen learning capacity. The implications of this dichotomy and the experiment are profound.

Diamond and Lee (Diamond and Lee 2011) summarize a wide range of programs that have been shown to strengthen executive function in children between the ages of 4 and 12 and among children with mental disorders such as Attention Deficit Hyperactivity Disorder. I summarize their summary and include descriptions of related programs from other sources.

The Montessori schooling program**,** founded by the Italian, Maria Montessori, at the end of the 19th century, has several features that have been shown to strengthen executive function.(Diamond and Lee 2011) Montessori's program initially focused on educating children with mental disabilities, subsequently on the children of the poor. Self-discipline, independence, and orderliness are taught. Students are encouraged to learn on their own, independently, and are provided with learning resources as they need them. Students are encouraged to find internal rewards for their activities rather than rewards through grades or extensive external praise. In addition, Montessori encourages cooperation with others, for example taking turns instructing and being taught by classmates. Peacefulness is taught as a principle of interaction, a byproduct of mindfulness training as well. In an experiment, when students were admitted to a Montessori pro- gram by lottery, as in a randomized study, Montessori students did better in several executive functions than non-Montessori age-mates.(Lillard and Else-Quest 2006) Also, as expected, relative to students in a regular, non-Montessori school program, Montessori students were less likely to become engaged in rough play.

Aerobics

Several randomized control trials of aerobics, an optimal experimental design for determining effectiveness, have been found to increase executive function in children at various ages. It seems that there is a minimum of exercise required to achieve an effect, and there is a "dose-response," i.e., above the minimum threshold, the more exercise the child is exposed to, the greater the benefit. (There must also be an upper limit, after which the benefit diminishes with fatigue.)

4. DISCUSSIONS

The writing of this essay has been an exercise in what I am describing, i.e., self-teaching. From a kernel idea that I had, I have used my own knowledge and learning skills to develop an argument and discussion. I began with a rough and vague notion that the process by which I learn is part of my self-listening, judging what I take in and adjusting what I already know to this new input. I asked myself, what issues this notion raises philosophical, conceptual, social, and what might solutions be. How might self-teaching happen, and how can one make the process more deliberate and productive. My thinking led me to recall things I have read, and I investigated those. In the course of developing this essay, there are several areas I have wandered into that I did not initially consider and that took me by surprise-savants, the evolution and development of consciousness, the biology of knowledge. I sort these ideas out, put them in conceptual “bins,” combine, link, and split concepts as I find makes sense, throw some out, move them around so they fit. I ask myself what elements of my theory mean, do they make sense, do they make sense with each other. Are there ideas that others have proposed that are relevant, similar, dissimilar-and how, so that I will either modify my own position or reject theirs. In this work, I am rearranging a sector of my own system of thought and I am using my system of thought to do that. The essay unfolds. I keep going until I believe it a coherent whole. Questions remain.

I believe I have established two basic points. First, that conversations that each of has with ourselves are a fundamental way in which we learn in which our knowledge, understanding, problem solving abilities themselves grow. Learning is not the simple absorption of information, but the creation of knowledge from existing knowledge, using existing internal tools. Our learning is dependent on those tools of learning. Thus I believe that pedagogy in schools should not focus on the provision of information, but on shaping the process of receiving, digesting, and recreating information. Second, that there is a wide range of interventions that have been shown to work in strengthening the capacities of the internal conversation for learning. Certainly more research is needed; there are important questions to be answered (Diamond 2011). The matter of expanding the transfer of learned executive abilities to unlearned abilities is critical. Sustenance and maintenance of learned skills are vital. But we already have a firm and productive basis of knowledge for action.

What follows from these points is that a prominent, if not the dominant focus of our educational system should be the development of the capacities in students of self as teacher. Students need basic information about the world and its operation adding, subtracting, multiplying, reading and writing, interactional skills and emotional control in order to function in the world. But it is the self-as-teacher that gives us the capacity to acquire and use this information optimally and to increase and develop our knowledge and solve problems. The development of self-as-teacher should be central to our educational system. It should be integrated into and central to standard classroom learning of subject matters. It is also a process that is available to adults after and beyond school.

Solving problems is a part of anyone’s daily life and planning. Self-teaching is a daily, even minute-to-minute activity. We perceive, decide, act, modify our beliefs ceaselessly, from minute to minute. I believe that we can all benefit from training the self-teacher. Work to refocus our educational system on training the capacity of self-teaching. Make your self-teacher a great one. Help others do the same.

There is an old and true saying: “If you give a man a fish, you may satisfy his hunger for the day. If you teach him how to fish, you may satisfy his hunger for a lifetime.” I recommend adding to this proposition: If you teach him how to learn, he can then satisfy many hungers.

5. ACKNOWLEDGMENTS

I thank several friends for comments on this essay-Andrew Hahn, Ramon Girvan, and Elliott Churchill.

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