STEM History:
Using the lens of consciousness to re-interpret Kuhnian paradigm shifts

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Current Research
My current themes of research are in the inter-relationship among teaching to both the intuitive and analytical sides of the brain, transformational education, emotional intelligence, and STEM (science, technology, engineering, and mathematics). I do not currently have any publications in the field of Education.

Abstract
We live in a time of unprecedented change. Global science, technology, engineering, and mathematics (STEM) innovations abound. It is probably more important to study STEM history than it has ever been. But a study of inventions and shifts of Kuhnian paradigms are not enough; they risk being mere descriptions of history, without enough insight into the consciousness, and therefore, the motivations of our ancestors. Transformation occurs when the educational experience allows for critical examination of the diversity among peoples and between our current generations and our former ones. Education has created a great blind spot by projecting the modern left-brain consciousness onto earlier groups, denying a re-birth of our right-brain genius. Doing this, then trying to interpret the history is like analyzing a team's performances without having the playbook. Once the history of consciousness is overlaid onto STEM advances, we open students to the possibility of true future innovation.

Introduction

There is a serious mismatch for educators in the U.S. when we are trying to honor both history and also integrate science, technology, engineering, and mathematics (STEM). Although there may be many problems in this area, the focus of this paper is singular. This paper addresses a lack of awareness that human consciousness has been changing. What Kuhn (2004) describes so well as paradigm shifts in the human outlook on science still does not fully cover the pattern of how consciousness has shifted over time. Therefore, this paper uses the history of

consciousness as a backdrop to study the history of human invention and discovery.

"Transformation theory holds that our acquired frames of reference and the beliefs and values that they endorse may be transformed through critical reflection on one's assumptions and the resulting interpretations validated through discourse" (Mezirow, 1996, p. 237). The individual's learning process is not only aided by entering into dialogue with a group, but also through relational aspects by: receiving encouragement, scaffolding, and increasing self-efficacy from the group. Learning in circles, a type of learning that claims to transform character is achieved by meandering through ideas where a circle of individuals think as if they were one person, according to Asante (King & American Educational Research Association. Commission on Research in Black, 2005). Mesirow (1991) builds on the idea of transformation of the interaction that aligns more with right-brain, intuitive, relational activities. An historical backdrop for the pedagogy in which early African society situated its first educational institutions reveals highly intuitive approaches that parallel the way Mesirow and Asante re-connect to the ancient ways (Diop, 1974; Houston, 2007; Stone, 1976).

The History of Consciousness in Light of STEM

As part of the study of consciousness one must consider factors that affect learning. Earliest evidence of the learning process lies in the study of the origins of civilizations (Asante, 1991; Diop, 1974; Gaskill & Redgrave, 2007; Graves, 1875; Houston, 2007; Loewen, 1995; Ptahhotep, Kagemna, Gunn, & Amenemhet, 1985; Stone, 1976; Teresi, 2003). Parallels can be drawn between the social and cognitive development of the child and the early development that many civilizations go through. Much has been written about the inter-relationship of the social, emotional, and consciousness factors that affect learning in the first stages of childhood (Bandura, 1971; Carroll & Tober, 1999; Gardner, 1993, 2008; Glazer, Smith, & Spirituality in

Education, 1999; Goleman & Boutsikaris, 2006; Goleman & Senge, 2007; Goleman & Whitener, 2005; Kuhlewind, 2004; Mezirow, 1996; Miller, 2005; Palmer, 1993, 1998, 2004; Palmer, Zajonc, & Scribner, 2010; Papert, 1980; Piaget, 1950; Piaget & Inhelder, 1969; Portes & Salas, 2011; Quinn, 1992; Senge & Barker, 2008; L. Vygotsky, 1979; Lev Vygotsky, 2002; Wertsch, 1985). So, this paper then, will map the social history of consciousness onto the social / cognitive development of the child. The reason for this connection lies in the argument that consciousness changes in fluid stages. And those stages of various civilizations tend to follow the pattern of the stages of the development of the consciousness of the child.

First, I will examine the specific stage of development when a child shifts from a consciousness that is able to comprehend whole ideas, but is not able to break up those wholes, nor analyze abstractions, to the stage where analysis and reason takes over and the child begins to lose the ability to grasp whole ideas in the same manner as before. I will connect the definition of consciousness from Sylvia Wynter, that will be used in this paper, as our "subjective experience, including that of our subjectively experienced modes of identity" (Wynter, 2001, p. 4) to the idea that this consciousness is not caused by our physical, biological, neural processes – but simply correlates to them. I will use evidence from ancient writings, that humankind relied upon, that were received intuitively (Stone, 1976). And so, the purpose of the paper will be the inference that if consciousness – subjective experience – is not necessarily biologically driven, then perhaps shifts in consciousness are not. And therefore, if both early childhood and early humankind used to think in wholes – a different subjective experience, or consciousness, then perhaps children are receiving whole ideas intuitively. And if these intuitive acts do in fact represent a valid subjective experience to our ancestors and our childhood stages, perhaps this form of thinking can cycle around to be accessible to us now. I will further venture that certain

academic disciplines like quantum physics can only be comprehended by a consciousness that can hold intuitive right-brain ideas when used in concert with the analytical left-brain ideas. One implication that is relevant to STEM teaching can therefore be made clear at this point. Phenomena such as: electromagnetic induction, epigenetics, observer effect, evolution, entanglement, or complementarity are enhanced by the ability to think in whole ideas - a consciousness that can be studied either by an historical study of ancient humankind or a study of early childhood stages of learning.

Even though educational research has an intense interest in the learning process and despite the fact that it recognizes that there is a parallel in human cognitive developmental stages to the historical development of the consciousness of humankind as a whole, there remains a gap in the scientific treatment of the psychological characteristics of consciousness as it relates to the learning process. “The question of the psychological nature of consciousness is persistently and deliberately avoided in our scientific literature” (L. Vygotsky, 1979). In this paper I define consciousness according to the research of the last quarter century, then I review the literature for major psychological characteristics of consciousness as it relates to educational theory and the learning process. I conclude with a prescription for educational reform that calls for a curricular difference in the teaching of history and STEM subjects.

Defining Consciousness

To define consciousness is an extremely difficult task because it involves the observation of thoughts either through the use of other thoughts or through the use of some ability to observe thoughts, that is itself not comprised of thoughts (Piaget, 1950). Consciousness is defined as our “subjective experience, including that of our subjectively experienced modes of identity, must necessarily remain outside the reach of a transculturally applicable, and thereby, scientific,

description." (Wynter, 2001, p. 4). Wynter claims that the subjective experiences of our consciousness correlate to neural processes – but that it would be a biocentric bias to assume that they give rise to or have a causal relationship with consciousness. In other words, consciousness does not come *from* the physical - it comes *to* the physical. Consciousness causes neural responses, but does not arise from them. It is here that I infer intuition.

An intuitive idea, for the purposes of this paper, is one that arrives in the consciousness in a whole form, without necessarily revealing its origin or its parts from previous, biological, neural activity. It is the inference of this whole paper that a new type of education could be built on improving the reception of intuitive ideas. These would be to the benefit of the understanding of many STEM subjects such as quantum physics, epigenetics, evolution, and others. This new education would be based on the interaction between the intuitive right brain and the analytical left brain, working in concert.

Piaget (1950), Vygotsky (1966/2002; 1978), and Bandura (1971) show that early childhood cognition includes a stage where the child produces novel responses that are intelligent, yet completely untraceable to prior experiences. At that same stage, it can be shown experimentally that while the child embraces whole ideas, the child cannot break those whole ideas into parts (Piaget & Inhelder, 1969). Very soon after shifting from this stage, the child can break up whole ideas and therefore can perform abstract, analytical reasoning (Bandura, 1971; Piaget, 1950; Piaget & Inhelder, 1969; Lev Vygotsky, 2002). Wynter speaks of the inability to explain certain ideas to a person of a different "order of consciousness" (Wynter, 2001, p. 32) much in the same way that Piaget describes how one cannot explain certain ideas to a child at an earlier stage of cognitive development (Piaget, 1950; Piaget & Inhelder, 1969). Vygotsky argues that it "is easy to see that consciousness cannot be regarded as a phenomenon of a second line,

neither biologically, physiologically, nor psychologically" (L. Vygotsky, 1979, p. 11). Therefore, consciousness is a primary, human behavior that lies within the non-physical area of thought and is inextricably accompanied by thought. With this in mind, let us now broadly sketch the changes in consciousness that occurred near some origins of civilization.

The Social History of Consciousness: Matriarchy

The relevance to this paper of the next section is that it reveals that numerous early societies were quite intuitive, or what we now call right-brain dominant. Many early human civilizations refer to changing stages of behavior that the human consciousness goes through (Casas, 1992; Diop, 1974; Graves, 1875; Houston, 2007; Loewen, 1995; Stone, 1976; Teresi, 2003). Some of the earliest evidence of civilization lies in what is now Africa (Diop, 1974; Houston, 2007; Loewen, 1995; Stone, 1976; Teresi, 2003). A large body of early historical research was lost in the destruction of the library at Alexandria (Diop, 1974), but some early human records reveal Ethiopian civilizations in what is now the north eastern part of the African continent (Diop, 1974; Houston, 2007; Stone, 1976). Houston (2007) argues that the oldest records she has found, report that the Cushite colonies were in the valley of the Nile, Barabra, and Chaldea no later than 7,000 or 8,000 B. C. Stone (1976) asserts that these early societies were matriarchal. Women were revered, according to Stone, and ran the society. A Goddess, known in most historical documents as the Queen of Heaven (also known as Earth Mother), was worshipped above a God. “There were records of such Goddesses in Sumer, Babylon, Egypt, Africa, Australia and China” (Stone, 1976, p. 3). Stone explains that “Diodorus wrote of warrior women existing in Libya, reporting that these women had formed into armies which had invaded other lands. According to him, they revered the Goddess as their major deity and set up sanctuaries for Her worship” (Stone, 1976, p. 35). The man in such societies often had a role that

is the reverse of current societies. “Herodotus of Greece, several centuries before Diodorus, wrote that in Egypt, ‘Women go in the marketplace, transact affairs and occupy themselves with business, while the husbands stay at home and weave’” (Stone, 1976, p. 36). Diop corroborates these findings, asserting that in the ancient society, the “matriarchal system is the base of the social organization in Egypt and throughout Black Africa” (Diop, 1974, p. 142).

Stone reports bias in the historical treatment of such societies. She claims that males from our current, patriarchal society project values onto the past and disrespect the values of the peoples that they research and simultaneously devalue the intuitive powers of such societies.

> Priestesses of the Goddess, who provided the counsel and advice at Her shrines of prophetic wisdom, were described as being fit for this position since as women they were more “intuitive” or “emotional,” thus mediums for divine revelation. These same writers generally disregarded the political importance of the advice given or the possibility that these women might in fact have been respected as wise and knowledgeable, capable of holding vital, advisory positions. Strangely enough, emotional qualities or intuitive powers were never mentioned in connection with the male prophets of Yahweh. (Stone, 1976, p. xxi)

Stone’s work reveals that modern researchers demonstrate a bias that has two distinct aspects. On the one hand, she shows that researchers today live in a patriarchal culture and often picture historical scenes as through a male dominated lens. A second aspect of this bias, according to Stone, is that current researchers live in a consciousness that does not respect the earlier, intuitive consciousness of the matriarchal societies. This echoes the work of Wynter (2001) and Lee (2005) as they describe the inability of so many writers today to appreciate that consciousness has changed throughout history – and that the change has landed us in a position from which we cannot always understand the way previous thought paradigms were constructed. While Kuhn's (2004) work on human paradigm shifts in thinking is a landmark in this arena, it is the goal of this paper to shine a spotlight on the aspect of consciousness shifts as primal and causal of STEM advances and even STEM regressions. The male dominated lens has been a consciousness

shift away from intuition of whole ideas toward analytical thinking in parts. This is similar to the way that early childhood cognition shifts from embracing whole ideas to taking ideas apart, analytically. The matriarchal society could still nurture ideas and see them as whole, relational, intuitive paradigms. The patriarchal shift gained an ability to reason more analytically, but it seemed to be the end of an intuitive phase, since history does not speak of direct intuitions as an integral way of decision-making as it did in the records prior to 2,000 BCE. So, when Stone tries to present a second paradigm – that of matriarchy - to coexist with equal importance to patriarchy, the modern lens has trouble seeing those two ideas at one time (Stone, 1976, p. 29).

Consider as an example, the specific shift in consciousness that occurred to the region from Africa to Greece around 2,000 BCE to 1,000 BCE. This was right before the time of Homer, Pythagoras, Socrates, Plato, and Aristotle. This shift occurred around the same time as the change from matriarchy to patriarchy. It paralleled the cognitive shift later in this paper that occurs in most children around the age of three or four. It is characterized by the human consciousness losing the ability to embrace whole ideas easily – and gaining the ability to analyze ideas, dividing them into parts. The nurturing Africans of 2,000 BCE gave way to a patriarchal group that could divide and conquer, looking out more for the individual, than the group.

The Social History of Consciousness: Patriarchy

It is known that the Cushites of ancient Ethiopia had developed astronomy among many other sciences, technologies, engineering techniques, and mathematical advances (Diop, 1974; Houston, 2007). In fact, early civilizations in Africa, India, and Asia - well before the Golden Age of Greece - pioneered alphabetic writings, astronomy, history, chronology, architecture, plastic art, sculpture, navigation, agriculture, and textile industries (Diop, 1974; Houston, 2007;

Stone, 1976; Teresi, 2003). It is also known that much of this was done in matriarchal societies that prospered with successful governing bodies, peaceful commerce, and well-run cities that balanced urban technology with their rural agriculture (Diop, 1974; Houston, 2007; Stone, 1976). But patriarchal societies became dominant over time. Today, the sociology of a great majority of the world is patriarchal (Asante, 1991). What happened to our historical knowledge and appreciation of the matriarchal societies?

Historical records that support conjectures of the origins of the northern tribes that invaded the Near Middle East are scarce. Reliable research that both sociologists and historians can agree on generally begins after the "invasions of the historical period, which began at about 2400 BC, are attested by literature and surviving artifacts and are agreed upon by most historians and archaeologists" (Stone, 1976, p. 63). Another point that is in agreement is that these northern tribes were patriarchal (Diop, 1974; Stone, 1976). But a light can be shown on the social history of the consciousness of the peoples of this region as to the general behavior shifts as they changed from a matriarchy to a patriarchy. Female influences and tendencies to nurture, to be intuitive, to approach decision making by more collaborative means, to be more inclusive of members of society, diminished; and male tendencies of making decisions alone, individuality, aggression, exclusivity, and assertiveness, emerged (Diop, 1974; Houston, 2007; Loewen, 1995; Stone, 1976). Transformations of this magnitude impact one's entire world view. This is a consciousness shift. And the implications to such things as the STEM theories entertained, the technology that is invented, and the engineering processes that are implemented are directly affected. Kuhn describes world view shifts "as elementary prototypes for these transformations of the scientist's world that the familiar demonstrations of a switch in visual gestalt prove so suggestive. What were ducks in the scientist's world before the revolution are rabbits afterwards.

The man who first saw the exterior of the box from above later sees its interior from below. Transformations like these, though usually more gradual and almost always irreversible, are common concomitants of scientific training" (Kuhn, 2004, p. 111). It is the conjecture of this paper that this elusive thing called the *consciousness* has everything to do with human shifts in paradigm and world view. Specifically, I believe that the key shift around 2,000 BCE in the north of what is now the African continent, is from right-brain dominance to left-brain dominance. I believe that is is one of the most significant transformations in recorded history, and all of the STEM activities that followed reflected this. Our science, technology, engineering, and mathematics were viewed through an increasingly analytic, logical, left-brain lens after this consciousness shift. As this paper will suggest, I believe trend toward increased left-brain dominance continued until quite recently in the 1800s, at which time right-brain dominance began to come back. But, this next turning point is outside the content of this paper. Getting back to the turning point from matriarchy to patriarchy around 2,000 BCE, it was of course not just STEM views that changed.

Historical / Sociological / STEM Overlaps

The clash that occurred when the whites from the north met the blacks from the south initiated trends that have endured to form the present threads of our modern sociological fabric. Trends were born around 2,000 BCE that differentiated and stratified peoples in order to define who was superior. Instead of the right-brain inclusion of diversity in groups, left-brain judgments of differences entered whereas "evidence suggests that it was these northern people who brought with them the concepts of light as good and dark as evil (very possibly the symbolism of their racial attitudes toward the darker people of the southern areas) and of a supreme male deity" (Stone, 1976, p. 66). Differences in races were problematic as they were paired with a

consciousness that was moving away from the matriarchal worship of mother earth to a more patriarchal, individualistic basis for decision-making and religious practice. "Thus it may have been that the patriarchal invaders, who saw women as inferior, are responsible for the origins of racist attitudes as well" (Stone, 1976, pp. 71-72).

This is why we must study history in order to understand STEM. With the shift in consciousness from a matriarchal to a patriarchal society, inclusive ways of thinking that saw peoples and concepts in wholes gave way to exclusive ways of thinking that separated and stratified members of society (Diop, 1974; Houston, 2007; Stone, 1976). Analytical, abstract reasoning gave birth to division of labor, a new and pervasive form of slavery, and capitalist forms of the economic structure that favored certain individuals over others (Diop, 1974). The seeds were planted for the kind of thinking that would support a future replete with scientific investigation and an industrial, technological society that could harness natural resources for the use of humankind, but in this very movement from a matriarchy to a patriarchy, peaceful ways in many measures gave way to aggression. The seeds of aggression within a society where workers are to be exploited by the more powerful capital owners would later parallel the aggression of one society against another in the form of invasion and slavery practices (Diop, 1974). To be sure, certain disputes had previously existed between societies in the earlier matriarchal era (Houston, 2007; Stone, 1976); and the practice of a certain form of slavery also subsisted (Diop, 1974; Stone, 1976). But the consciousness shift in humanity that could abide by this era of patriarchy saw a new form of self serving aggression of one group against another; and it saw that "man has invented nothing worse than slavery to degrade and exploit his fellow man. Hence, the truly revolutionary regimes are the slave regimes, whether the brutal slavery of ancient Greece or the barely disguised but not less virulent slavery of the Western Middle Ages. That is

why, with the development of ancient or modern capitalist production, both those societies led to revolution" (Diop, 1974, p. 223).

Patriarchy as Related to STEM Practices

The definition of the word analysis involves the concept of separation – to analyze is to separate. This was an essential element in the consciousness of the patriarchal society. They were analytical in thought and separatist in nature. The patriarchal society and the patriarchal individual in such a society was analytical in a way that caused both scientific and social separation, and with this came oppression (Diop, 1974). This is not meant to denegrate the strides in STEM advancements that this leap in left-brain thinking afforded. This was the age where across India, Egypt, Islam, and China great strides took place in mathematics, astronomy, technology, Greco-Roman culture, medicine, engineering, and pre-cursors to modern physics took place. This was the flourishing of forms of the: magnet, compass, abacus, odometer, astrolabe, sun dial, lever, wheel, inclined plane, use of acids and base and salts, trebuchet, and studies of parabolic motion. But we can no longer study history as a one-way story of upward progress. There were losses, also. A price humankind paid for a focus on left-brain analytical thinking was the loss of right-brain connection to nature and each other.

Where the state of consciousness of the matriarchal society intuitively saw relationship, interconnectedness, and whole ideas (Stone, 1976), the behavioral archetype of the patriarchal society analytically saw individuals who were out for themselves (Diop, 1974). The essence of this difference lies at the basis of Marxist thought as a root cause of economic and eventual political oppression (Asante, 1991; DeMarrais & LeCompte, 1995; Diop, 1974; Freire, 1998, 2000; Lemert, 1999, 2004; Morrison, 1995; Shor & Freire, 1987). In the shift from matriarchal to patriarchal societies, history can witness the birth of a significantly higher level of oppression.

Massive or vehement oppression hardly existed in the matriarchal societies (Houston, 2007; Stone, 1976); it did exist, but in a form that was ancillary to the main thrust of societal drives toward well-being. It was not at the heart of the motivations of those who ran the society and it was not on the everyday minds of the individuals within the society (Houston, 2007; Stone, 1976). In the patriarchal society, a different urge pumped the lifeblood of members and leaders alike – the urge to succeed on one's own, even if at another's expense. "In the final analysis, the common denominator found in economies of the Asiatic type (Black Africa, China, India, pre-Columbian American, Iran, etc.) is the absence of slavery in the full sense of the term, as a means of production. Thus, the resulting social situations are hardly revolutionary" (Diop, 1974, p. 225). While the birth of the Greek State saw a renaissance in differentiated sciences, art, technology, mathematics, and feats of architecture and engineering hardly imagined, the consciousness shift into the Greek State also came at the price of a loss of right-brain influences of relationship and interconnectedness. To see a larger part of the whole picture here, we must step back from just seeing the STEM implications and note that left-brain dominance also has serious social consequences. "The Greek State was founded from birth on slavery and the intangibility of private land ownership" (Diop, 1974, p. 225). Meanwhile, Asia was able to retain a right-brain dominance. "In contrast, the appearance of a State with an Asiatic economic system, as described by Marx and Engels, shows that it did not spring abruptly from the brutal contact of two races, one of which enslaved the other and thus created, from the outset, the conditions for the development of the class struggle and private property" (Diop, 1974, p. 225).

This abstract, analytical way of thinking that entered the consciousness of humankind with the shift to patriarchal paradigms not only caused a separation of each individual from one another, but it also produced a separation of the human individual from nature (Bortoft, 1996;

Diop, 1974; Goethe, 1840/1970). Oppression resulted in the social sphere from the selfish act of thinking only with exclusive, separatist, analytical constructs. This same thinking – when used in the STEM sphere - provided the clear thinking that ushered in a new form of investigation that could separate one idea from another in order to eventually spawn the modern technological era. According to Diop (1974), however, this new form of consciousness that had a heightened emphasis on the individual, at once separated humankind from the gods, then exalted the human to a god-like level. So, as this analytical consciousness allowed humankind to think in the new, scientific way, perceived social power passed from deities to humans. History shows that the seeds of STEM were sown at the expense of a reduction in the image people had of the gods. No longer did people listen to the earlier intuitions of matriarchal priestesses that were supposedly heard from on high (Stone, 1976). Now, knowledge would progressively be found by experimentation of one human individual and shown to another, without the supposed guidance from a spiritual world. This is the period where humankind wielded power at an increased level of attention to individual gain, and therefore the level of ruthlessness proportionately increased (Burke, 2009; Diop, 1974; Houston, 2007; Stone, 1976).

Forgotten History - a Product of Modern Projection onto the Past

In a STEM context, psychological projection - the act of assuming that another's thought patterns are like your own - is a double-edged sword. On the one hand, projection allows a freedom from earlier scientific limitation and habit. "Science represents the office of intelligence, in projection and control of new experiences, pursued systematically, intentionally, and on a scale due to freedom from limitations of habit. It is the sole instrumentality of conscious, as distinct from accidental, progress" (Dewey, 1916/2005, pp. 181-182). But, on the other hand, projection of current attitudes can cause humankind to bury past wisdom because we may have

lost the ability to see what we formerly knew. We may have forgotten ways of understanding nature that could bring our current technology and engineering forward. If we are to continue learning from nature's subtle interconnections that we have lost the ability to perceive, then STEM advances are being held back by our lost wisdom and by our projection of our current paradigms onto the past. For example, mechanical and mathematical models of Galilean and Newtonian physics made advances with the: pendulum, clock, telescope, and vacuum tube possible. But the ideas of the separateness of material objects that conceived of these advances and such notions as action-at-a-distance, proved to be a detriment in conceiving of relativistic and quantum notions. Again, something was gained and something was lost.

Evidence of humankind emerges from pre-recorded history to recorded history revealing that at least in part, our species began in a more intuitive state, then progressed to a logical, analytical state (DeBoer, 1991; Diop, 1974; Houston, 2007; Kuhn, 2004; Nisbett, 2003; Stone, 1976; Teresi, 2003; Wynter, 2001). So it is with the life of one single human being. Cognitive experts have long established that the child begins more in a right-brain intuitive state and progresses to a more left-brain analytical state (Bandura, 1971; Piaget, 1929/2007; L. Vygotsky, 1962, 1966/2002, 1979; L. Vygotsky & Cole, 1978). Further, it seems to be in like manner as one drills in to more specific detail to examine the way a single person begins a day. We know from personal observation that the act of waking from a dream state is more intuitive and the reasoning left brain engages as the day progresses. Drilling even further we can examine the anatomy of a single act of thinking something. Arnheim argues that each thought is received as a whole idea in an intuitive state and then becomes analyzed as we consciously look at it (Arnheim, 1986a, 1986b; Eisner & National Society for the Study of Education, 1985). Therefore a pattern emerges that suggests that there is an evolutionary set of stages from intuitive

to analysis. In light of this pattern, one might question whether or not it was the political act of patriarchal invaders from the north conquering the matriarchal society that caused the shift from right-brain to left-brain dominance. Perhaps it was the evolution of the human consciousness that was bound to move this way in any case. Either way, the child's stages can be mapped in order and kind onto the history of humankind and vice versa.

By the mapping above, it must be noted that just as a child forgets early intuitive notions and, in fact, the ability to be intuitive, so does humankind. History has been forgetting earlier forms of wisdom and knowing. Since approximately 2,000 BCE recorded history has been quite sparse in reporting that there once existed matriarchal societies that had advanced knowledge (Diop, 1974; Stone, 1976). And with this forgetting came the lack of intellectual discussion of a direct, intuitive way of acquiring knowledge. This loss of intuitive wisdom has had a materializing effect on humanity. It has pervaded the literature, where knowledge is portrayed as a product of material, physically-bound communication and experience. In other words, whereas moderns assume that the spread of STEM ideas and techniques must have taken place by direct, physical contact between groups of people, ancients assumed that a group mind not unlike the hive mind of bees (Thomas, 1974) could spread knowledge and abilities from one part of humanity to another. As humankind grew up, analytical thinking increasingly caused separateness and races became painfully aware of stark contrasts to each other and the issues of superiority and inferiority came into sharp focus. ‘Otherness’ was noticed to a greater degree as humans became against other humans with increased racism. Humans changed from feeling one with nature to a desire to conquer nature and exploit the other animal and plant species. Wholeness, relationship, and community lessened as individuality, power, and slavery increased. While this opened the door to the industrial, scientific, technological, and information

revolutions, it closed the door to intuitive investigation. Just as most school children do not know that besides Plato, "Pythagoras, Thales, Solon, Archimedes, and Eratosthenes, among others, were trained in Egypt. Egypt was indeed the classic land where two-thirds of the Greek scholars went to study" (Diop, 1974, p. 232), they also are not taught that they had a wisdom when they were very young that would inform their STEM investigations of later life if only they could recover it. And so the members of the human race who gained knowledge, in part through intuition prior to 2,000 BCE, who later passed on this wisdom to the Greeks, for all intents and purposes, have been forgotten. Through projection of the current human condition onto our own past, we have buried the fact that we once had *and used* this intuitive ability. And along with this forgetting comes a distinct lack of intellectual interest in the period before recorded history. It is almost as if human wisdom and knowledge are assumed to begin with our written records. Perhaps this paper is also a call for research studies of pre-recorded history, if only we could creatively imagine how this could be done. Since I have alluded to early childhood as a parallel phenomenon to early stages of humankind, perhaps one form of research into human history could be through the cognitive development of the child. A pertinent question that therefore arises is, "Can comparisons be drawn between the development of stages of the consciousness of humankind and cognitive stages of the child"?

The Cognitive Development of Early Childhood as a Parallel to the Development of Early Human Consciousness

The early cognitive development of the human child parallels the early development of the consciousness of the human race as it moved from the matriarchal, intuitive consciousness to the patriarchal, analytical way of thinking and behaving. It will be helpful at this point to compare writings on cognition of Albert Bandura (1971), Jean Piaget (1929/2007, 1950, 1959,

1965, 1973, 1976; 1927/2001), and Lev Vygotsky (1962, 1966/2002, 1979; 1978). Both the child and the early human receive perceptions without a perceptible outer stimulus (Bandura, 1971; Piaget, 1950; Piaget & Inhelder, 1969; L. Vygotsky, 1979; Lev Vygotsky, 2002; L. Vygotsky & Cole, 1978; Warford, 2011; Wertsch, 1985). This act of behavior is considered, in some cases, to have arisen within the human as an intuitive perception; but more often it is experimentally recorded as a shift in behavior with an unknown origin (Bandura, 1971; Piaget, 1950; Piaget & Inhelder, 1969; L. Vygotsky, 1979; Lev Vygotsky, 2002; L. Vygotsky & Cole, 1978; Wertsch, 1985). Vygotsky offers an explanation for this by describing a zone of proximal development (ZPD), defined as the distance between a child's "actual developmental level as determined by independent problem solving" and the higher level of "potential development as determined through problem solving under adult guidance or in collaboration with more capable peers" (1978, p. 86). Whenever one comes to know something, the question of intuition arises. The question of whether the seemingly new knowledge came from an assemblage of prior elements or somehow arrived as a completely fresh insight is extremely important here – and is quite controversial (Bandura, 1971; Piaget & Inhelder, 1969). Another question arises as to the nature of the influence of the people who accompany the child who arrives at the new insight. Did an adult facilitate this insight? Was it passed from adult to child or inspired by social contact with peers? These are excellent questions for another investigation of the factors by which new insights can be stimulated – in fact it is the hope of this paper to motivate the need for more research into this area. My intention is only to establish that there exists a point where the human arrives at insights where there are no perceptible a priori stimuli – and that this is recorded in modern experiments in early childhood cognition, as well as in early records of the history of the

human race. Vygotsky describes how children, generally before the age of three or four, do not analyze, abstract, or break up whole, tangible concepts:

> Experiments and day-to-day observation clearly show that it is impossible for very young children to separate the field of meaning from the visible field. This is a very important fact. Even a child of two, when asked to repeat the sentence “Tanya is standing up” when Tanya is actually sitting in front of him, will change it to “Tanya is sitting down.” (L. Vygotsky, 1966/2002, Locations 168-170)

One could compare this early stage of childhood to the stage of humankind just prior to recorded history in order to see if there are key similarities. In both cases, there is a tendency to live in the moment, experiencing what is directly in front of the individual as an indivisibly whole event without writing about it, analyzing it, or reflecting on it. In both cases, the use of the abstraction of words to signify a portion of the meaning of the whole experience is antithetical, perhaps impossible. According to Piaget, pictures or symbols seem to be imagined for a child in these early stages. The adult observer of the child may call these imagined because both their origins and their stimuli are imperceptible to the observer as "preconceptual reasoning" (Piaget, 1950, p. 140). It is presumptuous to assume that one can discuss human cognition from the period of time before recorded history, except to say that the very next period, in all likelihood, was some sort of continuation of it and therefore exhibits vestiges of similar behaviors, perhaps in diminishing amounts. The consciousness of the people of the early, matriarchal period are reported to have dealt in whole concepts, at times perceiving intuitive knowledge without necessarily having used the processes of analytic deduction or induction (Diop, 1974; Stone, 1976). In other words, they sometimes saw ideas without building them up from parts. Extrapolating backwards, then, it is conceivable that the people just prior to this group saw ideas in inextricable wholes. If so, they would share this trait with the child of about two years old.

> In a very young child there is such an intimate fusion between word and object, and between meaning and what is seen, that a divergence between the meaning field and the visible field

> is impossible. This can be seen in the process of children's speech development. You say to the child, "clock." He starts looking and finds the clock, i.e., the first function of the word is to orient spatially, to isolate particular areas in space; the word originally signifies a particular location in a situation, so-called reality perception. This is something for which there is no analogy in animal perception. Essentially it lies in the fact that I do not see the world simply in color and shape, but also as a world with sense and meaning. I do not see merely something round and black with two hands, I see a clock; and I can distinguish one thing from another. (Lev Vygotsky, 2002, Locations 175-192)

Bandura also speaks of the fact that early developments of cognition are not simply motivated by association through repeated imitation. The child responds to certain social stimuli with more frequency than others. And novel responses, those defined as not having perceptible origins, appear without observable stimuli where, according to Bandura, "the principle of association does not adequately account for the fact that behavior is controlled by some social stimuli, but not by others that have been associated with equal frequency. A more serious limitation is the failure of these formulations to explain how novel responses are learned to begin with" (Bandura, 1971, pp. xvi-xvii). Bandura is careful not to assume that novel responses arise within an individual from random causes. He considers the use of novel responses to be a way of learning. He notes that some theorists do not call this new behavior - formed from novel, unique combinations – learning. But he does, and he cites the great innovator, Beethoven as exemplifying a form of learning from the combining of associative parts that have been previously observed – but placing them together in new, novel responses. I therefore pose the question, "Could Beethoven be an example of the action of a fully developed, logical adult accessing the intuitive capabilities of a child to perceive combinations of parts in a whole ensemble?"

STEM History from Pre-recorded to 2,000 BCE / The Child After Three or Four Years Old

A child begins a form of abstract reasoning that will mature approximately from the age of three or four to the age of seven. An important point should be noted, here. Many studies are investigating the permanence of stages in human cognition. It is not the intent of this paper to advance stage theory; and it is not needed to develop the arguments contained herein. The point here is that a type of abstract thinking does develop in almost every child. This thinking allows for the separation of meaning from experience in both analytical deduction and induction (Piaget, 1950). This is the time where a child can play in such a way that a form of pretending can separate meaning from a real object and assign it to an intermediary object (such as pretending a stick is a horse) (Lev Vygotsky, 2002). From the age of roughly three or four to seven years old, childhood cognition may be likened to the period of human history ending around 2,000 BCE. Children at this age pull away from the mother, become more individualistic, egoistic direction enters the behavior, and the analytical level of abstract thought allows for the development of reading, writing, and arithmetic. World civilization changed at this period from matriarchal to patriarchal. Civilizations that were much closer to mother figures and intensely interested in the relationships within the community, became dominated by war-like groups that sought individual power through egotistical leadership, increased abstract, intellectual writing and mathematics, and slavery became an economic fixture (Diop, 1974; Houston, 2007; Stone, 1976). But this period between three or four years of age and about seven years of age appears to be a sort of gestation period for the early child becoming an adult in thinking and consciousness. Vestiges of intuition definitely remained, but slowly diminished as logical thinking became dominant. Previously “unanalysable relations" (Piaget, 1950, p. 146) begin to separate in the child’s consciousness. But, especially at the beginning of this phase, the child still relies heavily on whole pictures and intuitive reasoning.

> INTUITIVE THOUGHT
> The forms of thought we have been describing can be analysed only through observation, since young children's intelligence is still far too unstable for them to be interrogated profitably. After about 4 years, on the other hand, short experiments with the subject, in which he has to manipulate experimental objects, enable us to obtain regular answers and to converse with him. This fact alone indicates a new structuring. In fact, from 4 to 7 years we see a gradual co-ordination of representative relations and thus a growing conceptualization, which leads the child from the symbolic or preconceptual phase to the beginnings of the operation. But the remarkable thing is that this intelligence, whose progress may be observed and is often rapid, still remains pre-logical even when it attains its maximum degree of adaptation;1 up to the time when this series of successive equilibrations culminates in the "grouping", it continues to supplement incomplete operations with a semi-symbolic form of thought, i.e. intuitive reasoning; and it controls judgments solely by means of intuitive "regulations", which are analogous on a representative level to perceptual adjustments on the sensori-motor plane. (Piaget, 1950, pp. 142-143)

It is important to note that the child, moving from three to seven years old is gaining abilities while also losing faculties. She gains what Piaget calls “operational methods” (Piaget, 1950), but she loses parts of the ability to instantly see a whole picture. Modern research can easily see how this tradeoff is advantageous to the reasoning child becoming a reasoning adult. There is a question here, however. Could it be valuable to the reasoning adult to also have this ability to see whole ideas, intuitively? What STEM research and invention might be augmented by adults with such intuitive fluidity of thought? If there were a way to re-integrate this faculty – that was so accessible around the age of three – could both faculties exist simultaneously in an adult with profitable result? As Piaget historically has done numerous experiments with the child at this transition point, we can study it clearly. But most researchers of early childhood cognition study this phase and only look at intuition as a phase to get over, so that operational thought processes can arrive. The entire point of this paper is to consider what, if anything, is lost as the child goes from intuitive to operational methods, and to consider if this represents a loss of something that could be useful to the fully logical adult. I would submit that the stage where humankind became predominately patriarchal corresponds roughly to the age of seven. The child of seven has

arrived at a reasoning phase that can carry into adulthood without major changes of the magnitude that had occurred in the earlier stages (Piaget, 1950).

In a recent research paper, Warford explores an application of Vygotsky's Zone of Proximal Development to teacher education. While we are exploring the ancient mind, I think it is interesting to note how the contemporary mind interprets the use of the ZPD as it applies to adults.

> According to Vygotsky (1986):
>
> > Thought itself is engendered by motivation, i.e. by our desires and needs, our interests and our emotions. Behind every thought there is an affective-volitional tendency, which holds the last answer to why in the analysis of thinking. A true and full understanding of another's thought is only possible when we understand its affective-volitional basis. (p. 252)
>
> The importance of this initial, tuning-in phase cannot be over-stated; the teacher educator cannot hope to promote teacher learning without carefully calibrating the candidate's pedagogical dispositions. (Warford, 2011, p. 254)

Warford's research is using the ZPD in showing a teacher how to leverage the learner's motivations. Vygotsky, in the passage that Warford has quoted, speaks of the affective-volitional tendency that precedes every thought. If we apply this to the special transition point we started with, where a child of about two passes over into becoming a more egoistic child of three or four, an interesting fact emerges. The child of three or four – the beginner adult – has plans that are hatched from her own designs. She analyzes what has happened in the past and puts together a combination of parts of schema (Piaget, 1950). Much of this can be deconstructed into perceptible stimuli (Bandura, 1971; Piaget, 1950; Lev Vygotsky, 2002). This motivates and informs. All the way to adulthood, this pattern of being driven by pieces of puzzles we call concepts will increasingly dominate the increasingly egoistic thinker. But before the age of three or four, the ego is not so developed. Unlike an adult, the very young child is motivated by whole concepts that appear from largely imperceptible roots. It is precisely this difference that parallels

the very disparate motivations of the Ethiopians and the invading northern tribes around 2,000 BCE. The Ethiopians worshipped female Goddesses, nurtured the good of the whole group, and were motivated by relationship (Stone, 1976). The northern tribes worshipped male Gods, sought individual gains, and were motivated by the acquisition of power (Asante, 1991; Diop, 1974; Houston, 2007; Stone, 1976). The development of egoistic self in ancient humankind – parallels the development of the ego in early childhood. And the motivations of the early human consciousness inform the motivations of the early childhood learning process. And therefore, the intuition that seems to have been stronger in the human race in early times, seems to suggest that a child may be unable to separate whole ideas possibly because the child receives them as single, intuitive thoughts.

This is not to say that being analytical is bad. This paper is recommending left-brain analytical thoughts to work in concert while the adult human is receiving intuitive right-brain thoughts. Considering that adults in today's world could possibly operate with a slightly similar skill of intuition to the priestesses of Ethiopia, one might ask how that might impinge the learning process and the ZPD? Although Warford is not asking this question, listen as he asks how he thinks one would best use the ZPD to motivate adult learners to move to a new insight or understanding. Then we can deconstruct what he has found to work, and apply our lens of adult intuition to his pragmatic findings.

> A core wisdom of a Vygotskyan approach is the idea that learning leads development. One way to help learners weave personal and programmatic narratives is a technique called prolepsis, which involves teaching in a way that "assumes (or pretends) that the learners know more than they actually do" (van Lier, 2004, p. 153). Prolepsis, according to van Lier (2004), "create[s] invitational structures and spaces for learners to step into and grow into" (p. 162). Proleptic instruction serves the ZPD by exploring optimal distance between actual and potential development. In fact, as it was originally conceived, the ZPD viewed the learner as "an active organism in an ecosystem, in a social-cultural-historical life space" (p. 155, citing Lewin, 1943), a quality of participation that emerges from the periphery to the center (citing Lave & Wenger, 1991) much in the same way that prolepsis anticipates the

> internalization of yet to be attained concepts. In applying prolepsis to teacher development, teacher educators should acknowledge and validate candidates' prior experiences of teaching and learning, while employing the future tense in discussing new lenses through which they will consider the same phenomena. (Warford, 2011, p. 254)

Perhaps the teacher is not pretending that the adult learner knows more than they actually do. Seen through the lens of intuition, one might interpret that the technique of prolepsis works on a motivational level because the human actually has access to the next understanding on an intuitive level, before it becomes conscious:

> To be sure, Vygotsky was enamored with the idea of learning as a future-in-the making; this focus on pushing learner capacities contrasted sharply with the Piagetian preference for limiting interventions to mediation within prescribed stages of cognitive maturation (Lantolf & Poehner, 2007; Vygotsky, 1986). Had Vygotsky benefitted from the opportunity to investigate the ZPDs of teaching candidates, he would have collided with the ossified labyrinth of adult cognitions. In contrast to the malleable, maturing minds of child-test subjects, adult learners' neural networks lose some of their plasticity. Whatever they have gained in developing an ego and an array of formal operations, such assets transform into liabilities when confronted with the phenomenological complexities of teaching and learning. (Warford, 2011, p. 253)

It is precisely this loss of fluidity that a person experiences in adult life as compared with childhood, that forms such an informative parallel if we consider humankind as nearing its adulthood. But there are adults who retain or regain child-like enthusiasm and agility of assimilating new ideas. What would be the implications of a method whereby we could help children to temporarily lose intuition, then regain it as they become adults?

Educational Implications

The whole point of this paper is that intuitive thought may be attainable and useful, today. I have attempted to show that humankind used intuition to receive ideas in large, whole pictures from the beginning of recorded history to around 2,000 BCE, where this ability slowly diminished and analytical thought began to dominate our consciousness. I then drew parallels of these stages to early childhood from the ages of three to seven – three year olds going through

cognitive experiences much like the holistic, matriarchal societies of Ethiopia around 8,000 - 7,000 BCE, and seven year olds waking to operational, analytical methods of learning as compared to the historical shift to separatist, patriarchal societies of about 2,000 BCE on.

The suggestion has also been advanced that the adult may have the ability to re-integrate intuitive faculties. As Mezirow argues for transformative learning in adult education and how to put theory to practice, he underscores the importance of "consciousness raising" (1997, p. 10). There is a cognitive stage from about three to seven years of age where both intuitive and operational methods of thought coexist (Piaget, 1950). Some controversial theories of learning believe that novel responses of both the child and the adult can combine previously known entities into entirely new creations such as the great masterpieces of innovation of the likes of Beethoven (Bandura, 1971) and great STEM individuals (Kuhn, 2004). Therefore, the suggestion of this paper is this: perhaps an adult today could use both intuition and analysis to become, as Vygotsky (1962) puts it, what he not yet is.

According to Bandura, "A much-needed 'new look' in studies of child language learning, stimulated by transformational grammar and characterized by the work of such psychologists as Roger Brown, Susan Ervin-Tripp, and Martin Braine, has emphasized the creative and original aspects of the child's learning, and has minimized the role of imitation, the traditionally overburdened explanatory device in this realm (Braine, 1963; Brown & Bellugi, 1964; Brown and Fraser, 1963; Chomsky, 1965; Ervin, 1964; Fraser, Bellugi, & Brown, 1963; Miller and Ervin, 1964)" (1971, pp. 104-105). This new entrance of sentences that a child has never heard, which is not just a logical remixed set of known words, may be to a child, what the field is to Faraday, relativity is to Einstein, or quantum probability is to Schrodinger. If learning employs

both operational methods and intuitive perceptions of whole, new ideas, think of what this may mean to the way we educate children.

When a STEM student today is taught the Theory of Complementarity, it is often explained that light is both a particle and a wave. The student learns that two concepts that cannot be understood by the analytical mind to be true at the same time seem, under experimentation, to be so. The only way for a student to integrate this idea – and truly learn it – is to use the intuitive right-brain faculty of learning. With pure logical, analytical thought one can only say that experiments show this contradiction – but it is just that – a contradiction. Complementarity makes no sense to reason; it violates the law of non-contradiction. Similar problems arise with many historical STEM experiments. To take a few examples from physics, right-brain thinking is helpful and sometimes necessary to understand: electromagnetic induction (Faraday, 1839/1965), light theory (Bohr, 1949), entanglement (Young, 1804), relativistic phenomena (Einstein, 1920/2010, 1950/2011), wave probabilities (Schrodinger, 1944/1992), observer effects (Heisenberg, 1950), or even the conspiracy theory from the early Munich quantum experiments (Greenstein, 1997). The concept of quantum co-location states that more than one object can occupy the same location. This does not fit in the historical world of Newtonian Physics because Newton represents the height of left-brain thinking. To the left brain, co-location cannot make sense. If a STEM student uses only analytical thinking, there is an inability to associate to such an idea. But using both analytical and intuitive thinking, where wholes exist, and both ideas and physical objects can be conceived of as whole and inextricable, the student can begin to see how complementarity, co-location, and entanglement can be understood. If the student's intuitive mind can conceive of the whole tree in each seed, or the whole hive-mind of the bee colony in each bee, then co-location can start to come into view. In

an intuitive education, STEM concepts can be paired in the right brain with social theories of coexistence, schema for globalization, countless poems, and musical renditions. Obviously, the formation of a new kind of education that includes the training of the faculty of intuition could easily be its own, lengthy treatise. I hope that I have, in some small part, opened the possibility.

REFERENCES

Arnheim, R. (1986a). *New essays on the psychology of art*. Berkeley: University of California Press.

Arnheim, R. (1986b). The Two Faces of Gestalt Psychology. *American Psychologist, 41*(7), 820-424.

Asante, M. K. (1991). The Afrocentric Idea in Education. *Journal of Negro Education, 60*(2), 170-180.

Bandura, A. (1971). *Psychological modeling conflicting theories*. Chicago: Aldine/Atherton.

Bohr, N. (1949). *Discussion with Einstein on epistemological problems in atomic physics*. Kobenhavn: University of Copenhagen.

Bortoft, H. (1996). *The wholeness of nature: Goethe's way toward a science of conscious participation in nature*. Hudson, N.Y.: Lindisfarne Press.

Burke, C. A. (2009). Mindfulness-based approaches with children and adolescents: A preliminary review of current research in an emergent field. *Journal of child and family studies, 19*(2), 12.

Carroll, L., & Tober, J. (1999). *The indigo children: The new kids have arrived*. Carlsbad, CA: Hay House.

Casas, B. d. l. (1992). *The devastation of the Indies: A brief account*. Baltimore: Johns Hopkins University Press.

DeBoer, G. E. (1991). *A history of ideas in science education: Implications for practice*. New York: Teachers College Press.

DeMarrais, K. B., & LeCompte, M. D. (1995). *The way schools work: A sociological analysis of education*. White Plains, N.Y.: Longman.

Dewey, J. (1916/2005). *Democracy and education: An introduction to the philosophy of education*. New York: Cosimo Classics.

Diop, C. A. (1974). *The African origin of civilization: myth or reality* ([1st ed.). New York: L. Hill.

Einstein, A. (1920/2010). *Sidelights on relativity*. LaVergne, TN: Merchant Books.

Einstein, A. (1950/2011). *The theory of relativity and other essays*. New York: Open Road Integrated Media.

Eisner, E. W., & National Society for the Study of Education. (1985). *Learning and teaching the ways of knowing*. Chicago, Ill.: National Society for the Study of Education: Distributed by University of Chicago Press.

Faraday, M. (1839/1965). *Experimental researches in electricity*. New York: Dover Publications.

Freire, P. (1998). *Teachers as cultural workers: Letters to those who dare teach*. Boulder, Colo.: Westview Press.

Freire, P. (2000). *Pedagogy of the oppressed* (30th anniversary ed.). New York: Continuum.

Gardner, H. (1993). *Frames of mind: The theory of multiple intelligences* (10th anniversary ed.). New York, NY: BasicBooks.

Gardner, H. (2008). *Five minds for the future*. Boston, Mass.: Harvard Business School Press.

Gaskill, T., & Redgrave, L. (2007). *Avicenna and medieval Muslim philosophy*. Boulder, Colo.: Knowledge Products: Blackstone Audiobooks.

Glazer, S., Smith, H., & Spirituality in Education, C. (1999, 1999). *The heart of learning: Spirituality in education*, New York.

Goethe, J. W. v. (1840/1970). *Theory of colours*. Cambridge, Mass.: M.I.T. Press.

Goleman, D., & Boutsikaris, D. (2006). *Social intelligence the new science of human relationships*. New York: Audio Renaissance.

Goleman, D., & Senge, P. M. (2007). *Working with presence*. New York: Audio Renaissance.

Goleman, D., & Whitener, B. (2005). Emotional intelligence. Prince Frederick, MD: Landmark Audiobooks.

Graves, K. (1875). *The world's sixteen crucified saviors; or, Christianity before Christ, containing new, startling, and extraordinary revelations in religious history, which disclose the oriental origin of all the doctrines, principles, precepts, and miracles of the Christian New Testament, and furnishing a key for unlocking many of its sacred mysteries, besides comprising the history of 16 heathen crucified gods*. New York: Truth Seeker Co.

Greenstein, G., Zajonc, A. G. (1997). *The quantum challenge: Modern research on the foundations of quantum mechanics*. Sudbury, Mass.: Jones and Bartlett.

Heisenberg, W. (1950). *The physical principles of the quantum theory*. [New York: Dover Publications.

Houston, D. D. (2007). *Wonderful Ethiopians of the ancient Cushite empire. Book I*. Sioux Falls, SD.: NuVision Publications.

King, J. E., & American Educational Research Association. Commission on Research in Black, E. (2005). *Black education: A transformative research and action agenda for the new century*.

Mahwah, N.J.: Published for the American Educational Research Association by Lawrence Erlbaum Associates.

Kuhlewind, G. (2004). *Star children: understanding children who set us special tasks and challenges*. Southport, Merseyside, United Kingdom: Temple Lodge.

Kuhn, T. S. (2004). *The structure of scientific revolutions*. Chicago [u.a.]: Univ. of Chicago Press.

Lemert, C. C. (1999). *Social theory: The multicultural and classic readings*. Boulder, Colo.: Westview Press.

Lemert, C. C. (2004). *Social theory*. Boulder (Co.): Westview.

Loewen, J. W. (1995). *Lies my teacher told me : everything your American history textbook got wrong*. New York: New Press : Distributed by Norton.

Mezirow, J. (1996). Beyond Freire and Habermas: Confusion a response to Bruce Pietrykowski. *Adult Education Quarterly, 46*(4), 237.

Mezirow, J. (1997). Transformative learning: Theory to practice. *New Directions for Adult & Continuing Education*(74), 5.

Miller, J. P. (2005, 2005). *Holistic learning and spirituality in education: Breaking new ground*, Albany.

Morrison, K. (1995). *Marx, Durkheim, Weber: Formations of modern social thought*. London; Thousand Oaks, Calif.: Sage.

Nisbett, R. E. (2003). *The geography of thought : how Asians and Westerners think differently--and why*. New York: Free Press.

Palmer, P. J. (1993). *To know as we are known: Education as a spiritual journey*. San Francisco: HarperSanFrancisco.

Palmer, P. J. (1998). *The courage to teach: Exploring the inner landscape of a teacher's life*. San Francisco, Calif.: Jossey-Bass.

Palmer, P. J. (2004). *A hidden wholeness: The journey toward an undivided life: welcoming the soul and weaving community in a wounded world*. San Francisco, CA: Jossey-Bass.

Palmer, P. J., Zajonc, A., & Scribner, M. (2010). *The heart of higher education: a call to renewal*. San Francisco: Jossey-Bass.

Papert, S. (1980). *Mindstorms: Children, computers, and powerful ideas*. New York: Basic Books.

Piaget, J. (1929/2007). *The child's conception of the world*. Lanham, MD: Rowman & Littlefield.

Piaget, J. (1950). *The psychology of intelligence*. London: Routledge & Paul.

Piaget, J. (1959). *The language and thought of the child*. New York: Humanities Press.

Piaget, J. (1965). *The moral judgment of the child*. New York: Free Press.

Piaget, J. (1973). *The child and reality; problems of genetic psychology*. New York: Grossman Publishers.

Piaget, J. (1976). *The grasp of consciousness: action and concept in the young child*. Cambridge: Harvard University Press.

Piaget, J., & Inhelder, B. r. (1969). *The psychology of the child*. New York: Basic Books.

Piaget, J., & Valsiner, J. (1927/2001). *The child's conception of physical causality*. New Brunswick (N. J.); London: Transaction Publishers.

Portes, P. R., & Salas, S. (2011). *Vygotsky in 21st century society: advances in cultural historical theory and praxis with non-dominant communities*. New York: Peter Lang.

Ptahhotep, Kagemna, Gunn, B. G., & Amenemhet. (1985). *The instruction of Ptah-hotep and The instruction of Kegemni: the oldest books in the world*. London: J. Murray.

Quinn, D. (1992). *Ishmael: A novel*. New York: Bantam/Turner Book.

Schrodinger, E. (1944/1992). *What is life?: The physical aspect of the living cell; with Mind and matter; & Autobiographical sketches*. Cambridge; New York: Cambridge University Press.

Senge, P. M., & Barker, T. (2008). *The necessary revolution*. Westminster, MD: Books on Tape.

Shor, I., & Freire, P. (1987). *A pedagogy for liberation: Dialogues on transforming education*. South Hadley, Mass.: Bergin & Garvey Publishers.

Stone, M. (1976). *When god was a woman*. New York: Dial Press.

Teresi, D. (2003). *Lost discoveries: the ancient roots of modern science -- from the Babylonians to the Maya*. New York: Simon & Schuster.

Thomas, L. (1974). *The lives of a cell; notes of a biology watcher*. New York: Viking Press.

Vygotsky, L. (1962). *Thought and language*. Cambridge: M.I.T. Press, Massachusetts Institute of Technology.

Vygotsky, L. (1966/2002). Play and its Role in the Mental Development of the Child. *2003*.

Vygotsky, L. (1979). Consciousness as a Problem in the Psychology of Behavior. *Journal of Russian and East European Psychology, 17*(4), 3-35.

Vygotsky, L. (2002). Play and its Role in the Mental Development of the Child (Original publication: Voprosy psikhologii, 1966, No. 6). *2003*.

Vygotsky, L., & Cole, M. (1978). *Mind in society the development of higher psychological processes*. Cambridge, Mass. [u.a.: Harvard Univ. Press.

Warford, M. K. (2011). The zone of proximal teacher development. *Teaching and Teacher Education, 27*(2), 252-258.

Wertsch, J. V. (1985). *Vygotsky and the social formation of mind*. Cambridge, Mass.: Harvard University Press.

Wynter, S. (2001). Towards the Sociogenic Principle: Fanon, Identity, the Puzzle of Conscious Experience, and What It Is Like to Be "Black". *HISPANIC ISSUES, 23*, 30-66.

Young, T. (1804). The Bakerian Lecture: Experiments and Calculations Relative to Physical Optics. *Philosophical Transactions of the Royal Society of London, 94*, 1-16.