Spring 2019

Educational Neuroscience for Adult Education Students in the U.S. and Maine

J.Sean Chung
SIT Graduate Institute

Educational Neuroscience for Adult Education Students in the U.S. and Maine

Sean Chung

Submitted in partial fulfillment of the requirements for the Master of Arts in TESOL degree at

SIT Graduate Institute

Brattleboro, Vermont

April 8, 2019

IPP Advisor: Dr. Elka Todeva

Consent to Use of IPP

I hereby grant permission for World Learning to publish my IPP on its websites and in any of its digital/electronic collections, and to reproduce and transmit my IPP electronically. I understand that World Learning's websites and digital collections are publicly available via the Internet. I agree that World Learning is NOT responsible for any unauthorized use of my Thesis by any third party who might access it on the Internet or otherwise.

Student name: Sean Chung

Date: April 8, 2019

Abstract

Cumulative scientific evidence over the last seventy years has established that the brain has a lifelong ability to change itself which has almost revolutionary implications for educators and mentors. No longer is the brain thought of as fixed, with a gradual loss of potentiality. Rather, experiences have been shown to have the ability to alter and prune the neural connections in the brain, allowing for lifelong learning, and, not as once thought, learning in youth only. This paper will explore such neuroplasticity from an educational perspective, in particular how various pedagogical approaches and experiences can sculpt the adult brain. The newer studies of the brain have merged with studies from other disciplines such as psychology and education and their results have broad implications for the educators/mentors of learners attending adult education and community education programs. Federally funded adult education programs in the U.S. and in Maine will be reviewed, as well as the factors that pose barriers for the basic literacy and English as a Second Language (ESL) students attending them. We will conclude by bringing to the attention of mentors and educators some approaches that nurture brain growth, enhance self-motivation, increase autonomy, and promote lifelong learning.

Keywords: adult education, educational neuroscience, neuroscience, neuroplasticity,

Education Resources Information Center (ERIC) Descriptors

Adult Basic Education

Community Education

Adult Learning

Neurosciences

Social Problems

Teacher Student Relationship

Table of Contents

Introduction

Six locked doors separate me from freedom and the inmates that I serve at Penobscot County Jail. Located in downtown Bangor, Maine this facility which was built for a capacity of 157 has seen its daily population rise to an average of 190 with an additional 40 to 50 overflow inmates boarded to other facilities within the state (Harrison, 2018). The demographic of this north central county jail has changed dramatically from "bad checkwriters and night hunters" to those who have succumbed to the substance abuse and mental health crisis cutting across the nation (Harrison, 2018). On the second floor of this federal style building, one former cell block is now occupied by the jail's education office. Through a partnership with the sheriff's office and Riverside Adult Education (RAE)[1], the education office offers a variety of services for inmates who elect to participate in them including college-credit-bearing computer-based algebra courses, meetings to provide re-entry educational and workplace resources, and tutoring to pass the high school equivalency exam called the HiSET in Maine.

Prior to beginning work as a tutor for the jail in the fall of 2018, I had worked primarily with international students in a higher education setting teaching English for Academic Purposes. These were students who fell largely within what is considered the acceptable spectrum of 'traditional' students who had completed secondary education in their native countries and who had been conditionally admitted to Husson University in Bangor. The English as a Second Language (ESL) Center functioned as a pathway program to improve language proficiency with

[1] RAE represents a partnership of the three school districts of Hampden, Orono, and Old Town in Penobscot County.

successful program completion leading to university matriculation toward undergraduate and graduate degrees. These students were familiar with the academic system and strategies to learn. Most were supported and encouraged by families with the means to support a costly education abroad and were, for the most part, hopeful about their futures. When decreasing enrollment, precipitated by increasingly difficult student-visa obtainment, forced the closure of the ESL center, I waited and found this new area of focus.

I began my work at the jail somewhat naively believing that my knowledge and experience as an educator with students of diverse backgrounds might stand me in good stead even within this new context. I quickly learned from the first students that I worked with that experience and empathy were not the issue. What profoundly separated these adult learners from the ESL students I had worked with in the past had less to do with intelligence and socioeconomic status (SES) and more to do with trauma, poverty, and the resulting culture of hopelessness. How could I help these students, many of them awaiting court sentencing, and facilitate learning when the uncertainties of their fate were overwhelming? Furthermore, how I could assist learners with deeply-held negative experiences of learning overcome a sense of innate deficiency to see their potential? When I took on another position, that of the service coordinator of Literacy Volunteers of Bangor, a nonprofit organization with the mission of improving literacy by matching students with basic literacy and ESL needs with volunteer tutors, more overlap and patterns began to emerge. In my capacity as service coordinator, I met with students with low basic literacy and found similarities with the jail population that I worked with: generational poverty, trauma, and negative classroom experiences related to learning disabilities such as dyslexia and Attention-Deficit/Hyperactivity Disorder (ADHD), factors often contributing to eventual drop out in high school or middle school.

Both student groups expressed a desire to improve literacy skills to further independence and employability, with the jail group expressly seeking to pass the HiSET, the portal to further educational and professional opportunities. As I was considering the effect of psychological stress on basic literacy learners, I had also recently come across Medley's article (2012), "A Role for English Language Teachers in Trauma Healing," which called for English language teachers to consider the "social-psychological situation of the students," particularly as many refugee and immigrant ESL learners are survivors of trauma (p.1).

These questions dovetailed with a growing interest in neuroscience born of my parental need to understand the child's developing mind. Dr. Siegel's (2012) "Whole-Brain Child" linked the developmental challenges of childhood with specific stages of brain development and was revelatory. No longer was a child in upset simply "irrational," but acting out within the limitations of a fully developed yet raw emotional center (the amygdala); in the absence of a fully developed cortex, the capacity to judge situations and self-soothe would naturally be severely limited. I was beginning to see that emotional health was inextricably linked with the integration of the different parts of the brain: the left and right hemispheres, and the lower, "ancient" brain which is fully developed at birth with the higher cortical regions of the brain which are undeveloped at birth and mature into early adulthood. The foundation of emotional health, according to Siegel (2012) is relationships and heightened emotions arouse the body's mechanisms for survival, a condition which makes learning nearly impossible. With the need for emotional regulation as a necessary condition for learning, I began to investigate how brain-based approaches could be applied to adult education, namely with nontraditional basic literacy and ESL students likely to enroll in adult education centers and local community literacy programs. The focus of this paper developed organically out of a need to understand the new

context of adult education programs in which I found myself, and to explore neuroscience for its potential to serve nontraditional adult learners[2]. The resulting paper is a trail of these initial inquiries into neuroscience, adult education programs in the United States and in Maine, and several approaches for their educators/mentors. It is a representation that is still very much nascent and exploratory, rather than comprehensive.

The first chapter reviews the literature about on neuroscience and provides an overview of the brain functions before focusing on the processes involved in imprinting the changes commonly regarded as "learning." The second chapter provides an overview of adult education programs in the United States and in Maine, including the demographics of the student populations that they serve. The third chapter explores the barriers and challenges to learning and participation in adult education programs faced by nontraditional adult learners seeking both basic literacy and ESL programs. Using neuroscience as a foundation, the final three chapters explore approaches for educators/mentors of nontraditional adult learners that optimize neural pathways for learning. The fourth chapter pulls from theories of neuroscience and psychology to discuss the creation of environments that nurture students' neuroplasticity, an essential element for learning. The fifth chapter delves into theories of andragogy to explore how educators/mentors can create meaningful and more lasting learning experiences founded upon adult students' prior experiences and needs. The sixth and final chapter examines how reflective writing and the act of articulation through writing can challenge personal narratives, improve cognition, and foster brain integration and a revised self-narrative of wholeness.

---

[2] The Association for Orientation, Transition, and Retention in Higher Education (NODA) (n.d.) defines the "non-traditional student" as any individual who identifies with any of the following categories including part-time attendance, non-degree seeking, adult learner over the age of 25, working full-time while enrolled, veteran status, and not having a standard high school diploma ("Nontraditional Student Populations").

Throughout this thesis, the term educator/mentor will be used in order to acknowledge the multi-dimensional roles that teachers of adult learners serve. For the majority of adult learners who have been prompted by life transitions to gain greater language proficiency, educators/mentors do not merely deliver content and study skills. They are also allies who guide students toward becoming constructors of their own knowledge and to that end they facilitate practices that foster greater cognition, autonomy and agency, including greater "social capital" which Beegle (2007) describes as exposure to a network of relationships, cultural norms, and institutions that engenders social mobility (p. 95). Thus, the traditional role of the educator as 'expert' is subverted toward the more egalitarian one of mentor. This relationship holds the potential to challenge detrimental narratives of the self and of society for the student. According to Johnson (2006), in such a relationship, the educator/mentor serves as a kind of mirror who reflects the student's potential (p. 67); when the student feels her mentor's confidence, the student can then "join in that confidence" (Johnson, 2006, p. 67). Conversely, this relationship has the potential to affect and expand the awareness of the educator/mentor's prior knowledge and views of adult learner challenges, needs, and goals. As such, the relationship between the student and the educator/mentor holds bilateral potential for transformation. Furthermore, research shows that the type of emotional growth and learning that ensues has underpinnings rooted in neuroscience as will be discussed next.

Neuroscience Literature Review

For centuries, curious minds have sought to understand the functions of the brain. In ancient Greece, Aristotle believed that the brain controlled thinking and acting whereas Plato thought the brain controlled the body's cooling mechanisms while actions originated from the heart (Ahlsen,

2011, p. 460). Today's advancements in imaging technology[3] have provided a better understanding of the brain at tasks of greater specificity. As a result, scientists of myriad disciplines are posing increasingly complex and creative questions about the capabilities of neurons, "the nerve cells in our brains and nervous systems" (Doidge, 2007, p. xix). Neurolinguists, for example, have studied how merely observing certain actions such as licking, kicking, and grasping activates the same motor and language neurons within the observer as the actor. This field known as neuroscience and embodied cognition is continually expanding our knowledge of how the brain learns and of its capacity for adaptation. One of the interdisciplinary fields borne out of such a merger is educational neuroscience. Several key findings of interest for educators/mentors from this discipline are revised theories about how the brain learns in addition to new theories of the brain as adaptive and social. These insights which challenge traditionally held views can be seen as serving a twofold purpose for the educator/mentor: validating intuition about 'what works' and offering best practices backed by neuroscience. It is the belief of the author that these discoveries have significant implications for nontraditional adult learners who arrive with multiple stress factors including negative prior learning experiences.

How the Brain Learns

Neurons, the basic information carrying unit of the brain and nervous system, resemble trees (Whitman & Keller, 2016, p 33). They send and receive information from the branches of other neurons which are called dendrites; when those signals are strong enough, the cell body produces

[3] These include imaging technology that allows researchers to snap the magnetic activity of hydrogen in a brain lesion (MRI); note changes in blood oxygen related to neural activity which can reveal the activation sequence associated with a specific task **(**functional MRI**)**; similarly, neural patterns can also be observed through the injection of radioactive isotopes which produce gamma through positron emission technology (PET); and electrical brain patterns can be observed by attaching electrodes to the scalp with electroencephalography (EEG) (Ahlsen, 2011, p. 464).

an electrical charge which is sent along the trunk or axon (Whitman & Keller, 2016, p. 33). At the end of the axon is a space between neurons called the synapse. Chemicals called neurotransmitters carry the information across the synapse to the dendrites of other neurons to forge a connection (Whitman & Keller, 2016, p. 33). Such neural pathways are being created whenever the brain is stimulated and firing. The human brain has approximately 100 billion neurons that have between ten to 10,000 connections each (Cozolino, 2013, p. 25). As two adjacent neurons repeatedly "fire together," so are their metabolisms, or chemical reactions, altered to increase the efficiency of their activation (Cozolino, 2013, p. 28). Learning occurs as the brain works hard. The effort exerted thickens the myelin or white insulation material around the axons which is conducive for greater electrical processing; the result is faster brain processing and faster recall (Whitman & Keller, 2016, p. 34).

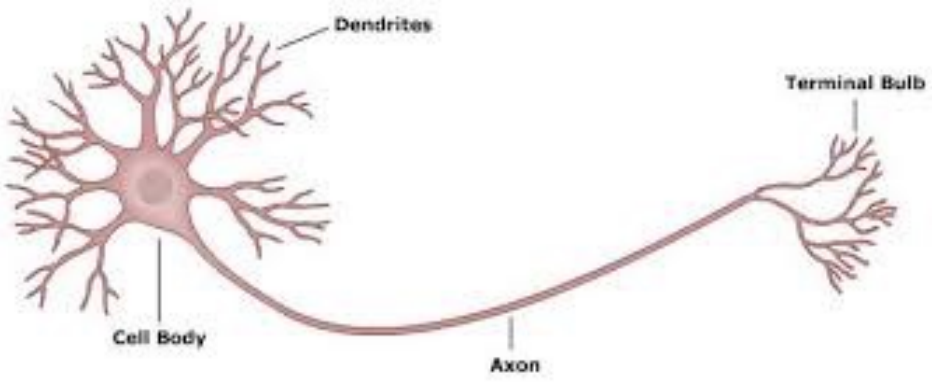


Figure 1. Basic illustration of a neuron. Adapted from: "When the brain's wiring breaks" [image], 2017, September 5. Retrieved from https://healthtalk.unchealthcare.org/when-the-brains-wiring-breaks/

The brain is comprised of three parts: the brain stem, the limbic system, and the cerebral cortex (Cozolino, 2013, p. 26) as shown in figure 2. The brain stem regulates the body's homeostasis: body temperature, heart rate, blood flow, and respiration and is fully formed at

birth (Cozolino, 2013, p. 26). The limbic system, situated between the brain stem and cortex, is composed of two structures, the amygdala and the hippocampus. The amygdala regulates emotions. It appraises environmental stress and diverts attention accordingly: in times of stress, it engages the sympathetic system to mobilize the body's primitive survival mechanism known as the "fight or flight" response (Cozolino, 2013, p. 27). The other structure, the hippocampus, is involved in memory and with spatial learning (Whitman & Kelleher, 2016, p. 36). It arranges explicit memory and works in tandem with the pre-frontal cortex to regulate emotion (Cozolino, 2013, p. 27).

Finally, the cortex, an intricate layer of cells on the surface of the brain (Zull, 2006, p. 3), processes sense and motor experiences. It is where abstract representations are formed of others, of our environment, and of ourselves (Cozolino, 2013, p. 27). It is comprised of four lobes (frontal, parietal, temporal, and occipital), each specialized to perform its own functions (Cozolino, 2013, p. 27). It is the former two which make up what is known as the executive functions.

Several processes comprise what is commonly referred to as the executive functions: coordinating and synthesizing emotions, memory, thinking, and any bodily movement according to Caine and Caine (2006, p. 56). Subsequently, the executive functions are critical to solve problems and control behavior and have been likened to the role that an orchestra conductor plays, not playing an instrument per se but modulating, setting the pace and rhythm that set the overall tone. These are experienced in the brain as self-regulation, planning, inhibition, and working memory (Caine & Caine *op cit.,* p. 56). According to Boone (1999), executive functions are the abilities of selection, and purposeful planning toward an intended performance (as cited in Caine & Caine, 2006, p. 56) that, according to Denkla (1999), requires the marshalling of

attention and memory (as cited in Caine & Caine, 2006, p. 56). As such, these neocortical regions are regarded as the seat of cognition and critical to learning (Zull, 2006, p. 3).

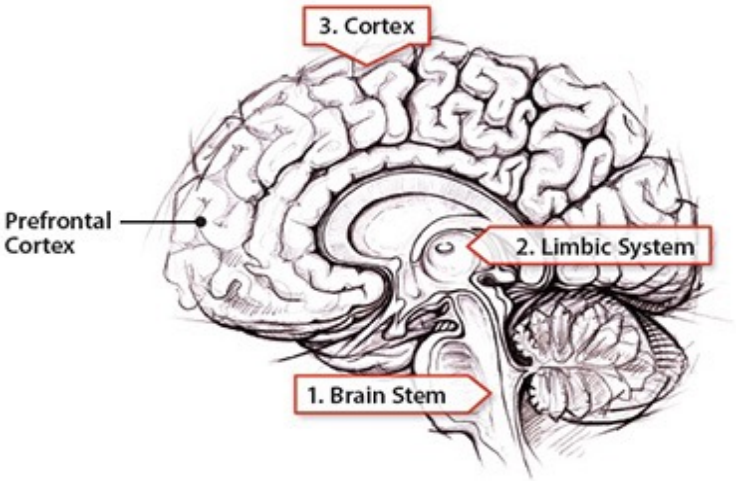


Figure 2. The three basic parts of the brain move in evolutionary order from (1) brain stem to (3) cortex. Adapted from: "Understanding the parts of the brain" [image], 2015. Retrieved from https://k12.thoughtfullearning.com/minilesson/understanding-parts-brain. Copyright 2015 by Thoughtful Learning.

How Learning Occurs

Learning is deeply interwoven with survival and is universal across species. Several brain functions including sense, motor, and association process stimuli in the environment that can lead to the change known as learning (Zull, 2006, p. 3). As previously described, dendrites from one neuron can connect with the dendrites of another to form a synaptic connection. According to Cozolino (2013), these neuronal relationships preserve learning into memory by altering and strengthening those connections (p. 25). Furthermore, the ability to refine neural connections that leads to learning is unique in primates; rather than constantly creating new neurons, known as neurogenesis, primate brains preserve, adapt, and grow existing neurons. Referencing the work of Purves and Voyvodic (1987), Cozolino (2013) states that its purpose is to "support the

mention of memory, deepen existing skills, and further the development of expert knowledge" (as cited in Cozolino, 2013, p. 25). Simply put, learning from a neuroscience perspective, occurs through neural changes in response to environmental stimuli. When two adjacent neurons fire together, their synaptic connections become stronger and, essentially synchronize in a process known as *long-term potentiation (*LTP) (Cozolino *op cit.*, p. 28). LTP also involves dendrites seeking out dendrites of neighboring neurons in order to form more networks in the complex web known as learning writes Cozolino (p. 28). Essentially, as neurons form connections, their axons become coated in white matter called a myelin sheath (Bailey & Pransky, 2014, p. 14). This myelin sheath gets strengthened and conducts information more quickly the more these neurons get activated (op. cit. p. 14). Citing Purves and Lechtman (1980), Cozolino (2013) states, however, that neurons that do not form relationships with other neurons are eliminated (p. 28) while myelin serves as a signal to the brain, write Bailey and Pransky (2014), to leave the neural connection alone (p. 14). Those then grow from "small sprouts" into "microscopic oak trees" in a process called arborization (Cozolino, 2013, p. 28).

Biologically, learning is initiated by the nervous system's response to environmental stimuli. The information is then sent to the neocortex, the part of the cortex that evolved more recently, for processing. According to Zull (2006), learning occurs directionally within its three distinct regions for "sensory, association, and motor functions" (p.3). Educators Bailey and Pransky (2014) write that learning is initiated by noticing a change in the environment which is then connected and indexed to a "network of internally stored information" (p. 15). Consequently, for every environmental stimuli, an organism can respond through physical movement (motor) or more "embedded behaviors" (association)" (Zull, 2006, p. 4). However, associations are not

quickly formed and require time in their respective neocortical regions (back and frontal)[4] in the form of reflection or sleep when competing stimulation and motor activity are minimal, writes Zull (2006, p. 4). Once associations are created, signals are then sent to the neurons in the motor region which are attached to the body's muscles and control movement (Zull, 2006, p. 4). Outside of this sense-association-motor function "package," growth neurons are instrumental for modulating the strength and duration of signals to the motor region (op.cit. p.4). In fact, the roots of these neurons originate in the brain stem, the most ancient part of the brain, and extend up into the neocortex, leading Zull (2006) to conclude that "Emotion systems are ancient, but they extend their influence throughout our modern brain" (p.7). Without these emotions and the communication between different regions of the brain, learning would not be possible. In fact, neuroeducational researchers Immordino-Yang and Damasio (2007) assert that emotion and cognition have a "nested" relationship, and that the "physiology of emotion and its consequent process of feeling have enormous repercussions for the way we learn for the way we consider and access knowledge (p.9).

Emotions and Stress in Learning

Emotions are regulated within "two almond-shaped structures deep within the brain called the amygdala" (Wolfe, 2006, p. 39). One of their primary duties is to detect and quickly respond to threats in the environment. Wolfe (2006), citing the work of LeDoux (1996), explains that danger signals trigger flight or fight, also known as a stress response which focuses and primes the body to react to the immediate emergency:

[4] The back neocortex synthesizes various facets of sense data such as shape and color while the frontal brain regions make "conscious association and manipulation of memories and sensory experiences, functions that are necessary for problem solving and creativity" (Zull, 2006, p. 4).

> During the stress response, adrenaline is released, heart rate increases, blood pressure goes up, senses are more alert, muscles tense, palms become sweaty, blood-clotting elements increase in the bloodstream, and all centers for movement are mobilized. Simultaneously, cortical memory systems retrieve any knowledge relevant to the emergency at hand, taking precedence over other strands of thought. (p. 39)

Such high levels of stress ensure survival and heighten memory of the crisis but is detrimental to learning. In order to conserve energy and focus on immediate survival, the brain foregoes long-term learning and shuts down plasticity according to Cozolino (2013, p. 19). Therefore, classroom stress, as well as any traumatic experiences of learning, can inhibit learning without the intervention of an educator/mentor to provide "emotional scaffolding" (Cozolino, 2013, p. 19).

Citing numerous studies[5], Cozolino and Sprokay (2006) write that mild to moderate levels of stress, however, can enhance memory and neural plasticity "by increasing the production of neurotransmitters and neural growth hormones, which trigger neural growth, enhance neural connectivity, and support cortical re-organization (p. 14). Consequently, learning experiences that engage students emotionally and motivate areas of interest will release mild amounts of adrenaline that make memories more vivid and likely to imprint. Taylor (2006) observes that, "The more intense the arousal…the stronger the imprint. It is almost as if the brain has two memory systems, one for ordinary facts and one for those that are emotionally charged (p. 39).

Brain imaging has also shown that this kind of learning leads to changes. Referencing the work of Draganski and others (2004), Zull writes that in people who had learned to juggle, the

[5] Cowan & Kandal, 2001; Jablonska et al., 1999; Meyers et al., 2000; Pham et al., 1997; Zhu & Waite, 1998

density of the neural network associated with sensing movement increased. However, once they stopped juggling and lost some of their ability, this density decreased (p 4). Zull (2006) confirms that the more signals generated by cortical networks, the more branches or dendrites they form (p. 4). The growth of these branches generates denser cellular material and forms more connections and synapses leading to the expression, “Neurons that fire together, wire together.” The repeated firing of neurons, lubricated with chemicals rooted in emotion, are responsible for the learning that modifies the brain (Zull, 2006, p. 5). This understanding undermines the historical view of learning as a function of the developing brain that is limited to childhood.

Critical Periods and Neuroplasticity

The traditional wisdom of the brain held that it was unchangeable. It was based upon the observations that older patients did not recover from their brain injuries, on the inability to actually observe the inner workings of the brain, and the rise, in the industrial age, of the analogy of the brain as a machine: steadfast yet incapable of adaptation. (Doidge xviii). In terms of learning, the brain was historically believed to stop developing in childhood and began to diminish at 25 (Cozolino, 2013, p. 24).

In fact, Doidge (2007) asserts that one of the greatest biological discoveries of the latter half of the twentieth century was that of the critical period. Also known as sensitive periods, these are times, Cozolino (2013) writes when synaptic connections occur at a rate of thousands per second and when learning is exponential (p. 32). Their timing is triggered by genetics and environmental stimuli (Cozolino, 2013, p. 32). These bursts of neural growth contribute to a disproportionate degree of early learning in shaping our brains (Cozolino, 2013, p. 32). The timing of these sensitive periods determines the sprout of new abilities. For language, reports Doidge (2007), the rapid period of growth is thought to start “in infancy and end sometime between eight years and

puberty"; once this window closes, learning a second language without an accent becomes more difficult and does not map on the same part of the brain as the native language (p. 52). However, increasingly sophisticated imaging technology and studies challenged those long-held beliefs and reveal that the brain's capabilities are neither genetically nor developmentally fixed but that it is, instead, malleable and adaptive.

Specifically, the brain has been shown to be continually sculpted by experience. In a study of rats, Doidge (2007) reports that Rosenzweig of the University of California in Berkeley studied rats in stimulating and nonstimulating environments and found that the rats in the former group had more neurotransmitters and heavier brains with better blood supply correlating experience with neural development (p. 35). Additionally, epigenetics is confirming that early relationships are critical for altering genetic expression (Cozolino, 2013, p. 41). Referencing studies by Szyf and colleagues (2008), Cozolino (2013) writes of rat pups that found a strong correlation between levels of maternal affection with enhanced immunity, plasticity for learning, ability to cope with stress, and enhanced maternal behavior with their young in the future (p.44). Thus, to the age-old nature-versus-nature debate, Cozolino (2013) posits the view that "while template genetics may guide the early formation of the brain during gestation, the regulation of gene expression directs its long-term development in reaction to its ongoing adaptation to the social and physical worlds" (p. 41). Early developmental environments are critical for establishing the long-term ability to learn and grow, however, neuroplasticity tells us that weak developmental brain maps can be successfully rewired in adulthood.

Re-Mapping the Adult Brain

Alexander Luria, born in 1902 in revolutionary Russia, studied soldiers with brain injuries and, much like a cartographer, mapped injured cortical areas with corresponding cognitive

impairments (Doidge, 2007, p. 32). Luria essentially provided a neural address with the loss of specific lingual, spatial, auditory, visual abilities (Doidge, 2007, p. 32). Traditionally, students with learning disabilities had to learn coping or compensatory behaviors to accommodate the impairment. Luria's research caught the attention of an education scholar, Barbara Arrowsmith, who had also been reading studies about the brain's plasticity. Arrowsmith had suffered from serious learning disabilities all her life as the result of asymmetry in her brain: "exceptional abilities" in her frontal lobes "coexisted with areas of retardation" (Doidge, 2007, p. 27). Doidge recounts that Arrowsmith used Luria's brain maps to create a series of brain exercises designed to repair her own impairments. With each repaired cognitive function, Arrowsmith created new brain exercises to address those remaining till she had raised her prior cognitive levels to average (Doidge, 2007, p. 36), and she went on to open the Arrowsmith School for children and adults with learning disabilities. As a result of her computer-based brain exercises and other innovative approaches[6], learners who were considered "unteachable" have reversed their cognitive impairments and come off medications for attention-deficit (Doidge, 2007, p. 36). Rather than having to learn compensatory behaviors for their learning disabilities, learners can now address and strengthen the "underlying problem" directly (Doidge, 2007, p. 44).

The Social Brain

In the 1970s neuroscientists discovered that biochemistry and anatomy are directly influenced by social relationships and the theory of the brain as a social organ appeared (Cozolino, 2013, p. xxii). Since then, research exploring the dynamic of relationships upon neural activation has validated its impact on health, plasticity, and learning (Cozolino, 2013, p.

[6] For example, to target impairment related to right-hemispheric function, Arrowsmith students wear patches over the left eye as they trace lines and letters (Doidge, 2007, p. 37).

xxii.). Cozolino further argues that emotions and the chemical neurotransmitters that they release are instrumental in learning because the brain is essentially a social organ. In fact, it is the activation of neurons in the brain that allow us to form relationships with others, and it has been found that brains influence one another. Citing research on the effects of human handling on animals that resulted in greater resilience, curiosity, and learning outcomes, Cozolino (2013) asserts that healthy relationships have positive effects upon brain development (p. 47). Researchers are discovering that neurons impact the brain's ability to be plastic or to change and adapt flexibly to different situations.

Cozolino (2013) argues that this makes solid evolutionary sense as living in tribes enhances chances for survival. Furthermore, he correlates the expansion of the cortex with the expansion of the size of tribal groups in order to interact in an increasingly complex "matrix of relationships" (p. 6). While no single area of the brain is dedicated to recognizing social behavior, according to Cozolino and Sprokay (2006) multiple "streams" of information are received through the sense aspects (sensory, cognitive, and motor) to communicate, often unconsciously, with those around us (p. 13). The discovery of mirror neurons further attests to social influence. Located in the frontal and parietal lobes, these neurons fire sympathetically when observing someone else performing a goal-directed behavior such as peeling a banana; mirror neurons within the observer's brain signal to the matching sensory networks as if the observer were performing the action and not merely observing it (Rizzolatti, & Craighero, 2004, p. 171). Though their name suggests that their role is merely imitative, mirror neurons are also involved in the "planning and execution of actions in time and space as well as predicting the behavior of others" - two essential abilities for survival (Cozolino, 2013, p. 141). If mirror neurons serve survival, then it stands that humans evolved "to learn from important others as we

observed their activities" (Cozolino, 2013, p. 141). Furthermore, if social interactions serve instructional purposes that sculpt our brains, then there are implications for instruction which will be explored in the subsequent chapters for the educator/mentor and the student.

Adult Education Programs in the United States and in Maine

The nontraditional adult students who seek out adult and continuing education programs often do so because of the socioeconomic limitations posed by low literacy and limited English proficiency skills in an increasingly complex employment landscape. According to the Organization of Economic Cooperation and Development's (OECD) (2005) "Thematic Review of Adult Learning in the United States," drastic changes to the contemporary U.S. economy[7] have reduced the "bargaining power of the low-skilled worker" and the demand for heavy manual labor has been replaced by more intellectually demanding jobs" (p. 7). Job responsibilities increasingly include such abstract skills as analysis, interpretation, and response to uncertainty (p. 7). However, the National Adult Literacy Survey (NALS), the most comprehensive and detailed survey about the literacy of Americans, conducted in 1992, found that between 46-51% of respondents performed at or below the second of five proficiency levels; this indicates difficulty with comprehending longer texts without headings, interpreting tables, and synthesizing information (Schierloh, 2018). The target demographic of the study were Americans over the age of sixteen largely thought to be finished with formal education, and, thus least likely to make gains in literacy (Kaestle, 2001, p. 16). The key finding of the NALS survey was the correlation of level of formal education attained with adult literacy proficiency (Kaestle

[7] Among the "transformative factors" cited by the Organization of Economic and Collaborative Development (OECD) (2005) are trade expansion agreements favoring competitively priced foreign products; technological paradigm shifts toward leaner production systems; and the decentralization of the wage setting process in tandem with loss of union density (p.7).

2001, p. 23). Regardless of the effectiveness of a school's literacy program, completion of K-12 program correlated with "substantial gains in adult literacy proficiency for all groups, at all levels of education" (Kaestle, 2001, p. 23). Despite the connection between increased literacy level with length of formal education, each year one in six individuals between the ages of 16 and 24 drops out of high school without receiving the equivalent of a high school diploma or GED. With literacy levels determining access to increased wage employment and to greater socioeconomic status, those who want to complete their secondary degree often seek out the free or low-cost educational programs offered through a local adult education center or a local community education program.

In the United States, more than 3,100 adult education programs operate under the Adult Education and Family Literacy Act (AEFLA), title II of the Workforce and Innovation and Opportunity Act (WIOA). AEFLA's objectives for state-grants is four-fold: (1) promoting basic adult literacy; (2) increasing skills and knowledge for employment and self-sufficiency; (3) becoming "full partners" in the educational development of children; and (4) earning a secondary diploma or its equivalent (AEFLA Resource Guide, 2017, p.1). WIOA is the main source of states' federal funding for adult education programs (AEFLA Resource Guide, 2017, p. 1). These funds are allocated by the Department of Education's Office of Career, Technical, and Adult Education (OCTAE). Keenan (2018), Director of OTAE's Division of Adult Education and Literacy reports that total WIOA funding for the fiscal year 2018, including funding for section 243 for the Integrated English Literacy and Civic Education (IELCE) program which includes English literacy instruction in the context of civic studies, was $616,955,000

("Estimated adult education state award amounts"). For the same fiscal year, Maine was awarded $1,750,637[8] (Keenan, 2018).

Adult Education in Maine is offered at 78 locations and serves 85% of towns, cities, and territories (Maine Adult Ed Association, n.d.) throughout the state. Most programs operate out of areas that have a public high school and day and evening programs are offered throughout the year (Maine Adult Ed Association). Program offerings fall broadly within three categories as shown in Table 1[9]: Adult Basic Education (ABE), Adult Secondary Education (ASE), and English Language Acquisition (ELA) according to OCTAE (2018).

Table1

Table 3: Participants by Program Type and Age

Program Type (A)	16-18 (B)	19-24 (C)	25-44 (D)	45-54 (E)	55-59 (F)	60+ (G)	Total (H)
Adult Basic Education	512	863	1,167	253	99	76	2,970
Integrated Education and Training Program	11	30	58	15	9	+	124
Adult Secondary Education	177	301	342	73	22	18	933
Integrated Education and Training Program	7	15	26	+	6	+	59
English Language Acquisition	10	170	1,272	402	109	140	2,103
Integrated Education and Training Program	0	+	31	10	+	+	48
Integrated English Literacy and Civics Education (Sec. 243)	0	0	0	0	0	0	0
Integrated Education and Training Program	0	0	0	0	0	0	0
Total	**699**	**1334**	**2781**	**728**	**230**	**234**	**6006**

Participants by Program Type and Age in Maine, July 1, 2017-June 30, 2018.

Note. Reprinted from "Participants by Program Type and Age" by Office of Career, Technical, and Adult Education National Reporting System, retrieved from https://wdcrobcolp01.ed.gov/CFAPPS/OVAE/NRS/tables/view.cfm?tableID=3

Educational Testing Services (ETS) (2008), a private nonprofit educational testing and assessment organization, reports that ABE classes created by the U.S. Department of Education, offer free instruction in basic reading, writing, speaking, math, problem solving, and

[8] Of that total, $104,004 was allocated for IELCE.
[9] A fourth class, IELCE, was granted and is offered for the first time in Maine for the fiscal year 2018 (Keenan, 2018).

computation to individuals performing below the 12th grade level in any one of those skills (p. 3). The U.S. Department of Labor sponsored resource Career One Stop (n.d.) outlines the following eligibility requirement: students must be over the age of sixteen, and they may not be enrolled in high school or possess a high school diploma ("Brush up on your Basic Skills"). In addition to the skills listed above, ABE instruction also includes high school equivalency preparation as well as ESL instruction for non-native speakers. The overall aim of ABE is to improve literacy and numeracy skills to improve participation in family life, society, and the workplace.

ASE is aimed at adults who possess some literacy skills and who are able to function in everyday life but who either need additional support toward proficiency or lack a high school certificate or its equivalent[10] (ETS, 2008, p. 3). The goal of ASE is to help students earn secondary school certificates or equivalency in order to improve employment opportunities and/or to transition to higher education. To support non-native speakers, ESL instruction is offered to improve English language proficiency in order to improve the ability to function in daily life and in jobs.

The National Reporting Service (NRS) for Adult Education and Literacy tracks, compiles, and aggregates state information from federally funded adult education programs. In their survey of the 2018 fiscal year[11], 6,006 individuals participated in Adult Education programs in Maine. Of those, 2,970 participated in ABE, 933 in ASE, and 2,103 in ESL instruction. According to OCTAE's Table of Measurable Skills Gain (MSG) for the same fiscal year, among those

[10] In Maine, the test for high school equivalency is the HiSET, an exam administered by ETS which can be taken as a paper-based or online exam.
[11] July 1, 2017-June 30, 2018

students, receiving instruction below the postsecondary level, 1,651 advanced at least one functioning grade level and 715 attained a secondary diploma or its equivalent[12]. Additionally, correctional facilities in partnerships with local adult education sites offer high school completion programs, and online courses transferrable for college credit.

Adult education programs are largely staffed by part-time employees. According to OCTAE (2018), in FY17 in Maine, there were 740 part-time teachers and 102 full-time teachers; 101 part-time paraprofessionals and 8 full-time paraprofessionals; 28 part-time counselors and 8 full-time counselors; and 168 part-time administrative staff and 171 full-time administrative staff ("Adult Education Personnel by Function and Job Status"). Of those teachers, 427 part-time and 71 full-time teachers had less than one year of teacher experience in adult education; 60 part-time and 6 full-time teachers had one to three years of experience; and 253 part-time teachers and 25 full-time teachers had more than three years of experience. In terms of teacher certifications, 452 part-time and 70 full-time teachers had no certification; 121 part-time and 19 full-time teachers had adult education certification; 182 part-time and 26 full-time teachers had K-12 certification; 19 part-time and 3 full-time teachers had special education certification; and 16 part-time and 0 full-time teachers had TESOL certification (OCTAE, 2018, "Adult Education Personnel by Function and Job Status").

Table 2

Adult Education Personnel by Function and Job Status in Maine, July 1, 2017-June 30, 2018

[12] ABE has six levels with the ASE accounting for levels four and five. Similarly, ESL instruction is tiered from levels one to six.

(A)	Total Number of Part-time Personnel (B)	Total Number of Full-time Personnel (C)	Unpaid Volunteers (D)
Function			
State-level Administrative/Supervisory/Ancillary Services	+	+	0
Local-level Administrative/Supervisory/Ancillary Services	168	171	+
Local Counselors	28	10	+
Local Paraprofessionals	101	8	66
Local Teachers	740	102	62
Teacher Experience in Adult Education			
Less than one year	427	71	
One to three years	60	6	
More than three years	253	25	
Teacher Certification			
No Certification	452	70	
Adult Education Certification	121	19	
K-12 Certification	182	26	
Special Education Certification	19	+	
TESOL Certification	16	0	

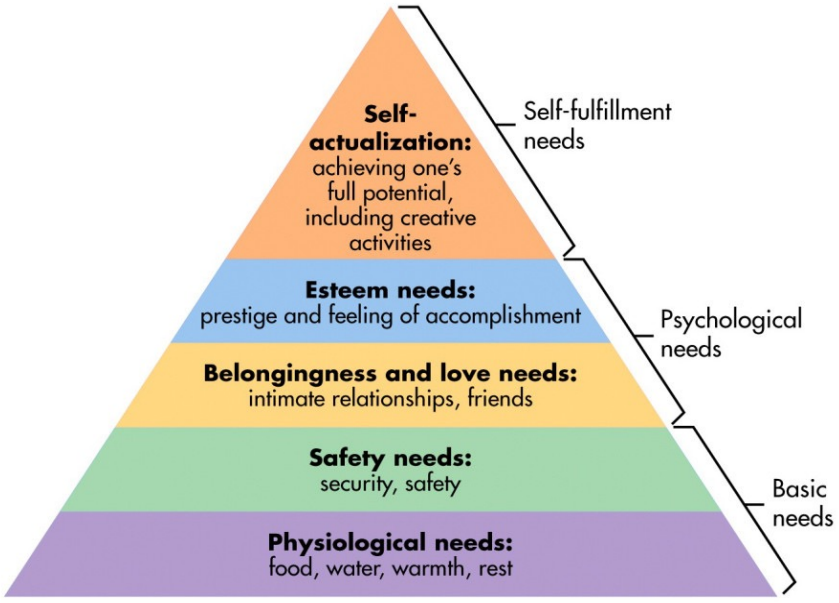
Note. Reprinted from "Adult Education Personnel by Function and Job Status" by Office of Career, Technical, and Adult Education National Reporting System, retrieved from https://wdcrobcolp01.ed.gov/CFAPPS/OVAE/NRS/tables/view.cfm?state=ME&year=2017&tableID=10

These findings suggest that adult education teachers are drawn from a pool of individuals from non-traditional teacher certification tracks, recent graduates, as well as retirees. This is fitting as most of the students that they serve fall within the definition of the nontraditional student and face hurdles to completing their educational goals.

Barriers Faced by Adult Learners

Adult learners with low literacy, numeracy, and English-language proficiency face considerable barriers to regular attendance to adult education programs. Many of these barriers can be more clearly understood through the framework created by psychologist Abraham Maslow (1943). Drawn from the biographical writings of luminaries whom he identified as successful, he created a framework and theory of human needs organized as five distinct tiers of a pyramid: physiological, safety, belongingness and love, esteem, and self-actualization (McLeod, 2007). This framework provides a useful model upon which to examine the barriers

that adult education students face (see fig.3). His theory proposed that higher needs could not be attained before the achievement of those below: before one could develop friendships, one's basic needs for food and shelter had to first be met[13]. As successive needs are satisfied, goals shift to higher tiers until those are achieved and so on[14]. The bottom four tiers were termed "deficiency needs" (d-needs) while the fifth was termed a "growth need" (g-need) (McLeod, 2007). These d-needs will continue to increase the longer that they are unmet; however, once the need is met, shelter for example, d-needs cease (McLeod, 2007). Conversely, the satisfaction of g-needs such as learning new skills, would increase motivation to continue meeting additional self-actualization needs.



[13] This was later revised to the view that different needs could be achieved concurrently.
[14] However, this is not an "all or nothing" model and it is possible to be working toward different needs and goals concurrently.

Figure 3. Maslow's hierarchy of needs five stage pyramid [image]. Reprinted from Simply Psychology by S.McLeod, 2018. Retrieved from https://www.simplypsychology.org/maslow.html. Reprinted with permission.

Maslow's hierarchy has a direct bearing upon the "nontraditional" student population that attend adult education programs in the U.S. Rather than focusing on inherent and therefore unchangeable factors such as age, race, and gender which have historically underscored the definition, NCES (n.d.) focused their three criteria upon self-selected choices that could be altered but which put students as higher risk to discontinue studies: (1) enrollment patterns, (2) financial and family status, and (3) high school graduation status ("Nontraditional Undergraduates"). In terms of enrollment pattern, NCES (n.d.) describes a nontraditional student as one who has "[delayed] enrollment in postsecondary education by a year or more after high school or who attended part time" ("Nontraditional Undergraduates"). Identifiers of "nontraditional" financial and family status include "family responsibilities and financial constraints" such as "having dependents other than a spouse, being a single parent, working full time while enrolled, or being financially independent from parents" (NCES, n.d., "Nontraditional Undergraduates"). Finally, in terms of high school graduation status, NCES defined nontraditional students as those who did not receive "a standard high school diploma but who earned some type of certificate of completion" ("Nontraditional Undergraduates").

Given that one of the biggest indicators of poverty is low literacy, with 43% of those with the lowest literacy living in poverty (ProLiteracy, n.d.), many of the nontraditional adult students attending adult education programs face some barriers posed by having unmet basic needs. Low-wage labor or unemployment's impacts on physiological needs include, at the extreme, homelessness or provisional living situations, lack of access to reliable transportation, lack of

sufficient childcare, and health-related issues, in addition to the chronic stress of daily survival. Without the satisfaction of these physiological needs, suffice it to say that satisfying the subsequent need for safety and security would be difficult. Additionally, students who have largely met their physiological needs may still be exposed to safety and security concerns. Chronic pain due to lack of health insurance, the stress of waiting for a public assistance check to clear, waiting for immigration-status paperwork, are some examples of the kinds of immediate security-related stresses that can prevent nontraditional adult students from regular attendance and attainment of learning goals. However, when and if these basic foundational needs are met, the adult learner can then focus on the next two tiers which are categorized as psychological needs.

Supportive family and friends create the trust, intimacy, and acceptance that engender a sense of belonging and self-identity. The shared sense of values and cultures of the individuals around us mirror back and affirm our identification within affiliations of friends, family, and work colleagues. Once we have established affirming relationships, we can then focus upon needs based on self-esteem. Adult learners who do not have the support of family or friends risk rejection by venturing outside the culture of their inner circle by advancing their education. Additionally, many adult learners have experienced failure in formal classrooms and carry memories marked with trauma and shame. As a result of negative learning experiences, their affective filters are raised increasing their fear and stress responses. The adult learner who views learning and/or classrooms as threatening, is challenged to experience the trust and acceptance needed to create a sense of belonging.

For the other psychological need, self-esteem, Maslow created two categories:(1) self needs, composed of achievements, mastery of skills, and independence and (2) desire for reputation,

composed of recognition from others, status, and prestige (McLeod, 2007). Adult learners who have met the previous needs can now attend to the goals that have compelled them to seek out adult education: the desire to improve literacy, earn their high school equivalency, and gain greater control and independence. Furthermore, the satisfaction of those goals may generate recognition and approval from others, thus increasing status.

The potential trauma and low economic conditions experienced by adult literacy and ESL students can create obstacles that make it challenging to meet those psychological needs. The National Education Association (NEA) (2016) reports that coming from impoverished backgrounds makes it more likely that children heard more discouraging than encouraging words, and it increased the likelihood that questions and requests were met with anger and outbursts (NEA, p. 11). When caregivers are stressed from working multiple jobs, lack of resources and time to spend with children, children often internalize that stress and blame themselves for those problems and will try to gain approval through over-compensating or withdrawing (NEA, 2016, p. 11). Whatever the coping strategy employed, the physiological effects of such attacks on the developing body and mind are consistent: increased stress levels mobilize the body's survival mechanism making it difficult to focus attention on content. As a result, memory is impaired, and stress further has the effects of de-regulating emotions and decision-making (NEA, 2016, p. 12). With chronic stress, children will become adults with poor stress responses and inhibited cognitive development. Furthermore, parents from low socioeconomic backgrounds are less likely to advocate for their children, seek formal diagnoses for learning disabilities which make it more likely that their children fall behind.

Adverse childhood learning experiences associated with shame can then result in a sense of fear and anxiety in an educational setting. Displaced immigrants and/or refugees may also be

harboring experiences of loss, hardship, and culture shock that lead to anxiety states. Neuroscientist and psychiatrist Perry (2006) describes how these stress responses turned outwardly can present as hyper-vigilance or, if feeling threatened, aggression; the same insecurities turned inwardly may be observed as withdrawal, daydreaming etc. (p.23-24). If extreme enough, these experiences would have been felt as traumas. It is also not uncommon for adult learners to cite bullying, ADHD, learning disabilities, and parental neglect as reasons for quitting school. Consequently, nontraditional adult learners often feel a deep sense of failure and hopelessness about their intellectual ability and their ability to learn.

Once those basic and psychological needs have been met, however, the last remaining need is self-actualization. Self-actualization is defined as reaching one's full potential by doing all that one is capable of. As the needs and goals in this category are highly individualized, the sense of success for each learner would be different. For the nontraditional adult learner, this could be signified by gaining literacy skills, achieving a high school equivalency, finding a job or one with greater complexity, getting a driver's license, gaining citizenship and/or autonomy, improving health, or earning higher wages. For others, self-actualization may be defined as continuing with higher education, professional degrees, the ability to write a letter, fill out an application independently, or experience enrichment through greater decoding skills. However different these outward goals, the satisfaction resulting from growth and attainment of new skills would not be dissimilar.

The following chapter will describe how educators/mentors who work with adult learners can prepare neural pathways for learning by creating a sense of safety based upon trust.

Creating a Safe Space for Learning

Each step that an adult student has taken to finally "show up" and arrive at an adult education site, community literacy center, a community college classroom, or volunteer tutoring session - from contacting the appropriate individual, filling out forms, participating in an intake interview about their educational experiences and goals, in addition to undergoing assessments - has required crossing socioeconomic and educational borders and represents acts of courage and resiliency particularly when literacy and language skills are limited and attended with negative associations about learning (NEA, 2016, p. 25). Awareness that many students arrive with emotional scars about learning as well, as less than optimal neural pathways for regulation, allows educators, administrators, and mentors to create an environment that minimizes the sense of threat and optimizes the neuroplasticity necessary for learning (NEA, 2016, p. 25). Stress, as previously discussed, makes it difficult for students to focus on any matter other than immediate survival. Furthermore, if the brain is also a social organ that is shaped by social interactions with other brains, then the educator/mentor can serve as an agent for positive neural activation through her individual interactions with students as well as by establishing a classroom culture akin to a "holding environment" (Taylor, 2006, p. 82).

Holding Environments

Referencing Kegan (1982), Taylor (2006) writes that a "holding environment" is the foundation for all development (p. 82); this was derived from observations by Winnicott that infants who were not held, despite being fed, clothed, and sheltered, failed to thrive (Taylor, 2006, p. 83). Kegan identified three stage of the holding environment that nurtured the infant (1982): "holding on," "letting go," and "sticking around" which translate into the learning environment as "confirmation, contradiction, and continuity" (Taylor, 2006, p. 83). Confirmation

is the stage where the educator/mentor raises the learner's confidence and concentration with words of encouragement that praise effort through difficulty (Taylor, 2006, p. 83). Next, contradiction is when the educator/mentor extends learners toward a new challenge just beyond their comfort level yet still within reach of attainment. Finally, in continuity, the learner has mastered enough skills that the mentor/educator is no longer needed; at this stage, the relationship will require re-evaluation and the dynamic becomes more equitable and resembles that of peers or co-learners[15] (Taylor, 2006, p. 83). For such a relationship to be effective, there must be a "balance of support and challenge" (Taylor, 2006, p. 83). Cozolino (2002) reasserts this, "We appear to experience optimal development and integration in a context of a balance of nurturance and optimal stress" (cited in Taylor, 2006, p. 62).

As such, affect plays a pivotal role in learning regardless of age. Every region of the neocortex is interwoven with cell bodies that originate in our emotional center, the brain stem. Furthermore, Zull (2006) writes that these neural networks are also bathed in chemicals secreted by emotions that modulate the strength and continuity of each step of the learning process (p. 7). To regulate affect, it has been suggested that the educator/mentor can use aspects of psychotherapy to enhance neural plasticity as both outcomes share similar educational aims.

Psychotherapeutic Models

Colin A. Ross (2006), psychiatrist and founder of the eponymous Institute for Psychological Trauma, proposes that "psychotherapy, education, and brain self-repair are different facets of a single, complex, unified process" (p.29). Citing evidence from brain images by Liggan and Kay (1999), Ross (2006) contends that psychiatry repairs the brain and that "the reflective process

[15] This stage often takes time to develop and is most often observed among graduate students and faculty (Taylor, 2006, p. 83).

that leads to insight has been shown to affect - and ultimately change - patterns in the brain" (p.30). He also points out that the root of education, *educare* means "to draw out," a major goal shared with psychotherapy (2006, p. 31). Toxic developmental inputs can harm a developing psyche and brain, but self-reflective practices and insight can heal the mind which in turn repair the brain. This view is also supported by Cozolino and Sprokay (2006) who cite additional principles of psychotherapy as conducive to learning in other contexts such as "a safe and trusting relationship with an attuned other" and "maintenance of a moderate level of arousal" (p. 12).

Trusting Relationships

Neuroscientist Bruce D. Perry (2006) cites the "invisible yet powerful web of relationships that effective educators create between themselves and learners, and among learners" as "crucial to an optimal learning environment" (p. 27). These relationships are especially important for adult learners who may possess negative learning experiences, trauma, and/or learning disabilities. Donna Beegle (2007), poverty scholar, also asserts that people from impoverished backgrounds need a "trusting relationship with a professional" in order to be able to leave their comfort zones to learn (p. 101); she adds that people from poverty "connect to people, rather than to abstract knowledge" (p. 101). Johnson (2006), faculty fellow with the Center for Human Development, Research Foundation of the State University of New York concurs that "the key is in the spaces created by the mentor-learner relationship, spaces where the learner feels uniquely seen by the mentor, valued, and safe" (p.66). The mirror neurons described in the first chapter facilitate this process by allowing empathetic connection with others. Johnson (2006) observes:

> When the learner feels her mentor's care and support, her fears start to subside. If she looks into her mentor's eyes and sees reflected what she can become, she will borrow

> (take in) that confidence until she can produce her own. In other words, mirror neurons will enable her to feel the confidence that her mentor has in her and to join in that confidence. (p.67)

In fact, the educational safe space resembles early caregiver-infant relationships where the caregiver provided emotional soothing which the infant was unable to provide for herself. The following are some approaches that the educator/mentor can use to create attunement with the adult learner.

Finding Common Ground

Kenneth Burke (1969) believed that in order to build a relationship, individuals need first to find common ground. Beegle (2007) asserts that this is necessary because humans are continually seeking cues to how best to live from others whom they trust (p. 87). In order to trust others, first individuals need to be receptive and listen and share stories about "who they are and their experiences" (Beegle, 2007, p. 87). To that end, Burke's identification theory framed multiple levels of such self-disclosure of which Beegle (2007) found three of greatest significance:

> Level 1 - Sharing information regarding specific subject matter or resources
>
> Level 2 - Sharing personal stories, experiences, feelings, and preferences
>
> Level 3 - Sharing deeply personal information, gut-level values, and beliefs
>
> (pp. 88-89).

The identification theory is a bilateral practice which paves the way for both the adult student and the educator/mentor to find the common ground to help one another step out of their respective comfort zones. Many professionals stop at the first level of information sharing and never fully identify with the individual which often creates a sense of "other" (Beegle, 2007, p.

91). However, when both parties can self-disclose and find commonalities, trust can be established. It is only within such a trusting environment that Perry (2006) says that learners can feel safe enough to embark on the cycle of "curiosity, exploration, discovery, practice, and mastery" that is learning (p. 26).

Building connections with students is vital for engendering trust. Rather than merely delivering impersonal and formal information and instruction (Level 1), educators/mentors can also share some personal information. For example, they can tell a student how they learned the information they are teaching or give an instance when they applied this knowledge in their own lives (Beegle, 2007, p.88). Beegle (2007) writes that "This society often teaches that the people who are successful in life already know information just because they are smarter," so that hearing messages of personal challenge and growth are encouraging to marginalized students (p. 88). Once the educator/mentor becomes a "'real person' who is not so different from them," their words will have more weight and students will become more invested in the program and eventually in their learning (Beegle, 2007, p.88). Beegle (2007) shares her own story of realizing that a professor was a "real person" when he told her class about his pending divorce; as the result of his self-disclosure, she realized that he and she must not be as dissimilar as she had previously thought, and she found the courage to advocate for herself in the class (p. 89). By becoming more "real" through self-disclosure of personal struggles or of those faced by family and friends, educators/mentors can ameliorate student frustrations and help them to gain self-acceptance within their educational experience: rather than seeing themselves as defective, they can see themselves as normal. The flow of self-disclosure at Level 2 then becomes bilateral as the educator/mentor learns additionally about the student. The common ground footing grows firmer. Beegle (2007) writes:

> When teachers…know something about the people they serve, they are much more likely to reach out and do what is truly needed to help people move forward — including finding additional resources, opening doors of opportunity that were closed, and connecting people to others who can provide help. (p.90)

Citing Burke, Beegle (2007) writes that identification building does not require that educators/mentors utilize Level 3 self-disclosure involving "sharing intimate, deeply held gut-level values or beliefs" such as views on abortion and gun control (p.90). She does, however, state that educators/mentors and helping professionals must go beyond Level 1 information sharing in order to be seen, not as an expert or professional, but as a person by the individual being helped (p. 90). Beegle (2007) concludes that "Recognizing that you are more similar and have just had different experiences and opportunities can help you build identification and a relationship that will make a difference" (p.90). The educator/mentor's sensitivity and self-awareness of such commonalities initiates this process.

Taylor (2006), referencing Cozolino (2002), writes that, "*A safe and empathic relationship* establishes an emotional and neurobiological context conducive to the work of neural reorganization. It serves as a buffer and scaffolding within which [an adult] can better tolerate the stress required for neural reorganization" (p.82). The process of creating new brain patterns involves emotional and cognitive upheaval for which the educator/mentor can provide support. And though the educator/mentor's role is not necessarily the same as a therapist's, the outcomes of both processes leads to "greater self-awareness, less anxiety, heightened self-responsibility, increased cognitive complexity" (Taylor, p. 82). The following chapter will examine learning approaches that the educator/mentor can apply once the foundation of a trusting relationship has been formed.

Designing Meaningful Learning Experiences

To promote learning, educators/mentors may need to resist the current trend of teaching toward accessibility, or students' ability to "access" or recall short-term information (Whitman & Kelleher, 2016, p.81). Cognitive psychologists at the University of California - Los Angeles, Courtney Clark and Robert Bjork argue that teaching practices are often focalized around accessibility which often belies and misconstrues the underlying process of long-term learning (Whitman & Kelleher, 2016, p.81). To that end, Whitman and Kelleher (2016) believe that teachers can use methods that effectively foster "enduring learning" over "errorless learning"[16] (p.81). This chapter and the next will explore two approaches that educators/mentors can use to create the kinds of "deep, active cognitive engagement" (Whitman & Kelleher, 2016, p. 93) that lead to such enduring learning: creating experiences that engage the adult learner's experiences and "learning through articulation" (Taylor, 2006, p. 75).

Consciousness as the Seat of Cognition

Neurons make it possible for the brain to conduct its functions. While many of these functions are innate such as the ability of the heart to keep beating, others, Sheckly and Bell (2006) posit, are instigated by changes in the environment that create a change-in-body-state (COBS) (p.43). The frequency and intensity of COBS result in neurons firing-together and wiring-together (FTWT). Furthermore, the repetition of these phenomena results in denser neural connectivity and learning that is more durable (Sheckly & Bell, 2006, p. 43). These COBS experiences create brain circuits that include explicit associations culled from memories as well as implicit associations such as the sensations that they evoke (Sheckly & Bell, 2006, p 44). In

[16] Some practices they suggest are replacing quizzes for grades with "formative" assessments which act as frequent means of "forming" memories and which have low-stakes toward their grades (ungraded, low percentage, or graded on effort) (2016, p.85).

doing so, Sheckly and Bell (2006) argue that experience lies at the core of consciousness (p. 44). The multidimensional and layered tiers of consciousness within each adult learner can be used as a source for meaningful and lasting learning (Sheckly & Bell, 2006, p. 44). The neural circuitry and consciousness which allows for past associations to mingle with present ones and even to extend to the future consciousness of consequences and results, then forms the core of thinking and of reasoning. According to Sheckly and Bell (2006), this process is fundamentally the same, "Whatever the topic - the situation in Iraq, corporate misbehavior, or even drinking a cup of coffee - the cognitive processes of thinking, reasoning, and decision making are founded in the immediate COBS experience of the moment (p 46).

Unto this, past COBS episodes are woven with future imaginings and feelings derived from the prior conditions. Educators/mentors can implement this awareness of COBS and consciousness with adult learners who arrive at a learning space full of life experiences. To foster this, Sheckley and Bell (2006) created several instructional strategies that (1) draw out prior experience, (2) extend consciousness, and (3) enrich consciousness.

Strategy One: Drawing Out Prior Experience. The first strategy is to use students' prior COBS and experiences as the foundation for learning, or, in the words of Sheckley and Bell (2006), "to begin with the baseline of prior experience" (p. 46). Educators/mentors can do this by asking students about "immediate reactions, prior experiences, and future situations" (Sheckley & Bell, 2006, p.46). These can be assessed, according to the authors, through "class discussions, an interview, a portfolio, or a short essay" (Sheckly & Bell, 2006, p. 46). Based upon the experiences expressed, the educator/mentor can also adjust her practices. If, for example, a student expresses anxiety about past school failures, the educator/mentor can offer encouragement and activities that promote non-veridical assessments and also involve the

student in the selection of types of assessments that they would like to complete. Alternatively, the educator/mentor who is aware of a student's excitement about a goal could create affordances which allow the student additional time and resources. Additionally, the responses could serve as a source of reflection. For example, students could reflect on their prior experiences with math and the assumptions that resulted. The educator/mentor could than "ask students to build from these assumptions by exploring alternative perspectives, contrasting their assumptions with other explanations, or checking the validity of inferences they have made" (Sheckly & Bell, 2006, p.46). Student responses could also serve to alert educators/mentors to areas of misconception which can then be addressed through examination. In doing so, ideas could be restructured and thinking complicated and/or refined. A last suggestion with validity cited from research by LeGrow, Sheckley, and Kehrhahn (2002) is to have students create an integrated "lifetime history of COBS-based experiences into an organized storyline by compiling portfolios of their prior learning (as cited in Sheckley & Bell, 2006, p.47). Those who constructed personal storylines outperformed students who did not in their ability to problem-solve (Sheckley & Bell, 2006, p.47). Educators/mentors can similarly have students construct a cohesive and multidimensional timeline of instances when they felt they 'got' something and grasped understanding. Such an exercise can raise student consciousness of their preferred methods of learning which again provides useful data for the educator/mentor during lesson planning. Furthermore, this timeline can serve as a reference throughout their learning sessions much like a map-in-progress which can be used in conjunction with the following strategies.

Strategy Two: Extending Consciousness. All the experiences that students bring with them can serve as a kind of velcro upon which new concepts can be affixed (Sheckley & Bell, 2006, p. 47). In fact, Kant has said that experience without concepts is "blind" whereas concepts without

experience are “empty” (Sheckley & Bell, 2006, p. 47). The educator/mentor can supply new concepts that connect to the learners’ prior COBS, effectively broadening their perspectives, so they can arrive at generalizations (Sheckley & Bell, 2006, p. 48). These new ideas can allow learners to “remove the blinders of their prior experience” and adapt their experiences in new situations.

One strategy that educators/mentors can employ is the use of concept maps. Researchers at the Institute for Human and Machine Cognition, Novak and Canas (2008), describe concept maps as a graphic tool to represent and organize knowledge. Concepts are placed in circles or boxes. Lines connect ideas that are related and words or phrases upon the line explain what that relationship is. They can also be organized hierarchically, with most important ideas on top in decreasing order. During this process, educators/mentors can add multilayered dimensions to students’ consciousness by introducing them to new experiences such as interviews, new concepts, and new perspectives (Sheckly & Bell, 2006, p 48). After each new encounter, students can be asked to consider how this information fits with their prior consciousness. These changes can be recorded on the concept map to reflect the stages of knowledge that the student is constructing. This is a tool that could be used in both a classroom and individually, as well as be used evaluatively: throughout the course, it will reflect new understanding, and at the end, it will serve to show summative or comprehensive understanding.

Strategy Three: Enriching Consciousness. A third strategy proposed by Sheckley and Bell (2006) is for educators/mentors to acknowledge that COBS trigger fire-together wire-together (FTWT) episodes with purposeful injections of novelty (p. 49). To that end Sheckley and Bell (2006) suggest that:

> "instructors might incorporate into their lessons provocative events such as real-life problems adults are grappling with at work, debate on topics such as the constitutionality of *Roe* v. *Wade*, activities that link historical event such as the Battle of Hastings in 1066 with their lives today, research projects such as conducting an opinion poll about the invasion of Iraq, or simulations such as managing a mock stock portfolio." (p. 50)

These kinds of stimulating activities and themes prime the neural connections which are crucial for learning to be committed to memory.

In fact, this view is supported by neuroscience and cognitive science education consultant Pat Wolfe (2006) who states that the release of adrenaline during "mildly emotional and positive events" enhances memory[17]; Wolfe (2006) suggests that "classroom activities designed to engage students' emotional and motivational interest are quite likely to lead to more vivid memories of whatever grabs their attention. The more intense the arousal, however, the stronger the imprint. It is almost as if the brain has two memory systems, one for ordinary facts and one for those that are emotionally charged" with the latter remaining much longer in memory (p. 39).

Provocation can be both positive as well as controversial. Educators/mentors who are familiar with their students' backgrounds, interests, and goals will be able to locate a topic of interest. For students looking for employment, want ads could become a text for a literacy class or tutoring session. In an ESOL class, a case study of an immigrant experiencing language barriers could become a source of discussion to prompt personal experience. Additionally, educators/mentors can engage students in a complex situation such as composing a formal email or filling out an application for a driver's license. Engagement allows students to implicitly learn and untangle the intricacies these tasks involve (Sheckley & Bell, 2006, p. 50). Wolfe (2006)

[17] This is the reason why people often remember where they were during a crisis.

suggests adding “an emotional hook” to learning with the inclusion of such activities as “simulations, role plays, and other experiential activities” (p. 39). Wolfe (2006) continues that an additional way to heighten the emotional stakes of learning is for students to tackle a real-world problem and present their findings. For example, students in a literacy program could interview past participants about their experiences of learning to become more proficient readers and how their lives were transformed which can add an emotional context as well as personal motivation. Or students who have barriers to transportation could collect their findings and present them to the local public transportation authority, thereby creating a memorable experience in addition to having their voices heard. Sheckly and Bell (2006) conclude that “the broader the dimensions of COBS feelings these learners have, the greater is the depth and breadth of the resources they can call on when thinking, reasoning, and making decisions” (p. 50). Thus, the use of COBS has the potential to add multidimensionality to consciousness and should be a consideration in the educator/mentor’s instructional design.

Learning through Articulation

Oral storytelling is inherent to every culture. According to Cozolino (2013), “storytelling has a deep evolutionary history that has been woven into the fabric of our brains, minds, and relationships” and stories function to create social unity, regulate emotions, and aid memory (p.187). Stories also shape self-identity and serve as a way of organizing views, both positive and negative, about ourselves. Positive self-narratives, Fonagy and colleagues (1991) argue, assist in “emotional security and minimize the need for elaborate psychological defenses (as cited in Cozolino, 2013, p 188) while negative self-narratives, Cozolino (2013) argues “perpetuate pessimism, low self-esteem, and decrease exploration and learning” (p. 188). Since many adult learners do not possess confidence, personal narratives may be a way to re-examine and

challenge those beliefs. Students who receive instruction on writing personal narratives and tools for self-reflection can gain measures of objectivity necessary to question and reconstruct self-identity.

Additionally, stories, according to neuroscientists Oatley (1992) and Rossi (1993), serve to enhance neural network integration (as cited in Cozolino, 2013, p. 190). Common elements to good stories include time and emotions, regulated respectively by the left and the right hemispheres. In telling a meaningful story, the executive functions coordinate both hemispheres effectively by using the linguistic and temporal functions of the left with the emotional, sensorimotor, and visual information from the right, write Cozolino and Sprokay (2006, p. 15). Furthermore, Cozolino (2002) asserts that narrative writing also integrates subcortical and cortical regions in the brain (as cited in Taylor, 2006, p. 75). Several such practices that Taylor (2006) calls "learning through articulation" will be touched upon along with changes they foster in the brain (p. 75).

Journals

A subcategory of narrative writing, journaling is a way, according to Phyllis Walden (1995) for adult learners to "develop as knowers…[who understand] that knowledge is constructed by the self and others and that truth is contextual (as cited in Taylor, 2006, p. 76). Many of the techniques she uses are aimed at helping students to find their voice and consider their lives in the present, their past experiences, and to construct their futures (as cited in Taylor, 2006, p. 76). These techniques include "freewriting, list making, Progroff's steppingstones exercise[18], and

[18] Dr. Ira Progroff, a Swiss philosopher who studied with Jung, developed the Intensive Journal method. In this method, individuals write and examine 10 to 12 significant life periods that have brought them to this present stage. By identifying these periods as stages or processes that lead to another, life can be viewed as a dynamic process (Wright, n.d.).

one-minute exploration" (Taylor, 2006, p. 76). The practice of these techniques allows students to see themselves as sources of knowing and, in essence, the authorities of their own lives. Additionally, learning viewed across a spectrum of time affords the hindsight provided by time and by reflection, to observe how knowledge and truth are accrued contextually.

Autobiography

Autobiographies differ from journals in the exclusive focus on the past. In describing the connection between neuroscience and psychotherapy, Cozolino (2002) posits that autobiographical memory is powerful enough to regulate emotions as well as maintain the body's future homeostasis; he believes that adults who access these memories will be better able to integrate neural networks and to reorganize their brains (as cited in Taylor, p. 76).

By investing in autobiographical narratives, students can gain greater awareness and cognitive complexity. Neuroscientist Joseph LeDoux (2002) asserts that self-narratives are informed and sustained through explicit and implicit memory; while explicit or conscious memories shape identity, those that are buried and implicit also unconsciously permeate it (as cited in Taylor, 2006, p. 76). Taylor (2006) writes that the work of making hidden memories explicit serves the individual in becoming, and to "develop more flexible, inclusive ways of knowing" (p. 76). One example is the use of Prior Learning Assessments (PLA) (Taylor, 2006, p. 77). PLAs are a specific type of autobiographical writing submitted as part of a petition for transcript credit in lieu of a traditional class[19]. Having observed an informal interview between high school diploma candidates and an adult ed director discussing the PLA, I witnessed the immediacy of students' acknowledgements of learnings from specific life experiences such as

[19] Students who did not formally complete high school may obtain high school credits via PLAs that outline experiential learning.

employment and parenting; initially tentative students are surprised and uplifted to hear that their life experiences constitute learning and, feeling validated, they gain confidence on their journey toward a diploma. A study by Lamoreaux (2005) which analyzed learning outcomes of students who participated in the PLA process found substantial gains, among them the "affirmation of learning from experience, consciousness of the role of tacit learning, greater capacity for taking multiple perspectives" including an "awareness of consciously creating, modifying, and 'owning' their own perspectives" (as cited in Taylor, 2006, p. 77). Lamoreaux (2005) noticed a progression in these students as a result of the PLA process. Using cartography as the basis of analogy, she likened it to students mapping or locating their learning initially to then seeing the myriad possibilities in how a map could be created depending upon the mapmaker's perspectives and then to finally arrive at viewing their own potential as mapmakers (as cited in Taylor, p. 77). This signals a shift in identity and of cognitive complexity that is wholly transformative. As Cozolino (2013) writes, "Learning that we are more than other people's expectations and the voices that haunt us can provide hope and serve as a way to change our lives" (p. 196).

The writing that students produce as a result of these reflective writing practices can then become the source of greater discussion between the educator/mentor and the student. The educator/mentor can facilitate the process of delving more deeply in the text through clarifying questions that inquire about the underlying assumptions and implicit beliefs which can start another cycle of reflection for the student. In this way, the student's self-narrative can be revised and transformed to reflect their expanded awareness and cognition. Guided to discover their voices, students can also feel seen and heard, often in stark contrast to the invisibility felt by many students with low literacy and language skills.

Conclusion

"I want to learn to right my story of life I want to learn what other people now I want to be able to help my kids with there home work read them a book be able to go to college one day," [sic] Literacy Volunteers of Bangor. (2019, March). *Basic literacy student application.* Unpublished document.

Current trends support the continued need for support of nontraditional adult learners across the spectrum of learning and retention. Length of formal education corresponds globally with higher rates of literacy as shown in figure 4.

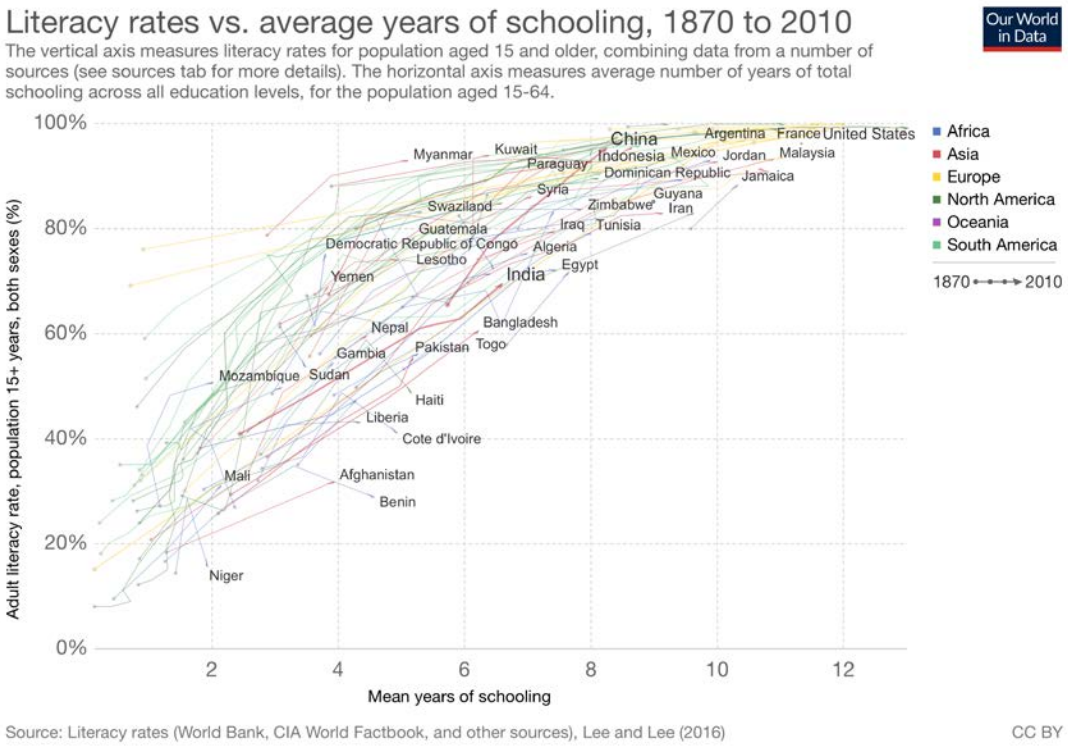


Figure 4. Literacy rates vs. average years of schooling, 1870-2010. Adapted from *Our World in Data* by M. Roser & E. Ortiz-Ospina, 2013, Retrieved from https://ourworldindata.org/literacy. Copyright 2018 by World in Data. Reprinted with permission.

In turn, higher levels of literacy correlate with increased job earnings and greater social mobility. However according to the NCES, dropout rates in the United States have increased from 3.8 percent to 4.8 percent in the ten year period from 2006 to 2016 ("Trends in High School Dropout and Completion Rates"); this accounts for approximately 234,000 students of the 11.2 million total students enrolled in high school in 2016 (NCES, "Trends in High School"). Additionally, NCES statistics on 2016 dropout rates[20] show that it is students from the lowest family income brackets, who are most susceptible to dropping out, comprise almost 65% of total dropout rates as shown in figure 5 ("Trends in High School").

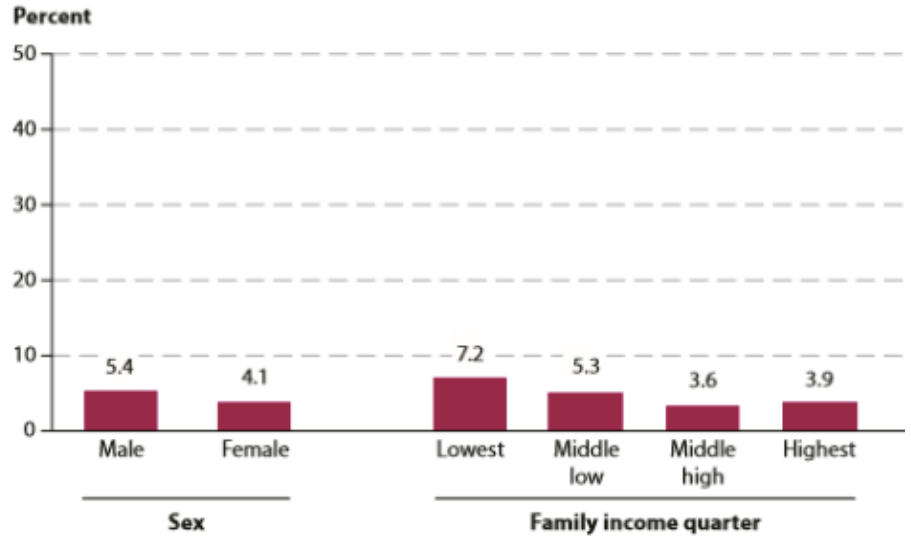


Figure 5. Percentage of grade 10–12 dropouts among persons 15 through 24 years old (event dropout rate), by selected characteristics: October 2016. Adapted from *National Center for Educational Statistics*, 2016. Retrieved from https://nces.ed.gov/programs/dropout/ind_01.asp. Copyright 2016 by U.S. Department of Education. Reprinted with permission.

[20] This is defined by the National Center for Education Statistics (NCES) (2016) as the percentage of individuals, ages 15-24 who were in grades 10 through 12, but left without earning a diploma or high school equivalency such as the GED or HiSET exam in Maine ("Trends in High School Dropout and Completion Rates").

Immigrant and refugee populations in the United States will continue to need services that increase language proficiency. While the Migration Policy Institute (MPI) (n.d.) reports a declining refugee acceptance ceiling ("U.S. Annual Resettlement Ceilings and Numbers of Refugees Admitted, 1980-Present"), trends in legal immigration show a historical pattern of growth. Compared with 20 million immigrants comprising 8% of the U.S. population in 1990, MPI (n.d.) cites that 44.5 million immigrants comprised nearly 14% of the population in 2017 ("U.S. Immigrant Population"). Of that immigrant population, MPI (2017) reports that the majority fall within the economically active 20-54 age bracket ("Age-Sex Pyramids of U.S. Immigrant"). Furthermore, in a report published by the Department of Homeland Security (DHS) Office of Immigration Statistics (2018) culled from Census reports, the estimated number of unauthorized immigrants rose from 11.6 million in 2010 to 20 million in 2015 (p. 2).

Additionally, attention to educational practices targeted at adult learners has implications to improve retention and graduation rates among the high proportion of nontraditional students enrolled in higher education. According to the Center for Law and Social Policy (CLASP) (n.d.), nontraditional students comprise approximately 40% of undergraduate enrollment (as cited in Hittepole, p. 1). Furthermore, citing the National Center for Educational Statistics (NCES) (2018), Barrow-Smith of the Hechinger Report (2018), a nonprofit, independent news organization focused on inequality and innovation in education, writes that college enrollment of students aged 25-34 increased 35% between 2001-2015 with an 11% increase projected from 2015-2026. The agenda of higher educational institutions is increasingly on addressing ways of recruiting, supporting, and increasing retention rates among nontraditional adult learners.

Many of the basic literacy and ESL students seeking out adult ed programs are often at a crossroads, which educator Mezirow termed a "disorienting dilemma," which serves as a catalyst

for change such as the loss of employment, pursuit of better employment opportunities, incarceration, or the desire for greater independence and autonomy in their lives. Adult education and community education centers provide a second, third, and countless opportunities to catch many of these students with few support systems and who face substantial barriers to learning due to negative prior experiences of learning, culture shock and potential trauma for immigrants and refugees, as well as learning disabilities and other stresses posed by lower socioeconomic factors. Knowledge of neuroscience can provide educators/mentors with additional insights about how to best serve the needs of these adult learners to create optimal conditions of learning. In fact, neuroscience provides good news for the adult learner: the brain does not stop developing in early adulthood. Rather, neurons in our brain are continually developing connections and pruning themselves so that the electrical signals between them become stronger and faster. Through arborization our brains are continually refining our neural networks based upon the skills that we most use (Cozolino, 2013, p. 28). This process of pruning is influenced by our relationships and by our experiences and confirms that learning is indeed a lifelong process. Emotions are also instrumental as chemical neurotransmitters such as adrenaline can imprint learning more vividly within the learner's memory.

This has considerable implications for the education of adult learners and points to the critical role of the relationship between the educator/mentor and the adult learner. Reducing stress to moderate levels of attention allows students to place their focus away from immediate survival toward learning. The sensitive educator/mentor who fosters both encouragement of the students' abilities as well as pose challenges serves the neural networks of the learner's brain. It has been suggested that the kind of safe spaces that educators/mentors provides is not dissimilar from those created in therapeutic practices as both aspire to "draw out" the 'student' toward

greater understanding and learning. Furthermore, mirror neurons in the student also respond to the presence of the attuned educator/mentor and can embody the confidence and potential reflected in their eyes. Burke's identification model provides an additional framework to nurture this type of trusting relationship in which both perceive that they share many similarities and are differentiated by experience and opportunities.

Unlike children, adult learners have accumulated considerable experiences and associations which serve as the foundation for learning. Environmental stimuli trigger change-of-body-states (COBS) which imprint within the brain with subsequent related experiences adding another dimension of association. Experience and consciousness are thus fundamental to learning. The educator/mentor can thus help with the building of neural pathways by using interviews, discussions, short essays, to (1) understand the consciousness that students possess regarding feelings, biases, knowledge, or misconceptions. This information can help the educator/mentor to assist the learner by untangling misconceptions, designing affect-appropriate lessons, or integrating COBS into a cohesive narrative. In the next step (2), the educator/mentor stretches the learner's consciousness by providing new concepts and fleshing them out with "life," "linking this new information to learners' COBS-based consciousness, perhaps by helping them reflect on their prior experiences" (Sheckly & Bell, 2006, p. 48). Thus, students can create meaningful associations to bring life and meaning to new concepts (Sheckly & Bell, 2006, p. 48). The final stage (3) involves enriching consciousness and proposes that educators/mentors optimize opportunities that will trigger COBS episodes by designing provocative and stimulating lessons and activities that will be both stimulating and relevant to their students' lives (Sheckly & Bell, 2006, pp. 49-50).

Finally, “learning through articulation” is proposed as an approach that utilizes the evolutionary role of storytelling as a means of passing down knowledge orally and which involves brain integration to enact. Reflective writing practices allow students to produce a self-narrative which can be examined and challenged, which is critical for adult education students, many of whom carry negative self-narratives of themselves as learners. Research has shown that such critical studies into assumptions and beliefs have the power to transform students’ awareness and cognition. As a result, students can see themselves as constructors of knowledge and that knowledge is contextual. This expansion and revision of self-understanding is transformative for personal identity, agency, and resilience; it also assists students to find their voices to be heard and engage in greater spheres of their lives.

Educators/mentors are critical for transformative adult education. Cozolino and Sprokay (2006) assert that “Teacher/mentors who inspire adults to learn may unconsciously embody the neuroscience of education. Their wisdom, enthusiasm, and effectiveness are due in part to an innate grasp of what it takes to support brain development in adults. In any case, understanding the brain’s processes enhances what they may intuitively know already” (pp. 17-18). Insights and observations from neuroscience can support the experience-rich adult learners of adult education programs.

Adult education programs in Maine and in the United States need continued and increased funding to accomplish their mission of serving underserved populations. The successful outcomes of measurable skills gain and transformative growth correlates positively with increased earnings and greater social mobility as well as with greater engagement within families, communities, politically, and nationally. Literacy and educational attainment also correlate highly with recidivism rates according to the Prison Studies Project (n.d); they

additionally cite The American Correctional Association's report that in Indiana the recidivism rate for GED completers is 20 percent lower than the general prison population's rate. While Maine does not currently have an automated system for tracking recidivism rates in the county and local jails, the Maine Narrative Report for AEFLA (July 1, 2016-June 30, 2017) tracked AEFLA funded educational programs in the state's correctional system prisons and found that "The unduplicated count for those receiving adult literacy and secondary completion services was 498. The number of those released was 234. Of that number, only 10 returned" (p. 11). Additionally, more than half of the inmates that I have worked with have been parents, and increased parental education also correlates strongly with increased family literacy and with renewed hope within families. As the Prison Studies Project (n.d.) reports, "When children are inspired by their parents to take education more seriously, they too begin to see viable alternatives to dropping out of school and entering a life of crime, thus breaking a harrowing cycle of intergenerational incarceration." While more tracking data is needed to confirm the effects of educational programs in the jails, these reduced recidivism state prison rates warrant further investigation to increase allocation of funds towards educational programs that support rehabilitation over incarceration.

References

Adult workers with low measured skills. (2016). *U.S. Department of Education Office of Career, Technical and Adult Education.* Retrieved from https://www2.ed.gov/about/offices/list/ovae/pi/AdultEd/factsh/adultworkerslowmeasuredskills.pdf

Ahlsen, E. (2011). Neurolinguistics. In S. Simpson (Ed.), *The Routledge Handbook of Applied Linguistics* (pp. 460-471). London, England: Taylor & Francis Group.

Bailey, F. & Pransky, K. (2014). *Memory at work in the classroom: Strategies to help underachieving students.* Alexandria, VA: ASCD.

Beegle, D. (2007). *See poverty…be the difference!* Tigard, OR: Communication Across Barriers, Inc.

Caine, G. & Caine, R.N. (2006). Meaningful learning and the executive functions of the brain. In S. Johnson & K. Taylor (Eds.), *The Neuroscience of Adult Learning* (Number 110, pp. 53-62). San Francisco: CA: Jossey-Bass.

Coley, R.J. (2008, Winter). Adult education in America. *ETS Policy Notes.* Retrieved from https://www.ets.org/Media/Research/pdf/PICPN161.pdf

Cozolino, L. & Sprokay, S. (2006). Neuroscience and adult learning. In S. Johnson & K. Taylor Eds.), *The Neuroscience of Adult Learning* (Number 110, pp. 11-20). San Francisco, CA: Jossey-Bass.

Cozolino, L. (2013). *The social neuroscience of education.* New York, NY: W.W. Norton & Company.

DHS Office of Immigration Statistics. (December 2018). *Population estimates illegal alien population residing in the United States: January 2015.* Retrieved from https://www.dhs.gov/sites/default/files/publications/18_1214_PLCY_pops-est-report.pdf

Doidge, N. (2007). *The brain that changes itself.* New York, NY: Penguin Group.

Perry, B.D. (2006). In S. Johnson & K. Taylor (Eds.), *The Neuroscience of Adult Learning* (Number 110, pp. 21-28). San Francisco: CA: Jossey-Bass.

Harrison, J. (2018, December 12). Penobscot County wants a new jail for 300 inmates. Price tag? $65 million or more. *Bangor Daily News.* Retrieved from https://bangordailynews.com/ 2018/12/12/news/bangor/penobscot-county-wants-a-new-jail-for-300-inmates-price-tag-65-million-or-more/

Hittepole, C. (n.d.). *Nontraditional students: Supporting changing student populations.*

Immordino-Yang, M.H. & Damasio, A. (2007). We feel, therefore we learn: The relevance of affective and social neuroscience to education, *Mind, Brain, and Education 1* (1), 3-10.

Izard, E. (2016). *Teaching children from poverty and trauma.* Washington, D.C.: National Educational Association.

Johnson, S. (2006). The neuroscience of mentor-learner relationship. In S. Johnson & K. Taylor (Eds.), *The Neuroscience of Adult Learning* (Number 110, pp. 63-70). San Francisco: CA: Jossey-Bass.

Kaestle, C.F., Campbell, A., Finn, J.D., Johnson, S.T., & Mikulecky, L.J. (2001). Adult literacy and education in America: Four studies based on the national adult literacy survey. Washington, D.C.: U.S. Department of Education. Retrieved from https://files.eric.ed.gov/fulltext/ED461718.pdf

Keenan, Cheryl. (2018). *Estimated adult education state award amounts for fiscal year (FY) 2018.* Washington, D.C.: U.S. Department of Education. Retrieved from https:// www2.ed.gov/about/offices/list/ovae/pi/AdultEd/2018-allocation-memo.pdf

Local adult education programs. (n.d.). *Maine Adult Education Association.* Retrieved from https://association.maineadulted.org

Maine narrative report (2016-17). (2016). *Office of Career, Technical, and Adult Education.* Retrieved from https://wdcrobcolp01.ed.gov/CFAPPS/OVAE/NRS/documents/index.cfm?s=&ss=ME&sy=2016&dt=1

McLeod, S. (2018). Maslow's hierarchy of needs. *Simply Psychology.* Retrieved from https:// www.simplypsychology.org/maslow.html

Migration Policy Institute. (n.d.). Age-sex pyramids immigrant and native-born population, 1970-present. Retrieved from https://www.migrationpolicy.org/programs/data-hub/charts/age-sex-pyramids-immigrant-and-native-born-population-over-time

Migration Policy Institute. (n.d.). U.S. annual refugee resettlement ceilings and number of refugees admitted, 1980 to present. Retrieved from https://www.migrationpolicy.org/programs/data-hub/charts/us-annual-refugee-resettlement-ceilings-and-number-refugees-admitted-united

Migration Policy Institute. (n.d.). U.S. immigrant population and share over time, 1850-present. (n.d.). Retrieved from https://www.migrationpolicy.org/programs/data-hub/charts/immigrant-population-over-time?

Nontraditional undergraduates / Definitions and data. (n.d.). *National Center for Educational Statistics.* Retrieved from https://nces.ed.gov/pubs/web/97578e.asp

Nontraditional student populations. (n.d.). *Association for Orientation, Transition, and Retention in Higher Education (NODA).* Retrieved from https://www.nodaweb.org/page/network_non_trad

Novak, J.D. & Canas, A.J. (2008). The Theory Underlying Concept Maps and How to Construct and Use Them. *Cmap.* Retrieved from https://cmap.ihmc.us/docs/theory-of-concept-maps

Organization for Economic Cooperation and Development. (2005). Thematic review on adult learning: United States country note. Retrieved from https://www.oecd.org/unitedstates/35406014.pdf

Pelletier. S.G. (2010). Success for adult students. *Public Purpose.* Retrieved from https://www.aascu.org/uploadedFiles/AASCU/Content/Root/MediaAndPublications/PublicPurposeMagazines/Issue/10fall_adultstudents.pdf

Prison Studies Project. (n.d.). Why prison education? Retrieved from http://prisonstudiesproject.org/why-prison-education-programs/

Proliteracy. (n.d.). U.S. adult literacy facts. [Flyer]. Retrieved from https://proliteracy.org/Portals/0/pdf/PL_AdultLitFacts_US_flyer.pdf?ver=2016-05-06-145137-067

Rizzolatti, G. & Craighero, L. (2004). The Mirror-neuron system. *Annual Review of Neuroscience, 27,* 179-192. doi:10.1146/annurev.neuro.27.070203.144230

Roser, M. & Ortiz-Ospina, E. (2018, September 20). Literacy. *Our World in Data.* Retrieved from https://ourworldindata.org/literacy

Ross, C.A. (2006). Brain self-repair in psychotherapy: Implications for education. In S. Johnson & K. Taylor (Eds.), *The Neuroscience of Adult Learning* (Number 110, pp. 29-34). San Francisco: CA: Jossey-Bass.

Schierloh, J.M. (n.d.). Adult Literacy in America: A First Look at the Results of the National Adult Literacy Survey. *Ohio Literacy Resource Center*. Retrieved from http://literacy.kent.edu/Oasis/Pubs/nalsrev.htm

Scheckley, B.G. & Bell, S. (2006). In S. Johnson & K. Taylor (Eds.), *The Neuroscience of Adult Learning* (Number 110, pp. 43-52). San Francisco: CA: Jossey-Bass.

Siegel, D.J. (2011). *The Whole Brain Child.* New York, NY: Random House, Inc.

Smith-Barrow, D. (2018, August 24). Is college enrollment among older adults increasing? Depends who you ask. *Hechinger Report.* Retrieved from https://hechingerreport.org/is-college-enrollment-among-older-adults-increasing-depends-who-you-ask/

Taylor, K. (2006, Summer). Brain function and adult learning: Implications for practice. In S. Johnson & K. Taylor (Eds.), *The Neuroscience of Adult Learning* (Number 110, pp. 71-85). San Francisco: CA: Jossey-Bass.

Trends in high school dropout and completion rates in the United States. (n.d.). *National Center for Educational Statistics.* Retrieved from https://nces.ed.gov/programs/dropout/ind_01.asp

Understanding the parts of the brain (2015). Retrieved from https://k12.thoughtfullearning.com/minilesson/understanding-parts-brain

When the brain's wiring breaks (2017, September 5). Retrieved from https://healthtalk.unchealthcare.org/when-the-brains-wiring-breaks/

Whitman, G., & Kelleher, I. (2016). *Neuroteach.* Lanham, MD: Rowman & Littlefield.

Wolfe, P. (2006). The role of meaning and emotion in learning. In S. Johnson & K. Taylor (Eds.), *The Neuroscience of Adult Learning* (Number 110, pp. 35-42). San Francisco: CA: Jossey-Bass.

World Education, United States. (2019). *Adult ed facts.* Retrieved from https://www.worlded.org/WEIInternet/us/adult-ed-facts.cfm

Wright, R. (n.d.). “An introduction to Ira Progroff’s Intensive Journal method.” *University of Arizona.* Retrieved from http://www.u.arizona.edu/~wrightr/Progoff.htm

Zull, J.E. (2006). Key aspects of how the brain learns. In S. Johnson & K. Taylor (Eds.), *The Neuroscience of Adult Learning* (Number 110, pp. 3-10). San Francisco: CA: Jossey-Bass.