A possible relationship among emotional intelligence, STEM, and algebraic scores in prison

Abstract

This paper describes a unique partnership between STEM topics and emotional intelligence in an integrated course with the objective of raising algebra scores of 16 incarcerated students. Two separate national movements are being addressed here: the need to reduce recidivism rates in our prison systems, and the need to increase applications of STEM curricula in our educational systems. This paper suggests a relationship between these two needs when the STEM topics are taught through a lens of psychological inspiration. This partnership resulted in 100% of the students becoming ready for college level mathematics, a newly written STEM curriculum, and a newly written course for education behind bars. The STEM curriculum resulted in a number of educational tools, including a formalized approach to mathematical dimensional analysis as a tool for math remediation and review, a series of highlights of recent advances in STEM-related fields, and a unique set of scientific reasons that inspire someone to get his or her life back on track.

Keywords

STEM; science; technology; engineering; mathematics; emotional intelligence; algebra; holistic; right-brain; left-brain

Introduction

In a NY Times editorial on Feb. 14, 2014, newly elected Gov. Cuomo was applauded for boldly attacking the problem of recidivism rates in our prisons by providing education behind bars in 10 New York prisons (New York Times Editorial Board, 2014). The editorial cites the Vera Institute for Justice's *Pathways from Prison to Postsecondary Education Project*, a five-year project to educate incarcerated individuals at prisons in New Jersey, Michigan, and North Carolina. The Vera Pathways program is funded primarily by the philanthropies: the Ford Foundation, the Sunshine Lady Foundation, the Open Society Foundations, the W.K. Kellogg Foundation, and the Bill & Melinda Gates Foundation. The three states (MI, NJ, and NC) have been selected to sponsor the five-year pilot in the hopes that all states will eventually provide increased education for incarcerated individuals. This is a movement that is part of a national shift from punitive to rehabilitative treatment of incarcerated individuals in the U.S., which follows the opposite, former attempts to improve society at large by increasing arrests on a national scale. The reason for the shift is that two things have gone wrong in in the past two decades. We are spending more on incarceration than we are saving from attempted reduction in crimes, and many families are being broken by imprisonment because nearly 40% of the offenders return to prison instead being rehabilitated by the

prison experience. One reason the NY Times editorial gives for this shift toward rehabilitation through education, at least in the state of NY, is that it will save taxpayers in the short run. "Mr. Cuomo was quick to point out that the cost — $5,000 per inmate per year — is a fraction of the $60,000 New York spends annually to house a prisoner" (New York Times Editorial Board, 2014). Even more important is the 30 years of studies that show the reduced risk of going back to prison within three years of release where educational programs are used in prison (Davis, 2013).

This paper describes my experience as one of the first Vera Pathways instructors for North Carolina. One of the purposes of this paper is to suggest one concrete, specific way a relationship between the areas in teaching where emotional intelligence is developed (Delpit, 2006; Delpit & Dowdy, 2002; Goleman & Boutsikaris, 2006; Goleman & Senge, 2007; Goleman & Whitener, 2005; Kozol, 1992, 1996, 2005; Ladson-Billings, 2009; Palmer, 1993, 1998, 2004; Palmer, Zajonc, & Scribner, 2010; Senge, 2000, 2008) and *hard* subjects like math and science are traditionally taught. There is an historical tradition of such relationships (Arnheim, 1986a, 1986b; Bruner, 1960, 1983, 1986, 2004; DeBoer, 1991; Dewey, 1910, 1916/2005; Kuhn, 2004; Nisbett, 2003) that predate the current STEM movement that needs to be brought forward and applied to the formation of STEM curricula. The possible offering this paper might spark is the unique blending of a series of STEM (Science, Technology, Engineering, and Mathematics) topics with typical life skills or emotional intelligence topics in an integrated way.

When the blending of Life Skills and STEM occurred in the Vera Pathways pilot, the results in the basic mathematics course were for all 16 students to achieve a level of college eligibility. In September, only 54% of them tested at a college-eligible level. By mid-November, two thirds of the way through the semester, we had a 46% increase to 100% eligibility. The test had to be redone at a higher level because so many of the students tested out of range, making it impossible to measure growth from November to the end of the course. The re-test was at a level of high school into college level mathematics; it was the highest level used for eligibility. Since the class was more prepared for higher mathematics, even more students scored out of range on this test. One can conjecture at this point that our success was achieved in part by blending STEM topics with the Life Skills course. Current scientific, technological and real world engineering breakthroughs were used to reinforce the Life Skills needed to believe in oneself. Who would think that there is a way of teaching how to get your life emotionally back on course through the use of

STEM?

Course Descriptions

The first semester at the correctional facility ran from mid-September to mid-December in 2013. Time was divided somewhat proportionally among four courses: Life Skills, Mathematics, Reading, and English. These courses were split between two different instructors. Classes were held from 8:30 to 2:30 for five days a week. Life Skills and Mathematics were taught by the first instructor (the author) on Monday through Wednesday. Reading and English were taught by the second instructor on Thursday and Friday. Originally, the Life Skills course was intended to be taught exclusively from the textbook, *On Course* (Downing, 2011), an excellent text that is slated at helping college freshmen make the transition to living on their own and taking college courses. This paper describes how I changed the Life Skills course by integrating a STEM curriculum directly within the personal, psychological lessons on emotional intelligence. Life Skills used approximately half of each day, three days a week. The overall purpose of this first semester was to bring as many students as possible up to a level where they were eligible to take college courses, and to re-orient them for life in college. The reason this paper is being presented is that it is possible that the blending of carefully chosen STEM topics that developed confidence with topics that directly articulate Life Skills not only enhanced the way the students accepted the Life Skills, but also opened them to learning mathematics (especially algebra). The dramatic 46% increase to where 100% of the students became college-eligible in mathematics may be related to the way the students gained belief in their emotional intelligence through the STEM / Life Skills course. Perhaps it is a topic for discussion in another journal whether the shift for an incarcerated individual's life skills is far more important than a few math scores; but it is a significant call for further research if indeed there may be a relationship between the three unlikely partners of Life Skills, STEM, and algebra.

The re-orientation of an incarcerated individual in order to get his or her life back on course was not just a preparation for the transition from sitting in prison to sitting in school. Heart felt discussions took place over situations that might come up in a job or with personal relationships. This course had to be the vehicle for the transitions back to real life - only this time, as the students reentered society, two things would be very different. On the one hand they would be treated as formerly incarcerated individuals; and this would mean many hurdles to overcome. And on the other hand, they would try to be new versions of

themselves, not the ones who got in trouble in the first place. The Life Skills course had to use material that would be practical for real life situations and also foster a confidence to face a new set of large challenges. So, an important question that might be asked at this point is, "How do STEM topics facilitate these needs?

Blending STEM with Life Skills

Since this was the pilot implementation of Vera Pathways, the only planning we had time for was some light discussion of curriculum, textbooks, and class procedure. The Life Skills textbook, *On Course* (Downing, 2011), ran a recurring theme of believing in yourself and shaping your life by the expectations you have. The students saw this theme as relevant, though the life situation references in the text were more suited for high school students entering college than they were suited for adults. A text for incarcerated individuals would add discussion of the fact that one's life has definitely gotten off course and there is a dire need to get *back* on course. Therefore, rather than stay within the confines of the textbook, I requested to integrate STEM topics into the course. I did this because I come from a STEM background since 2002 where I had been teaching alternative high school students who also wanted to get back on course. My teaching constantly used STEM content to blend hard science and practical engineering realities as bridges to discussing personal introspection and counseling.

There were various criteria for choosing STEM topics that could serve the dual role of making my students ready for the current job market while redeeming their self respect and emotional belief in self. These topics needed to bring the students up to date with the latest research and practices in technology and engineering that are derived from the current work in science and mathematics. They also needed to be current in the theoretical thinking of science. In addition, they needed to be uplifting in a deep way; in other words, they needed to foster one's belief in personal success in our world. One may ask, what do STEM topics have to do with human views of respect for oneself? Many times our current educational system exhorts positive thinking and hopeful attitudes ostensibly, while it teaches outdated scientific theories that imply more oppressive postures such as the human as a victim of heredity (B. H. Lipton, 2005, 2006; B. H. Lipton, Bhaerman, S., 2009), environment (Senge, 2008), and tradition-based trends (Kuhn, 2004). The goal of the integration of STEM and life skills topics was to align the teaching of the emotional intelligence of the incarcerated students so that each lesson simultaneously taught hard facts, while reinforcing confidence. Pause for a moment to consider this audience. These students have gained a heightened

sensitivity to subterfuge due to the realities of incarceration and they therefore needed an alignment and agreement of the highest intellectual level among the lessons taught in science, technology, engineering, mathematics, and life skills. The STEM areas of society are supposedly among the most objective of our human studies, so this was no place to introduce negative or subtly implied defeatism such as in outdated brain theory that does not embrace neuroplasticity (Bruner, 1986; Burke, 2009; Donaldson, 1989; Gardner, 1993, 2008; Palmer, 1993; Papert, 1980; Pink, 2006) or outmoded thinking on some of the unnecessary limitations of the biology of the body or the terrain (B. H. Lipton, 2005, 2006; B. H. Lipton, Bhaerman, S., 2009; Quinn, 1992; Senge, 2000, 2008; Talbott, 1995, 2007). Instead, the blending of topics was an act of letting the incarcerated students feel that someone 'had their backs'. It was an assurance that the world they were going back into could be a place of success and acceptance, despite clear and present danger. While they might have trouble getting hired and be looked down upon by many, this course was a safe space that would arm them with an inner strength, backed by STEM realities to get a job and forge personal relationships afresh.

Curriculum

The topics in the STEM / Life Skills portion of the course were as follows.

1. Getting Back Up Is What We Do Best
2. Letting Go of the Old
3. Leaving Former Scripts Behind
4. You Are Not a Victim of Your Genes
5. Meditation
6. Resilience in Returning to Yourself
7. Reaching Out in Prayer
8. Turning

Rather than break up science, technology, engineering, and mathematics offerings into artificially forced segments on a per topic basis, a more organic, natural approach was used. For instance, computer simulations, internet videos, and other technological tools sometimes aided the subject matter, and other times, the technological skills in using them were in fact the point of the matter. As for mathematics, rather than force a mathematical exercise into each topic, a novel approach was used where I taught a type of *dimensional analysis*. At the beginning of the course, I introduced a simple way to perform routine calculations using dimensional analysis, then referenced this method through various STEM topics. To understand the course as a whole, there will first be a description of this mathematical approach to dimensional analysis.

Dimensional Analysis - an underpinning to the whole course

I told the students, "You have been doing dimensional analysis all of your life." Dimensional analysis is an ingenious method for algebraically determining the dimensions of quantities to find relationships between those quantities, without having to solve the problem completely. For an even better benefit, a STEM student could perform a dimensional analysis problem and also choose to solve all numerical calculations. This can result in an exercise in ordered thinking, algebra, arithmetic, and familiarity with quantities from scientific, technological, or engineering fields. This is a powerful technique for integrating skills that are often taught separately. There are many forms of dimensional analysis and it is defined a variety of ways in engineering and science textbooks. To understand the way this paper is referring to dimensional analysis, let us consider a few examples as shown in Figure 1.

Examples of one type of Dimensional Analysis

1. Say you needed to determine how many *seconds* are in a *day*. The dimensions to analyze must start from a *day* and end in *seconds*. One way to solve this would be to break up the dimension *day* into 24 *hours*, then break up an *hour* into 60 *minutes*, and finally break up a *minute* into 60 *seconds*. Therefore you would multiply 24 x 60 x 60. Each time you broke up a dimension, you were using conversions. There are 24 *hours / day* x 60 *minutes / hour* x 60 *seconds / minute*. If you set this equation up as fractions, and treat each dimension as an algebraic variable, you can see that the dimensions *hours* and *seconds* cancel, leaving the dimensions *seconds / day*.

$$\frac{60\ \text{SEC}}{1\ \text{MIN}} \times \frac{60\ \text{MIN}}{1\ \text{HOUR}} \times \frac{24\ \text{HOURS}}{1\ \text{DAY}} = \frac{86{,}400\ \text{SEC}}{1\ \text{DAY}}$$

2. When shopping for the ingredients for cookies, what if the recipe calls for a pint of milk for a batch and you are going to make four batches. You do not want to buy four pints, because you can save money at the supermarket by buying the largest container possible. You therefore convert each two pints to a quart, then convert the two quarts you will need to a half gallon.

$$\frac{2\ \text{PINTS}}{1\ \text{QT}} \times \frac{2\ \text{QTS}}{1\ \text{HALF GAL}} = \frac{4\ \text{PINTS}}{1\ \text{HALF GAL}}$$

3. What if a part for your car is advertised as 12.7 centimeters, but you want to know how big it is in inches. You would multiply the size by 2.54 since there are 2.54 cm per inch.

$$\frac{1\ \text{INCH}}{2.54\ \text{CM}} \times \frac{12.7\ \text{CM}}{1\ \text{PART}} = \frac{5\ \text{INCHES}}{1\ \text{PART}}$$

Figure 1.

While the mathematics of dimensional analysis has roots in the study of physics, chemistry, and biology, it can be found in various forms throughout science, technology, and engineering. A chemical engineer in a pharmaceutical company uses stoichiometry (a form of dimensional analysis) to calculate the quantity of ingredients needed to produce a drug. Engineers design engines so that fuels mix in the proper ratios by analyzing the proportions of the dimensions needed. Doctors calculate the dose rates of drugs, especially when 2 or more drugs are being taken, with the help of dimensional analysis. Companies mining gold and rare metals use dimensional analysis to determine how much metal they can produce from a certain amount of ore. Every time you shop for food and convert four quarts of milk to one gallon or 8 ounces to half of a pound, though you may do this quickly in your mind, you are using dimensional analysis. In fact, any time a mixture of ingredients is used to create a product, some form of dimensional analysis is used to determine the proportion of ingredients. Examples are literally everywhere. The significance of having a dimensional analysis portion of this STEM course is that it reinforces basic mathematics and adapts to any science, technology, or engineering topic. If the course is covering cellular biology, dimensional analysis can be used to calculate relative proportions of cells that are in service to various functions of the body. If the discussion moves to physics, it can be used to find the number of seconds in a day or month or year.

Curriculum Topics

The course did not have a simplistic breakdown of Science, Technology, Engineering, and Mathematics topics. There was a natural integration. It should be noted that about four weeks into the three-month course, the students began growing rapidly in algebraic prowess. It seemed that these STEM topics were related to the students' algebraic ability in two ways. On the one hand, it seemed that the students who exhibited definite variations in intelligence than the strictly left-brain version that is so highly praised in schools in the U.S. today (Arnheim, 1986b; Bruner, 1960, 1986, 2004; Burton, 1999; DiSessa, 1982; E. v. Glasersfeld, 1995; Vygotsky, 1966/2002, 1979; Vygotsky & Cole, 1978; Wertsch, 1985) were rewarded for being taught with right-brain lessons that mixed human motives with scientific information. On the other hand, the topics were designed to be inspirational. Each topic was like an Aesop's Fable - there was a *moral to the story*. So, besides the practicality of introducing science, technology, engineering, and mathematics examples from real life, with real materials and job opportunities, these topics also sought to reinforce the

students' confidence and belief in self. Some specific examples follow.

Course Topics: Getting Back Up Is What We Do Best / Turning - *humankind: the only species that pushes boundaries to new frontiers*

An overview of the whole course was given in its first topic, "Getting Back Up Is What We Do Best". During this overview, themes that would emerge that were used throughout the course. Here is one example of an introductory theme from the world of biology. Consider the engineering feats of humankind by looking at the fact that our species is perhaps the best of all species at falling. Animals tend to have narrow specialties, but humans can engineer many technologies; we are broadly adept at many skills. The beaver makes a dam, horses can run fast and far, and bees create honeycombs. Add to these observations that most animals begin performing their specialties at an early age. Human beings by contrast, fumble around with their environment for a long period of time seemingly not able to specialize at all. They experiment with ways to perform engineering feats, scientific discoveries, technological breakthroughs, and mathematical theories; but in their experimentation, they fail and fall quite a bit before starting to succeed. In the long run however, humans learn to become the equivalent of a multitude of animals by trial and error by constantly making mistakes. Because we humans keep on going despite our setbacks, we not only become masters of all trades, we become good at getting back up after we fall. One might say that we are arguably the best species to deserve this ignominious distinction. And the portion of our species that leads all others in this trait of falling-and-getting-back-up are those who have made mistakes that are visible to society, our incarcerated population. Incarcerated individuals can be looked at two ways, depending on your point of view. They can be seen as examples of those who made mistakes and got caught and now must pay a consequence. Or, they can be seen as those who are demonstrating one of the most greatly prized traits of all species - the ability to fall and get back up. Both views are true, but according to the view you hold and repeatedly reinforce, your life can be experienced quite differently. Aristotle said, "Neither by nature, then, nor contrary to nature do excellences arise in us; rather we are adapted by nature to receive them, and are made perfect by habit" (Aristotle, 1984, pp. Nicomachean Ethics bk. 2, 1103a 1125). This is often quoted simply, "We are what we repeatedly do. Excellence, then, is not an act, but a habit." The trouble is, Aristotle does not say whether we should look at the excellent, repeated falls or the excellent, repeated comebacks. I guess that is up to us.

Course Topics: Letting Go of the Old / Resilience in Returning to Yourself

Several authors were introduced that served as a backdrop for the whole course. Discussions from the currently popular field of radical acceptance were used to treat the students' difficulties in letting go of old patterns of behavior. Figuring prominently in this field is the notion of loving whatever has happened, simply because it has happened and there is nothing to do but move on from there. Radical acceptance argues that by holding onto old problems one is simply letting a thought pattern or story rule one's life. Byron Katie describes this in her book, *Loving What Is* (2002). Katie has also given many live presentations where she helps individuals question the use of holding on to their stories. Many of these live presentations, notably one in prison, are available online. Comparisons were made between personal perceptions of chaotic situations where we feel everything coming apart and the Laws of Thermodynamics. When a human perceives the helplessness of a situation that is out of control, it is like the physical conditions of entropy - the concept from thermodynamics whereby all physical systems tend toward disorder. One ray of hope in either the personal or the physics case can come from the scientific fact that the only time entropy does not take place is if a conscious being creates order from chaos by building something up instead of watching it fall apart. Entropy cites that everywhere we measure in the universe, things are winding down, coming apart. But on the other hand, the collective consciousness of the human species is ever reaching a higher ordered state. By integrating these physics and emotional views, one can derive hope that one can always try to move up and out of a situation by asking for help. Perhaps entropy is indirectly teaching us that 'two heads are better than one.' The work of Dan Goleman is cited for his clear descriptions of ways for one person to help another let go of old behaviors and attitudes through the use of what he calls emotional intelligence and social intelligence (Goleman & Boutsikaris, 2006; Goleman & Senge, 2007; Goleman & Whitener, 2005). He cites current research on mirror neurons where studies of one person relating closely to another can cause physiological, autonomic responses as well as psychological responses to be mirrored in the two people. Martin Gardner (1993, 2008) plays into this portion of the course with his writing on multiple forms of intelligence.

These discussions may sound too intellectual for a course for incarcerated individuals who primarily want to reenter society, get a good job, and not go back to prison. But consider this. If you talk down to a person, she might see herself as the lowly person you see. I offer my students sophisticated

topics and they are consistently met with high levels of interest. Another reading that struck an important chord was from a book called, *Ishmael*, by Daniel Quinn (1992). Awarding this manuscript the distinction of winner of the Turner Tomorrow Fellowship Award in 1989, Ted Turner helped this unpublished work of fiction because he considered it the most creative and positive literary solution to global problems at the time. The award was worth $500,000, the largest single sum ever awarded to a single work of literature. When giving the award Turner said, "The great minds of today need to focus on the problems of global significance if humanity is to see new tomorrows". The story of Ishmael, an intelligent ape who could relate the animals' point of view to humans, was savored by the students as an inspiration and as a blueprint for change.

Course Topic: Leaving Former Scripts Behind - *the latest research on the amygdala and prolonged stress*

Current research in neuroplasticity is revealing that we adapt to situations much more fluidly than we thought before. By contrast however, studies of the activity in the amygdala where the individual is under prolonged stress show that a person can switch from smoothly adapting to a new situation to a classic *fight or flight* response (K. Bickart, Sauder, Kim, & Putnam, 2009). In normal English this means that incarcerated individuals - prime examples of people under prolonged stress - must consciously move out of stress as they reenter society or else their inner response to almost any changing conditions would be to be to fight that change or fly to some escape mechanism (Goleman & Senge, 2007). I used STEM topics here again to give 'teeth' to a recommendation of the emotionally / socially intelligent thing to do. In order for the students to practice conscious control of one's behavioral response to a situation, some engineering demonstrations that required a high level of observation without jumping to conclusions served quite well. One demonstration used a small glass beaker submerged in a large beaker of corn oil, making the small beaker almost invisible. I dropped marbles in the corn oil directly over the small beaker. The marbles piled up instead of all spreading out on the bottom of the large beaker, creating an enigmatic demonstration. Unless the students observed quite carefully, they only saw a yellow liquid in a large beaker and marbles that miraculously stayed together. If they jumped to conclusions as they made comments, I cautioned them to observe more before forming any analysis. On very close inspection, a few students started to see evidence of the small beaker. By then, it was appropriate to form the conclusion that the small beaker was

holding the marbles, because it was based on evidence that took patient observation. Other physical and chemical demonstrations were used to practice the act of suspending analysis and continuing objective observation. Although this training may sound simplistic or even unrelated, the point was well taken by the students. They learned that when a situation seems indeterminate, rather than jump, fight, or fly, it is probably best to calm down and continue to observe before making a hasty move.

Course Topic: You Are Not a Victim of Your Genes - *news from the front lines of genetic research*

A new field in microbiology called epigenetics, studies effects on cellular responses in the use of gene-based instruction sets. The old belief was that a cell is pretty much told what to do by its genes. And since genes are largely handed down from one generation to the next, that can mean to some people that your parents give you - through the gene chemistry of your body - a set of traits and tendencies that you are largely helpless to resist. Bruce Lipton has been doing research into this for the past decade (B. H. Lipton, 2005, 2006; B. H. Lipton, Bhaerman, S., 2009) and claims that the gene instructions are only a blueprint. He asserts that your consciousness can override those instructions by causing alternate copies of the DNA to be made. These copies can be made to vary from the genetic blueprint during the cellular reproductive cycle. The signals from the consciousness to the gene within the cell represent control coming from outside the gene, thus the term epigenetics. This means, according to Lipton, that human beings do not have to be like their parents. Lipton argues that we can change who and what we become. And the best part of his argument is that he believes that this is done through human intention and belief. Lipton emphasizes that electromagnetic (EM) fields that influence a cell to change can come from the brain and therefore change behavior. Lipton claims that the effect on RNA activity during cellular reproduction from EM fields is 98% effective as compared 2% effectiveness from chemical drugs. The idea that 'we are not victims of our genes' became a reference point for many discussions throughout the course, once the details of the cellular biology were understood. Even though Lipton's research is new, putting his studies before the students gave them encouragement to make changes in their behaviors and personality traits - changes that many of them formerly believed were simply not possible.

Course Topics: Meditation / Reaching Out in Prayer - *how Quantum Physics supports asking for help by connecting to others*

It is possible to take a tour of the history of electric inventions as they historically lead to

Einstein's relativity and the thinking that then lead to quantum physics. In so doing one traverses a myriad of current occupations in the technological and engineering fields. But, what does this have to do with meditation and prayer? Quite a bit, as it turns out. There are many jobs open to entrepreneurs working in the graphic arts. One can often find assignments as a freelance doing computer graphics, color printing, and illustration that can lead to more extensive retainer contracts. There are many jobs in computer-related fields and most jobs require some level of computer skills. Also, it helps to know how to navigate electronic screens of some devices, since so many others have similar user interfaces. But, oddly enough, if one traces the history of human prowess in abilities to handle electronic color reproductions for instance, one finds a paradox. While people have become infinitely more adept at using technology for printing photos and doing computer color graphics, we have lost a great deal of the human appreciation and perception of color itself. As Faraday invented some of the key electromagnetic inventions like the generator, motor, and transformer in the 1800s (Faraday, 1839/1965, 1860/2012), Goethe - known as arguably the greatest German poet - was conducting physics experiments in human perception of color (Goethe, 1840/1970). According to Goethe, the human species could differentiate, perceive, and psychologically be affected by color much more in ancient times. He asserts that our species has progressively lost touch with all of our sense perceptions over the years as we gave over our allegiance to machines. This loss, he claims, has cost humankind a commensurate detachment from our feelings and from each other. Therefore, he concludes that there is a relationship between practical success in working with people on your job and your ability to appreciate color. Although this point is quite subtle, if it is true, it has very strong implications for a formerly incarcerated individual who has reentered the working world. What to do? It's easy - practice quieting the modern mind that is dependent on machines, technology, and information - and get back to seeing what is in front of you. In a word, be present. The perception of color, by implications from Goethe's argument is the perfect barometer of how present one is to the person or job in the here and now. To this end, I had students observe colors from computer graphics tools, then practice seeing the after image in the eye, by closing the eyes. We practiced this exercise, then applied a simple meditation of clearing the mind of thoughts as best we could, then looked back at the colors. It worked - the colors had a stronger affective dimension when the mind was quiet and attention peaked! The class concluded that one can gauge presence by the ability to experience color. And the obvious moral to the

story was the emotional intelligence tip that anyone could perform an instant check on presence just by looking around.

But this still does not explain any connection to Einstein's relativity or quantum physics. Here is the connection. If you trace the history of our development from electric technology (batteries, early telephones) to our latest electronic technology (computers, cell phones), you are virtually watching a movie where you see humankind lose touch with the senses and personal relationships, while gaining prowess in science, technology, engineering, and mathematics. If graphs were made to show this progression, the graph of humankind's right-brain, intuitive activities would be a downward sloping line, whereas the left-brain, analytical activities graph would slope upwards (J. Bickart, 2013). The importance here is that as the movie reached Einstein's work, the right-brain graph would start to turn upwards. The imaginative thinking necessary to embrace relativity brings out the similar use of our brains to both ancient creativity and to the leaps of thought humankind must make in order to embrace quantum theory (Kuhn, 2004). A case in point can be seen in the quantum notion of entanglement. Entanglement comes from evidence that implies that perhaps matter can be in more than one place at a time (Schrodinger, 1944/1992). This challenges some part of our analytical, logical sense. A person basically has to go to right-brain thinking to approach anything like entanglement because it just does not seem to make sense to our reasoning left brain. And this is where prayer comes in. If quantum theory can suggest that perhaps physical objects that appear to be separated from one another can be entangled and somehow be together, and if incarcerated students can embrace this hard science, then maybe those students could consider that there is a chance that they are somehow still connected to loved ones at home. And prayer would then be an action that is not only an act of faith; it would also be a scientific experiment.

Pilot Program Assessment - Emotional Intelligence in relation to STEM and Algebraic Scores

This course was part of a pilot program in one of North Carolina's correctional facilities that was funded by a grant from the Vera Institute of Justice. The main objectives of this first course were to prepare the incarcerated individuals who had been selected for the pilot in two ways: to reenter society as college students, and to have college level math, reading, and language skills. I assessed the students' emotional / social readiness qualitatively through a series of essays that I required of the students and through class discussion. Since another instructor taught reading and language, I assessed mathematics readiness through

the TABE test (Test of Adult Basic Education). This paper is a call for further research into the contention that perhaps there is a correlation between teaching emotional intelligence and teaching algebra. It is hoped that future studies will test out a correlation or perhaps even a causal relationship between building student confidence through an integration of STEM topics with emotional / social intelligence topics and performance on analytically / logically based skills such as algebra.

Qualitative Assessment

Following are excerpts from a qualitative assessment of student writings. Pouring over them it became evident that belief in self was a central obstacle to learning. My qualitative conclusion was that without some level of self respect, the students did not believe they could grow into some new level of learning. Every time a new topic in algebra was introduced, the resistance to change, adaptation, and the shifting of mental paradigms to accommodate the new skills was palpable as educational research bears out in countless studies (Bandura, 1971; Piaget, 1929/2007; Vygotsky & Cole, 1978). So, I addressed this issue indirectly by introducing STEM topics where a strong paradigm shift has historically taken place (Kuhn, 2004) allowing for new engineering and technological breakthroughs that we all use and love. In this way, the natural tendency to incorporate new inventions like the cell phone, the computer (Dewey, 1910, 1916/2005), or the latest in car and truck technology became a bridge to making inner shifts within one's own personality. Often the integration of issues like love, tolerance, and learning were mixed naturally in the student essays - a fact that became a prescription for my teaching. One student wrote in an essay what advice he would give to a child - or himself as a child. By the way, these quotations are cited with permission from the students to use their first initials and last names. "I had people all the time telling me what I should do or shouldn't do, but I had to learn the hard way. My advice to you is always be honest regardless if it hurts someone's feelings because once the pain goes away they will respect you for your honesty. Never forget to be yourself, don't do things because everyone else is doing them, because when you get out of your character you will about 8 times out of 10 find yourself in an awkward situation. Young man the most important thing I can tell you is to love. Love your friends and family - even love your enemies. When you love, things you say and things you do for people won't go unnoticed because they'll know it came from a sincere heart. And always remember to love yourself, because you can't love others until you love yourself first" (C. Barnes). The main reason that this paper contends that there is a direct

connection between teaching a 'moral to the story' and purely analytical skills is that they both involve a review of old habits followed by an opening to new ones (Bruner, 1960). The opposite of learning would be holding onto old habits and worrying about launching into new ones. "I've learned to not take family, friends or freedom for granted, at any given time any of these can be taken from you. ... my grandmother always told me, 'worrying is like rocking in a rocking chair, you can do it for days and never get anywhere'" (T. Lackey). One of the greatest assets of human beings is the resilience with which we bounce back from doing things wrong until we finally learn to do them right (E. v. Glasersfeld, 1995). "We all make mistakes. When you get knocked down you have to get back up. 'Fake it until you become it'" (A. Kempeny).

In the book, *Language, Thought, and Reality*, Whorf describes how the Hopi and the Aztecs have no trouble seamlessly integrating multiple realities and multiple verb tenses. In other words, they use language to describe how things are forever manifesting or *becoming*, rather than how they were in the past, or how they are in the present, or how they will be in the future. Also, there is seamless amalgamation of the moral or spiritual and the material. Morals give way to inspiration, which gives way to motivation, which gives way to belief, which ends in prowess (Whorf & Carroll, 1964). This is why I think that my tendency to teach STEM topics mixed with psychological topics worked so well. The incarcerated students used personal recommendations as reasons to believe that they could do algebra. As one student wrote what he would tell his son in the next quote, notice that he only moralized. When faced with the question of the most important things to tell his son, he of course did not go to reading, language, and math - but that does not mean that these skills would not follow. I used this essay to turn the tables on him and get him to believe he could pass the algebra tests when he was losing confidence - and it worked. "Son, do this for me if you can. Be a simple kind of man. Be someone people can love and understand. Be strong, tough and work hard, but also be caring, loving and sympathetic for those who are weaker than you. Always remember that family comes first. Take care and protect them with your love and compassion" (T. Joynes). Emotional / social intelligence is not a superfluous ability that is unrelated to hard science and mathematical problem solving. It is integral, just as the latest studies are beginning to show that the left brain needs the right brain in order to function (Goleman & Boutsikaris, 2006; Goleman & Whitener, 2005). "Remember you are always loved. Love is gold. Give your gold to everyone you meet, just as it was

given to you but never with a price. This is your treasure, nothing more, nothing less" (J. LeJeune).

Quantitative Assessment

This paper is a call for further research. I did not conduct a formal study and the brief measurements we made were mentioned earlier. I will summarize them here. I worked with 16 students who were incarcerated and were getting ready to take college level courses before and after being released from prison. The two parts of my job were to get them socially ready for college and to get their algebra scores within college range. The course started in the middle of September and ended in the middle of December. Prior to the course a TABE test was administered to see how many of the students were in range. 54% were. Of those who were not in range, aptitudes were indicated as low as fifth grade level. One student came to me near the beginning of the course and gave me a book he had been studying that discussed and defined math phobias. His point was to deter me from trying to teach him algebra. He was convinced that he could not do it. He told me that he was 47 years old and tried to learn algebra many times in vain. By the middle October, we took the same TABE test. 100% of the students were in college range, including the student with multiple incarcerations and the 'math phobia'. This time, many were out of range (at the high end of the scale), making it impossible for us to measure progress from October to December. Therefore a second test was immediately given at the highest level of TABE tests and even more students were out of range at the high end. Therefore, a formal set of studies is recommended. This experience is just an indication. But if you could have seen the change in the students - the way they felt about the algebra scores and the way it affected their belief in themselves, you would probably be moved.

Implications for Practice

U.S. schools teach predominately to the analytical, logical mind which has traditionally been called left-brain activity (Arnheim, 1986b). This has foundations in behaviorism (Skinner, 1953), a tradition which treated individuals like parts in a machine. Since the mid-1900s, education in the U.S. has used a mechanistic paradigm of teaching (Dewey, 1916/2005) and the justice system has experimented more with both punitive and rehabilitative forms of societal reform (Davis, 2013). The overwhelming results from research into these tendencies is that in education, learning is impeded (Darling-Hammond, 2010); and the results in the justice system is that we have nearly a 40% rate of recidivism. The implications are that we do not provide enough feeding and caring of the intuitive, holistic mind which has

traditionally been called the right brain (Bruner, 1986); we act like we can reform incarcerated individuals to be good citizens by left-brain drill and practice. The most recent studies suggest that both sides of the brain need each other to complete either kind of thought (Goleman & Boutsikaris, 2006; Goleman & Senge, 2007; Goleman & Whitener, 2005). Several theorists, including Piaget, Vygotsky, James, Dewey, Bruner, and Bandura contend that before we ever went to school, we had a way of knowing and learning (Bandura, 1971; Bruner, 1960, 1983, 1986; Dewey, 1910, 1916/2005; James, 1984; Piaget, 1929/2007, 1950, 1959, 1976; Piaget & Inhelder, 1969; Piaget & Valsiner, 1927/2001; Vygotsky, 1962, 1966/2002, 1979; Vygotsky & Cole, 1978). At first, we saw whole ideas. We could not analyze these whole ideas into parts and explain them - but we somehow knew them. We had intuitive perceptions of: *interconnectedness*, *paradox, and consciousness* that were directly opposite to logic and reason (Piaget, 1929/2007, 1950; Piaget & Valsiner, 1927/2001). It is from these conclusions that I base my recommendations for education and reform using STEM topics. I therefore recommend that we teach STEM topics - which are naturally quite analytical, logical, and mathematical - by keeping them as whole, artistic, and emotional as possible. This will appeal to both the intuitive and analytical sides of our nature; in other words to both sides of the brain (J. Bickart, 2013). Therefore the implications are to integrate STEM topics with personal, psychological issues. We must constantly relate our current science to discussions of how the human is bettering oneself and our environment. We need to look for ways that technology has changed us and analyze if it is for the better or not. Our redemption lies in studying practical job applications of engineering industries while examining what happens to the person who performs these jobs. Looking at mathematical advances and performing the calculations, we should also step back and see the beauty in the patterns and allow time to marvel at what the human mind can do. This constant mixing of inspiration and perspiration is necessary to move from a zone of knowing into the next zone where we can only approximate knowing at first (Vygotsky & Cole, 1978).

Especially with populations of incarcerated students that have worked on bigger obstacles than most of us could handle, we must constantly inspire belief in humankind and respect for oneself. But we must not simply say, "You can do it." We have to mix hard scientific facts and substantial research that points to the fact that we can do it. We need to constantly relate a STEM topic to the questions of how the student will better herself or himself; and this cannot always be simply by looking forward to getting a job.

It goes deeper than that. The human aspirations go beyond money (Emerson, Atkinson, & Ebrary, 1992). They definitely include basic needs, but the matters on most students' minds that keeps them from learning - the things they are preoccupied with - also include issues of confidence and belief in self (Dewey, 1916/2005).

So, basically, if you want good algebra scores, one route is to mix STEM with emotional intelligence. As I reported throughout this paper, there was one theme that kept resurfacing during the course. It was the repeated story of how the human species excels at learning by making mistakes, and that some of the most skilled at falling, have made truly difficult choices that you or I might not even have had to face. In respect of the hard life many of my students have had, I retold the story, that from one point of view they should not have made those mistakes, but from another, perhaps equally valid point of view, they may have saved another human being by perpetrating the very mistakes that landed them in prison. There is an issue of respect here. If one makes a mistake and disrespects oneself, it is much harder to get up and try again. But if one sees a redeeming aspect to making a mistake, then the respect necessary to move on may be achievable. By the end of the course, this story was a piece of the fabric of our dialog. I took it further - perhaps to a place that will make the reader uncomfortable - perhaps to a place of radical acceptance (E. v. Glasersfeld, 1995; V. Glasersfeld, 1984). I told my students the true story of a dream I had where people sat at a table before being born. It seemed that the table was a place for a decision making process whereby they chose who they would be on earth. I wrote the story as a poem for my students, but I offer it now to you who have read this paper. Thank you.

The Table

I saw a table. You were there!
And many others, too.
Some were very smart and some were even wise.

We were deciding to go down to the physical world.
We were deciding what roles to play.
Together we would agree that someone needed to be this or that.
Then, the role of outsider was put on the table.
No one wanted the role.

You took it.

But, it was explained, "You will be cast out, disrespected.
The people are not like before.
Then, you might have been revered
as someone who makes the community come together

to handle such a different one.
Now, they avoid diversity."

But, you took the role.

Someone had to do it.

Thank you.

REFERENCES

Aristotle, B. J. (1984). *The complete works of Aristotle: The revised Oxford translation*. Princeton, N.J.: Princeton University Press.

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

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

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

Bickart, J. (2013). *The possible role of intuition in the child's epistemic beliefs in the Piagetian data set.* (Ph.D. Dissertation), UNCC, Charlotte, NC. DAI/A 74-11(E) database. (3589794)

Bickart, K., Sauder, C., Kim, D.-S., & Putnam, K. (2009). How falsely believing you are in control can shape brain responses to aversive stimuli using functional magnetic resonance imaging. *The FASEB Journal, 23*.

Bruner, J. (1960). *The process of education*. Cambridge: Harvard University Press.

Bruner, J. (1983). Play, thought, and language. *Peabody Journal of Education (0161956X), 60*, 60-69.

Bruner, J. (1986). *Actual minds, possible worlds*. Cambridge, Mass.: Harvard University Press.

Bruner, J. (2004). A short history of psychological theories of learning. *Daedalus, 133*(1), 13.

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

Burton, L. (1999). Why Is Intuition So Important to Mathematicians but Missing from Mathematics Education? *For the Learning of Mathematics, 19*(3), 27-32.

Darling-Hammond, L. (2010). *The flat world and education: How America's commitment to equity will determine our future*. New York: Teachers College Press.

Davis, L. M. (2013). *Evaluating the effectiveness of correctional education: A meta-analysis of programs that provide education to incarcerated adults*. Santa Monica, CA: RAND Corporation.

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

Delpit, L. D. (2006). *Other people's children: Cultural conflict in the classroom*. New York: New Press : Distributed by W.W. Norton.

Delpit, L. D., & Dowdy, J. K. (2002). *The skin that we speak : thoughts on language and culture in the classroom*. New York: New Press.

Dewey, J. (1910). *How we think*. Boston: D.C. Heath & Co.

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

DiSessa, A. A. (1982). Unlearning Aristotelian Physics: A Study of Knowledge-Based Learning*. *Cognitive Science, 6*(1), 37-75. doi: 10.1207/s15516709cog0601_2

Donaldson, M. (1989). *Children's minds*: Fortuna Press.

Downing, S. (2011). *On course: Strategies for creating success in college and in life*. Boston, MA: Wadsworth.

Emerson, R. W., Atkinson, B., & Ebrary, I. (1992). *The selected writings of Ralph Waldo Emerson*. New York: Modern Library.

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

Faraday, M. (1860/2012). *The chemical history of a candle*. Hoboken, N.J.: BiblioBytes.

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

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

Glasersfeld, E. v. (1995). *Radical constructivism: a way of knowing and learning*. London; Washington, D.C.: Falmer Press.

Glasersfeld, V. (1984). An introduction to radical constructivism. In P. Watzlawick (Ed.), *The Invented reality: how do we know what we believe we know? : contributions to constructivism*. New York: Norton.

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

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

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

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

James, W. (1984). *Psychology : briefer course*. Cambridge, Mass.: Harvard University Press.

Katie, B. M. S. (2002). *Loving what is: How four questions can change your life*. London: Rider.

Kozol, J. (1992). *Savage inequalities: Children in America's schools* (1st Harper Perennial ed.). New York: HarperPerennial.

Kozol, J. (1996). *Amazing grace: The lives of children and the conscience of a nation* (1st HarperPerennial ed.). New York: HarperPerennial.

Kozol, J. (2005). *The shame of the nation: The restoration of apartheid schooling in America* (1st ed.). New York: Crown Publishers.

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

Ladson-Billings, G. (2009). *The dreamkeepers: Successful teachers of African American children* (2nd ed.). San Francisco, Calif.: Jossey-Bass Publishers.

Lipton, B. H. (2005). *The biology of belief : Unleashing the power of consciousness, matter and miracles*. Santa Rosa, CA: Mountain of Love/Elite Books.

Lipton, B. H. (2006). *The wisdom of your cells : How your beliefs control your biology*. Boulder: Sounds True.

Lipton, B. H., Bhaerman, S. (2009). *Spontaneous evolution: Our positive future (and a way to get there from here)*. Carlsbad, Calif.: Hay House.

New York Times Editorial Board, T. (2014, Feb. 18, 2014). Gov. Cuomo's Bold Step on Prison Education, Editorial. *The New York Times*.

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

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

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

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

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

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

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

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

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

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

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

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

Pink, D. H. (2006). *A whole new mind: Why right-brainers will rule the future*. New York: Riverhead Books.

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

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

Senge, P. M. (2000). *Schools that learn: A fifth discipline fieldbook for educators, parents, and everyone who cares about education*. New York: Doubleday.

Senge, P. M. (2008). *The necessary revolution : how individuals and organizations are working together to create a sustainable world*. New York: Doubleday.

Skinner, B. F. (1953). *Science and human behavior*. New York: Macmillan.

Talbott, S. (1995). *The future does not compute: Transcending the machines in our midst*. Sebastopol, CA: O'Reilly & Associates.

Talbott, S. (2007). *Devices of the soul: Battling for our selves in an age of machines*. Sebastopol, Calif.: O'Reilly Media.

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

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

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

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

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

Whorf, B. L., & Carroll, J. B. (1964). *Language, thought, and reality: Selected writings of Benjamin Lee Whorf*. Cambridge, Mass.: M.I.T. Press.