

A STUDY TO DETERMINE THE RELATIONSHIP BETWEEN  
THE PERCEPTION OF THE DIFFICULTY OF A TASK  
AND PERSISTENCE IN ATTEMPTS TO  
SOLVE A PROBLEM

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ABSTRACT

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A Study to Determine the Relationship between the Perception of the Difficulty of a  
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The purpose of this study was to determine the relationship between the perception of the difficulty of a task and persistence in attempts to solve a problem. This study included a comprehensive review and critical analysis of the research and literature associated with an individuals perception or self-efficacy of the task at hand as well as identifying factors that promote successful learning. A summary of the results as well as conclusions and recommendations were made in order to give guidance to teachers in developing teaching styles that can promote students problem solving abilities.

In researching historical practices in educational research from past to present, it was determined certain traits were characteristics of successful and unsuccessful learners. Out of this review, self-efficacy and persistence at a task played a dominant role in successful student learning. The question then became “What causes persistence and self-efficacy to correlate?” Since past research was in the realm of the psychologist, and technology to study the function of the brain was not available, it was impossible for researchers to understand the correlation. With the advent of present brain research, how the brain learns is at the forefront of genetics, biology, and chemistry. It is this studies attempt to understand the complicated mix of emotional stressors and reinforcement which releases the chemical cocktail in the brain that the brain in turn must use to decipher which neural pathways will be interconnected and how memory is formed. The research attempts to show why the relationship between self-efficacy and persistence promotes learning in the subject.

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## CHAPTER ONE: INTRODUCTION

In April of 1983, the U. S. Department of Education's National Commission on Excellence in Education released their findings of 18 months of educational research in their report, "A Nation at Risk" U.S. Govt. Pub. (1983). This document was the stimulus for the majority of educational reforms that have occurred for the past two decades. The document showed student achievement deficits in the areas of literacy, science and English competencies, and math computations. These inadequacies were brought to the forefront using standardized testing techniques and their scores during the time period from 1963 to 1980. The standardized test quoted most often as being a leading indicator of achievement was the college board's Scholastic Aptitude Tests (SAT's). Students showed a continual decline over this span of 50 points in verbal scores and 40 points in mathematics scores. There were also corresponding drops in scores in science and related problem solving activities, all occurring during the time frame previously indicated.

Political banter has occurred back and forth over the years on both sides of the debate where statistics are used to support one version or other of the educational system's failure, and seemingly both arguments have a true validity unto themselves. This research and discussion is not to argue the merits of either argument, but the inferences drawn from research bring to the forefront the public's perception of our public educational system. Whether based in reality or not, perceptions of a failing educational system by the public at large are a problem as this is where the educational system draws either its support or the public's ire. To ignore this concern, educational institutions

would truly be shirking their responsibilities not to address such an issue. The reality of the perceptions also dictate to educators the need to strive to build confidence in the public, and their only way to achieve this is to make strides toward remedying these perceived and real problems. Education is a dynamic and everchanging entity. Therefore the educational system must accept constructive criticism and make changes where change is needed. Society and the skills that individuals need to be successful in that society change and education must adapt and respond to those needs.

As previously stated, the SAT scores give ample evidence of deficits in problem solving. This area has also been an area of grave concern among educators and has drawn much attention from them over the years. When asked by future employers what are the qualities you look for in an employee one of the answers that rises to the top is the ability to problem solve and work cooperatively in teams, which are essentially the abilities of an individual to learn new skills and adapt to new situations. Educators are constantly being bombarded with examples where students are too dependent on extrinsic rather than intrinsic rewards and rely on immediate gratification or else they will not persist long enough to solve difficult and/or even simple problems. Their frustration levels peak before they give their skills a chance to become engaged in the activity and help them solve the task. The question can then be posed: Is it the fact that a problem is too difficult to solve or is it that the student does not persist at the problem solving activity long enough to ensure success?

Specifically this research will examine the issue of whether a student's perception of the difficulty of a problem can cause that person to persist longer in their attempts to solve a problem. It is constantly being pointed out that other countries are doing a better

job of educating their youth than in the U.S. Blinco (1993) cited evidence of Japan's economic success formula as being persistence and patience. The example the Japanese have given the rest of the world has been exemplary in its ability to develop a highly skilled labor force.

Knowing that persistence at and solving a problem may be interrelated it is also known that an educator must consider other factors interfering with ascertaining solutions to problems. These factors can interfere with either the persistence of the task or the interpretation and usage of information and skills previously gained or learned concurrently during the solution of a problem. Research shows that students learn differently and use multiple intelligences to experience their environments and even store information in different ways (Gardener, 1999). Teaching styles and modalities, whether they be didactic or constructivist, need to address students differing learning styles and how they will approach and experience the problem solving conundrum. Numerous research has pinpointed key elements in student's that enable them to become more effective learners such as persistence, motivation, goal setting, and self efficacy (Anshel & Weinberg, 1992; Knoll, 1991; and Schunk, 1991). These are characteristics that can be controlled by the learner. Of the elements that contribute to effective learning which cannot be controlled but which also play an important role are genetics, environment, stressors, prior learning, and emotions (Debacker & Nelson, 2000; Endler, et al., 2001; Gipps & Tunstall, 1998; and Kaplan & Owings, 2000). These characteristics all play an important role in learning, and ultimately all of these interplaying with each other in some form, will affect how learning takes place.

Given our current state of affairs, it is imperative that educators step forward and accept the new challenges that face them and even embrace them and use them, not as points of contention to cast blame on others for past failings, but as opportunities to grow. Educators are fortunate to live in a time when technology is not only aiding us in the classroom but has also enabled us to explore the biological workings of the human brain itself. New technologies in the medical field are allowing us to explore and put together pieces of the puzzle that will help us to unlock the secrets of how the brain stores, relates to, and recalls differing bits of information. It is on this threshold that educators stand and look forward to the future, but always remembering the past and learning from both our successes and failures. New insights into learning will hopefully give educators the inspiration to change education and make the learning experience truly an educational experience.

### **Statement of the Problem**

A review of the literature shows that persistence at a task is a characteristic that gives a learner a greater opportunity for success in solving a given problem. Further research also shows that if a learner perceives a problem as less difficult, they will persist longer at solving the task.

Therefore, educators who can help a student to perceive a problem as less difficult will have the student persist longer at the task, and they will therefore have a greater opportunity for success in solving the problem.

## **Purpose of the Study**

The purpose of this study was to explore through a comprehensive review of the literature and research, teaching modalities that will promote self-efficacy in students so that they persist longer at a task and become successful problem solvers. Based upon critical analysis of the research and literature, the researcher formulated conclusions and recommendations.

## **Research Objectives**

This study focused on the following research objectives:

1. To research influences on learning theory both past and present
2. To define characteristics of successful and unsuccessful learners
3. To identify deterrents to learning
4. To research how the brain stores and recalls information and what may inhibit those processes
5. To research how the perception of difficulty affects learning

## **Definition of Terms**

For clarity of understanding, the following terms need to be defined.

Extrinsic motivation – motivation received by the belief that a person will receive external rewards such as money, prizes, etc...

Intrinsic motivation – motivation received by the belief that a person will receive internal rewards such as improved self esteem or self gratification.

Modalities – differing or various techniques used to teach the same concept.

Multiple intelligences – the theory that was proposed by Dr. Howard Gardener that there are eight intelligences that account for different styles of learning (Gardener, 1999).

Paradigm – a clear or typical example of a concept.

Self-efficacy – a person's judgements of their capability to accomplish a specific academic task.

## **Limitations of the Study**

The researcher has identified three limitations in the study. They are:

- 1.) The variabilities of learning styles make recommendations for a general population difficult.
- 2.) Brain research and how the brain learns is in its infancy and inferences made now may prove to be incorrect in the future.
- 3.) Brain research shows individuals perceive their environment in ways that are as unique as fingerprints which again makes inferences for the general population difficult.

## CHAPTER II: LITERATURE REVIEW

### *Learning Theory Past and Present*

The investigation of learning theories both past and present is relevant to the support of any conclusions that may be made as a result of this literature review. It is vital in the sense that the educator needs to understand what pre-existing knowledge, abilities, or tendencies the learner may or may not bring to the educational experience. Any of these same tendencies and philosophies an educational system deems as acceptable for those students in that same educational setting are also relevant to learning strategies that may need to be implemented. The reality of any classroom setting is that there is a heterogeneous mixture of students and how they learn as the theory of multiple intelligences proposed by Howard Gardener (1999) suggests. It is also true that these students have already been exposed to various modalities for learning, whether it be from parents, teachers, the community at large and to a great extent nowadays, from different forms of media or technology. These various teaching styles influence the manner in which ones mind develops and learns. Therefore an understanding of the groundwork that has been laid that precedes a specific educator will allow that educator to better understand approaches that may have to be implemented for successful learning to take place.

### *Ivan Pavlov*

Early educational theory was relegated not to the realm of educators per se but to other academic areas such as psychology, and in the case of Ivan Pavlov, the study of physiology. Pavlov, a Russian physiologist, is mostly recognized for his research that was done in the 1920's with dogs. His study of classical conditioning as described in

Woolfolk (1993) was an attempt to see if an animal could be taught to perform a task and as a result, have an automatic or unconditioned response become a conditioned response. He found that he could train an animal that naturally salivates over food to instead salivate after a bell was rung. He did this by introducing the conditioned stimulus (food) which involved an unconditioned response from the dog (salivation). It was found that if done in the suggested order and repeated many times, the bell could cause the conditioned response of salivation. Inevitably an extinction will occur in the behavior if the unconditioned stimuli is withheld and not introduced again, but this did show that a conditioned response could be taught.

Early implications of the study lead many educators, and boards of education that dictated the types of discipline for educators to implement, to believe an action could cause an acceptable response. Thus corporal punishment could be absolved of any indiscretions by manipulatively pointing to proven research as the foundation of the policy. Though effective to a large degree in eliciting the desired behavioral response of quiet, disciplined classrooms, the ultimate goal of causing learning to occur was most likely not accomplished by these methods, but by those methods employed by a conscientious teacher.

Unknowingly, teachers by using discipline in the manner of the day, most likely did condition responses in students such as anxiety, fear, and frustration. All of these responses which will be discussed later bring about responses in the brain that can inhibit retention and associations that must be made for something to be learned and stored in long term memory.

### ***B. F. Skinner***

B. F. Skinner continued along the line of thought of classical conditioning studied by Pavlov but carried it to the next logical step of trying to determine how it would apply to learning in humans. As described in Woolfolk (1993), Skinner observed classical conditioning as being respondent behavior rather than the operant behaviors most humans exhibit. Skinner believed that the operant learning involves the controlling of the consequence of a particular behavior. Ironically enough, his studies implied how behaviors were controlled in humans but yet his studies were primarily done on pigeons and rats.

Some of these generalizations made at the time have great merit, however the general theory of the day was that all brains functioned the same, just that some were more sophisticated than others. To suggest that a rat or pigeons learning could be transferred directly to human learning would by today's standard be an irresponsible extrapolation. To some extent, some of the connections may seem plausible, but it is not inherently correct as today we even suggest the brain and learning styles from person to person varies so drastically it is difficult to make general inferences for learning.

Another variable and question that Skinner introduced as described in Woolfolk (1993), was how do positive consequences effect a change in ones behavior when compared to an unpleasant consequence. He did this by making what is now call a Skinner box which was a cage the animal was kept in that was set up to either reward a behavior by giving food to the animal, or to punish a behavior by giving a mild shock to the animal. The operant is different in each situation as the positive consequence attempts to increase a behavior and the punishment as a consequence is intended to

reduce or stop a behavior. In order for the favorable outcome of a specific behavior to continue, the behavior was found to need reinforcing. Reinforcement schedules can be of either continuous reinforcement or intermittent reinforcement, also known as partial reinforcement. The merits or deficiencies of each will be discussed further at a later point in the review. It was determined that reinforcement must occur or the behavior would not be learned or repeated.

Skinner did succeed in showing he could cause or reduce a behavior by introduction of positive or negative reinforcers and/or the addition of punishment. The latter factor, punishment, seems to be a premise that was condoned by Skinner and drew the ire of many in educational circles as well as his peers. As stated in DeBell, & Harless, (1992), Skinner acknowledged punishment as the “most common used technique of behavior control used”, but in no way advocated its use. He in fact believed positive or negative reinforcement brought about changes in behavior that were more permanent than punishment. In fact, he stated that punishment neither taught a person to behave well nor did it eliminate a behavior. It may even have possibly resulted in behavior worse than the initial behavior which was intended to be eliminated.

### *Jean Piaget*

Piaget was a Swiss born psychologist whose roots also began in the study of natural science before his interests turned to psychoanalysis. It was during his studies in the Jean Jacques Rousseau Institute in Geneva that Piaget developed his theories on intellectual development which he is now renowned for. As cited in D’orio (1999) his research demonstrated clearly that children’s use of logic and thinking was entirely

different from adults. It was these findings which held and still hold tremendous implications for teaching and learning.

Piaget's work identified specific intellectual developmental stages, each with their own unique characteristics. They are identified in Woolfolk (1993) as sensori-motor (birth to 2 yrs.), pre-operational (2 to 7 yrs.), concrete operational (7 to 11 yrs.), and formal operational (11 to 15 yrs.). These stages will be discussed in further detail in later discussions when appropriate. Piaget believed that children progressed through each of these stages in a chronological order. He did not believe that everyone reached each stage at the specific ages listed as these were guidelines not absolutes, but that one had to pass through one stage before they could progress to the next stage. Piaget's stages of cognitive development theory were widely accepted and many educators adopted teaching techniques and strategies that accommodated their students levels of cognitive abilities. It was even perceived by some to be futile to attempt strategies beyond the accepted cognitive ability levels of their age of students.

### *Abraham Maslow*

Abraham Maslow was American born in Brooklyn, New York. Even though his father wanted him to become a lawyer he attended the University of Wisconsin to pursue his masters degree in psychology. His impetus for seeking a psychology degree probably is best summed up in his own words, "I was awfully curious to find out why I didn't go insane" People and Discoveries (2004). Maslow theorized that a person needed to progress through a ladderlike progression of needs beginning at the most basic of needs. According to Maslow (as cited in Woolfolk, 1993) a person was believed to progress through specific needs until they would finally advance through the hierarchy of needs

which ended at the highest level of self-actualization. The needs from basic to most advanced are as follows:

-Self-Actualization-  
 Needs  
 -----Aesthetic Needs-----  
 -Need to know and understand-  
 -----Esteem needs-----  
 -----Belongingness and love needs-----  
 -----Safety needs-----  
 -----Physiological needs-----

When Maslow introduced his theory of hierarchy of needs, again like Piaget, he suggested a need for an orderly advancement through each stage before the next need could be achieved. This opened him up to criticism from colleagues as there seems to be many people who sacrifice lower level needs to achieve higher levels of needs. Specific examples were of individuals willing to sacrifice needs of love for the need to attain knowledge and self-actualization in a specific area while being totally deficient in other areas of their lives.

Regardless of whether Maslow's hierarchy of needs is correct in the absolute sense, the implication it had for education were far reaching. Schools attempted to change environments so students felt safe and lunch programs were initiated along with school nurses to ensure a healthier student body. Whether influenced directly by Maslow's thinking or changing due to other pressures, Maslow's work has proven to be correct in a majority of situations. Group interactions prove vital in the school environment and was seen by Maslow as being part of his lower level needs. Children seek out social acceptance and belonging which in most cases helps a student gain self esteem and confidence which in turn leads to self efficacy. Efficacy is touted by many

researchers as a motivating factor for students to persist and achieve at a specific task.

Each of these basic needs which need to be fulfilled can help the student to feel comfortable in their environment. This in turn can lead to the development of curiosity in the student beyond their basic needs which lead to greater understanding and learning.

### Howard Gardener

Howard Gardener proposed his theory of multiple intelligences in 1983. In Gardener (1999) his theory suggests that individuals are hard-wired to learn using specific types of intelligences in specific sites in the brain. Gardener theorized the existence of and identified eight different human intelligences. Gardener supported his theories by studying stroke victims and showed that brain damage in a certain location of the brain corresponded to affect specific areas of cognitive abilities in the individual. An example of this would be of a stroke victim losing their ability to speak when the area identified to control verbal abilities was damaged. The eight intelligences Gardener proposed existed are found in Gardener (1999). They are logical-mathematical, linguistic, musical, spatial, bodily-kinesthetic, interpersonal, intrapersonal and naturalistic.

Gardener proposed we all have abilities in each of these intelligences, even excelling in one or more of the intelligences, but being less than remarkable in the other areas. A person with abnormal brain development, autism, etc, may be dysfunctional in many areas and brilliant in another intelligence. Stephen Hawking is a brilliant physicist who is wheelchair bound with cerebral palsy and cannot speak, yet through the miracle of technology was discovered to possess the mind of a genius and has been recognized as one of the most brilliant minds of our time. Evidence such as this supports Gardener's

multiple intelligences theory and urges educators to be acutely aware of abilities students may possess. This is why, to some educators chagrin, a student who is low achieving in most academic areas may be identified as gifted and talented and removed from class to be allowed to participate in a special program. It may cause the student to have a deficit in the class the student is being pulled out of but to the benefit of the child to help them learn and be aware of their own abilities.

Gardener put it best himself when he expressed his vision of education as, “Educators need to be helping students to gain a deeper understanding of significant themes and topics. They need to make individual differences in the classroom allies rather than encumbrances to the educational process. If students can approach topics from a variety of entry points, they can draw a variety of analogies and capture core ideas using various intelligences. The usage of a multi-pronged educational approach should help students attain deep—or at least deeper—understanding. Through the usage of different modalities of learning they will have experienced a taste of the disciplined mind” Gardener (1999).

### ***Constructivist Education***

The constructivist reform movement in education is a discipline that is attempting to move education from what is now teacher oriented, in a direction of becoming a student centered curriculum. It is intended to guide students to explore and become active learners while allowing the teacher to be a facilitator of activities and a resource to the student. Traditional settings have teachers in the role of disseminators of information and relegate students to the role of passive learners. Constructivism as a concept relies heavily on student participation and student autonomy in pursuing their learning.

The imagery of a constructivist classroom according to Brooks & Brooks (1993) would look something like this. The classroom itself would be a safe environment created by the teacher that encourages dialogue among both students and the teacher. It would be the teacher posing a problem or a set of problems to a group as a whole and allowing separate groups to pursue the answer to a problem in their own manner. The teacher would be seeking out viewpoints and misconceptions on topics and guiding individuals through the task. Students would be working cooperatively in groups and learning would be student centered rather than teacher centered.

It is interesting to note that when educators are approached with the concepts brought forth in constructivist methodology that most educators respond positively and acknowledge that students learn best using these techniques. Acknowledging the benefits to students and implementing the strategies is altogether quite different. Teaching students how to think differently about their role in education, having the teacher relinquish control over the subject matter, changing how students are assessed, and even allowing the classroom to be in a seemingly chaotic state, are all major obstacles for educators and their attempts in the use of the constructivist method. In the constructivist viewpoint, these are boundaries that need to be impinged upon and broken down before teachers can feel comfortable in using constructivist techniques in the classroom. Educators know that the new child that enters school for the first time is curious and has an innate curiosity to discover things on their own and to learn. Constructivists believe formal education has somehow ingrained in students that they are not to discover and explore on their own but must be filled like an empty vessel with knowledge and be told how and what to learn. To stop this trend, educators must be taught how to teach

students to think of their own education differently and they themselves must move out of their comfort zones and explore ways to give the educational process back to the child.

### *Characteristics of Successful Learners*

Students come from varied backgrounds and broad experiences that form their expectations and motivation in an educational setting. The culture, economic status, family structure and even genetics, play an important role in how successful a student will become in the classroom. It is true that certain attributes tend to predispose an individual towards greater chances of success. Of these characteristics elements that for the most part a student has control over are continually mentioned as factors important for successful learning as described in multiple works by Blinco, 1993; Pittenger, 2002; Wigfield and Karpathian, 1991; Schunk 1991; and Dai, 2000; are persistence, motivation, goal setting, and self-efficacy. The research will discuss each of the elements separately in the literature review.

### *Persistence*

The Japanese culture and economy has been the envy of the world for the past several decades. Two contributing factors that research has pointed out as a formula for Japan's success as was stated in Blinco (1993), is their educational system and their persistence. An example which speaks to both of these factors is that the United States dropout rate for high school which is approximately 33 %, whereas less than 3% of Japanese students fail to complete high school. The two of course go hand in hand as persistence at a task will allow a person to have a higher frequency of achievement than a person who does not persist at a task. As reported in Pittenger (2002), persistence is difficult to study and can be approached in terms of its effect on an outcome, or in terms

of individual variabilities in environment and human attributes to persist on a task. Persistence itself is defined as the extent to which an individual pursues reinforcement that is no longer available. This is the truly one of the greatest challenges facing educators today. What is an even greater challenge is to have individuals persist even after the positive reinforcement, which in most cases is the teacher, is absent.

Reinforcement seems to be the key to developing the appropriate behavior of continuing on a task in a student. What gives rise to the continuance of persistence can be complicated. As in Pavlov's experiments, he believed you could condition a response if the reinforcement for the behavior remained long enough for it to become a learned behavior. Or maybe as it is described in Pittenger (2002) when he is describing Amsel's frustration theory, it is the ability of a person to overcome the frustration of not being able to complete a task satisfactorily and the subject learns to resolve the internal conflict of not receiving reinforcement. The anticipatory response then takes over and becomes the motivating factor in maintaining persistence in the individual until they can attain the reinforcement they seek.

Both of the above scenarios operate on the supposition that persistence can be taught. Maybe as Gardener (1983) first proposed, we are all predisposition by our own unique individual makeup to be more adept at different intelligences and genetics really does take over at some point. Since persistence at a task is the basis of this literature review, persistence will be revisited in a later discussion and will be discussed from various viewpoints at that time.

### *Motivation and Goal Setting*

Having the pre-existing knowledge and skills along with the self discipline to work at a task would seem like the right combination for learning. However, without the other ingredient of motivation, learning is very unlikely to take place. All people must be motivated enough to complete a task or energies will be spent elsewhere. There needs to be something that is perceived to be of value for the learner to pursue and complete a task. The motivation may be extrinsic in nature or intrinsic, but nevertheless there has to be a sense of need for the task to be performed. In our classrooms rewards tend to be extrinsic in nature such as, "you will not receive a good grade unless the problem is completed satisfactorily". For some students a grade of "C" may be sufficient reward whereas another student would perceive the same grade as a failure and may even want to redo the assignment and receive a higher grade. The motivations for each are quite different but motivation is still present.

Whatever the motivation is it needs to be present and takes many different forms. Intrinsic motivation is generally thought of as a higher level of motivation, yet even adults respond to extrinsic forms of motivation. One might be rewarded with a bonus or given a raise if performance is found to be better than average. The average worker might not like working overtime but when they are paid time and a half for extra hours the motivation is too great for most to turn down. Young children operate almost entirely on extrinsic motivation, even though they might seem borderline intrinsic. They will try to walk, gurgle a word, eat peas, potty train, and various other things which involves learning. The child does it for the hug and smile and tickling they get from someone. That is how they are motivated to learn. When children are young and put into

orphanages without the constant nurturing and attention, they are not motivated to learn and do not develop cognitively or emotionally in the same way a nurtured child would be.

While observing his 25 month old son, Allan Wigfield, Wigfield & Karpathian (1991) observed something truly remarkable in his son when he uttered the simple words, "I did it myself!". The motivation was initially intrinsic in nature as the child learned how to do a task all by himself. Of course the extrinsic motivation of a big smile and a hug from Daddy was still there, but it shows that even the very young can be intrinsically motivated.

Lots of research has also been dedicated to determine whether an individual can enhance intrinsic motivation by setting personal goals. Research done by Schunk (1991) found that students who set their own performance goals and those who had goals assigned to them showed greater motivation than subjects who had no goals. Students who set their own goals showed the highest self-efficacy and skill. Schunk also showed that an extrinsic reward such as prizes can also be productive in motivating students to reach goals. The research showed that students who received prizes for performance increased learning of a concept, and combining rewards with goal setting was the most effective learning strategy of all and resulted in higher self-efficacies. He also showed that rewards for participation resulted in neither higher self-efficacy or performance.

It has not been without caution that goal setting has been introduced, as it is not always a precursor of motivation. Once goals are set, and especially if they are not kept private, competition levels in the classroom are increased. In this day of mainstreaming and anti-tracking, children of all ability levels, both cognitively and physically, are placed in the same environment. It is with caution that a teacher should set goals and they need

to be appropriate for the individual, not generalized to the class as a whole. Research done by Dai (2000) showed that educational environments that promote competition and accentuate normative success and comparison put low-achieving and learning disabled students at a motivational disadvantage. Even children of high-ability and of female gender are suspect if they perceive the goals as too challenging. In order to preserve their status they may avoid challenging tasks so they will not run the risk of failure and reveal an inadequacy. Students need to be challenged in order to maximize their potential but it is the educators function to make sure the environment is safe and non-threatening in order to build self-efficacy and ultimately a better learning climate.

### *Self-efficacy*

Self-efficacy as a theory is not a static entity. It is an ever changing construct of an individuals psyche that can be changing all the time. During a problem solving episode self-efficacy may even rise and fall during the course of the activity depending on successes and frustration. The interesting thing about self-efficacy is it is domain specific and an individual may have high self-efficacy in one area and low in another. In Schunk (1991), it was hypothesized that ones self-efficacy will affect a students choice of activity as well as that individuals effort and persistence at the specific activity.

Furthermore, it did show that successes raised efficacy whereas failures did have a tendency to lower efficacy. However in the impetus to raise self-efficacy in an individual it has been shown that failures have little effect on a persons efficacy if efficacy is strong in a specific area in the first place.

If a student has a high self-efficacy in an area such as math, it would seem to follow that it would be likely that performance in a math problem would produce

competent results. Schunk (1991) again stated that self-efficacy is not necessarily the most important influence in the outcome. Other important variables are previous skills and knowledge, expectations of the outcome, and value of the outcome. It shows that student success is inter-related with all the other areas of previous knowledge, motivation, and the self discipline of persistence at a task. Any one of these components that are missing can impede the learning process.

Schunk continues to explain when an individual has begun a task with low self-efficacy, it is not implied that confidence levels will remain low. Individuals all start out with low self-efficacy. It is by an individuals experiences and successes that a person raises efficacy. Progressively more and more successes and increased levels of difficulty raise efficacy even more, and also increase motivation and persistence at the task. Early failures of course have the opposite effect and literally hardwire the brain into believing past failures will lead to future failures resulting in low efficacy and helplessness.

Interestingly enough, Schunk and Hanson, 1985 (as cited in Woolfolk, 1993) performed a study with a group of students with learning difficulties who observed their peers working a series of math problems in subtraction. These students were proficient in their skills and were having success. When this was completed they participated in an instructional program given by the teacher. Another group watched a teacher demonstrating the math skill and participated in the same instructional program given the first group. The first group not only scored higher on tests than the control group, but had also gained greater confidence in their ability to learn. The inference is quite simple. Peers of near cognitive and emotional development showing competence creates a sense of self-efficacy in others in that someone at their own level can achieve, so can they. The

teacher who is at a much higher level is supposed to do it easily and does not reinforce the behavior of persistence whereas their own peers can reinforce the behavior in an individual although the individual may be experiencing it vicariously through their peers.

The implications for the classroom may include such simple ideas as priming activities (lower difficulty) that build confidence in student abilities before the student goes on to more challenging problems. Other ideas may be to have students demonstrate proficiency for the class, either in groups or by demonstrating their skill in front of the class. These may and can help students to perceive themselves as more capable and build self-efficacy in that domain.

### ***Deterrents to Learning***

Even if an individual possesses all of the characteristics of a successful learner, cognitive development cannot be assured. Although the three categories of deterrents relegated to this research can all be classified as stressors in the generic sense, this research prefers to define the category of stressors as those events which directly cause stress reactions. Although the other deterrents will bring about the same physiological changes in the brain, which will be discussed later, they are indirectly causing the physiological changes. The categories of deterrents the researchers Wesson, (2002); McGough (as cited in Wolfe, 2001); Sapolsky, (as cited in Jensen, 1998); Woolfolk, (1993); and Bluestein, (2000) identified as deterrents to learning are of the following: stressors, learning environment, and modalities of teaching.

Much research has been done in each of these areas leaving educators with many implications for the teaching field. Wesson (2002) adheres to the theory that it is biologically impossible to learn something in which the brain has not paid attention.

Stress brings out emotions, and emotions are what drive memory as it calls to attention that experience in which an individual is participating in. It is because of this that deterrents cannot be completely removed, and in fact student performance that occurs under no stress rather than mild to moderate stress, makes the learning experience so inconsequential that no lasting memory either short term or long term will be made, so in essence no learning will take place.

That is not to say that we shouldn't pay attention to these deterrents, as some deterrents are truly detrimental to learning. Educators have to be considerate of the differences in individuals so that care is taken in providing an environment that gives everyone the appropriate possibilities to learn.

### ***Stressors***

Stress can take many different forms, and what is stress for one individual may not be stress for another. An example may be a verbal scolding from a teacher in front of the class, while another stressor may be the announcement of a pop quiz. In the former example, most children would probably be scared and embarrassed that they needed to be reprimanded, while another probably hardly acknowledges being chastised as they are used to having corporal punishment administered at home or even a beating. This would be the extreme but an understandable differing in situations and the amount of stress it may invoke in an individual. The latter example of a pop quiz might elicit the response of fear of a poor grade as one student did not study, and another student is jubilant as they studied last night and it provides a moment to show what they have learned and possibly improve their grade.

The reality is that each of the above situations may elicit different responses but they are both stress, one being eustress (good stress) and the other distress (bad stress). Without stress in ones life a person will not respond to any stimulus. This would make us paralyzed to what is going on around us and would put us into a vegetative state. Even distress is not entirely aversive as the physiological response to stress of releasing adrenaline to increase heart rate and respiration gets us ready to perform at a task and may even preserve our survival. It stimulates the part of the brain which controls our senses and makes us ready to receive stimuli and respond to those stimuli.

Jim McGough at the University of California, (cited in Wolfe, 2001) performed a study showing that giving rats an injection of a stress hormone known as epinephrine right after they learn something enhances their memory of the learning situation. Tests were then done on humans using epinephrine which produced similar results. This situation in the brain due to stress imprints the event making this event and associated information easier to recall. The flip side to the reaction is that it also causes raised levels of cortisol that inhibit blood flow to the cerebral cortex where logical thinking takes place. Therefore the imprint of learning can be enhanced, but recall of other information as might occur on a test in a stressful situation may be difficult.

The release of cortisol as discussed in Wesson (2002) showed that it also causes difficulties in long term memory. It stimulates the amygdala which is the center of emotion which in turn results in an emotional hijacking of the cerebral cortex. Prolonged release of these chemicals will also produce an environment in the hippocampus, which is responsible for memory recall, which can destroy neurons and will then destroy neural connections which the brain relies on for association.

The prolonged stress situations bring about the expected result of diminished cortex development but also brings about the unexpected result of apathy toward life as observed in research done by Robert Sapolsky (cited in Jensen, 1998). It is his belief that a sustained imbalance of chemical neurotransmitters in the brain causes the brain structure itself to change. Sapolsky, knowing that sustained high cortisol levels can cause atrophy in the hippocampus, found that the hippocampus of Vietnam veterans diagnosed with Post-Traumatic Stress Disorder had levels of atrophication 8-24% above what would be normally expected in an individual of that age. The brain has the ability to cope with stress on an intermittent basis but was not designed to embrace stress as a lifestyle.

The double edged sword of stress has to be understood in the realm of the classroom. I has the ability to enhance the emotions and make the experience literally “more memorable”. Following this experience though the brain needs the stress to subside so homeostasis and a more normal chemical balance can be attained and the function of the brain restored to normal.

### *Environment*

Physically the constraints in a normal classroom are quite limiting as to what a teacher can do to create the desired spaces most beneficial to students. The ideal classroom, as described in Woolfolk (1993), would have spaces for different needs. An example would be spaces for formal lessons, spaces for group activities such as labs and cooperative learning, and spaces for quiet reflection. In a typical classroom that is most likely forty by forty feet or less these spaces can be quite a challenge to create.

The changes can be created by changing the way desks are being arranged to fit the needs of the day and also to have portable partitions that can be arranged to change

the space. Encouraging students to bring in old flop pillows or bean bags for quiet times so they can relax and reflect can be beneficial from physically creating a personal space of their own. When cooperative learning is preferred, tables where the entire group can sit in a specific area is best or circle the desks so all their attention is centered on the group.

Along with the physical the students psyche must also be tended to. The environment must be safe and non-threatening to create an atmosphere that is the most conducive to learning. Educators need to ask themselves pointed questions and be brutally honest with themselves about the environment they have created for their students. In her article *Creating a Caring Classroom*, Jane Bluestein (2000) posed the following questions each teacher must ask about their classroom environment:

- Do I reach out to students and provide ample opportunity for appropriate and challenging levels of success?
- Do I instill a feeling of belonging and treat all students with the respect and dignity they deserve?
- Is the students need for control, structure, and positive reinforcement being met?
- Do students receive recognition and approval and feel safe to voice opinions?

Being able to answer these questions affirmatively the vast majority of the time would suggest great strides in creating a safe environment for students.

With all the above suggestions adhered to the educator must take into consideration other aspects that interfere with the students self esteem. Cooperative learning has long been touted as a crucial skill that needs to be developed to make an individual successful within and beyond their formal educational years. The dynamics of a group itself may be an issue for acceptance and sharing of ideas for certain individuals creating a threatening environment. Gender issues can become limiting factors in a classroom and surely are so in a group. Debacker (2000) showed that regardless of

achievement levels, females perceived their abilities in a science class as lower than their male counterparts. This could in fact lead to submissive roles in groups and be a deterrent for learning.

With the advent of mainstreaming for the past decades, the introduction of lower ability learning disabled students into the regular educational setting has brought with it additional concerns of belonging and self worth. Howard-Rose (1994) conducted research in which learning disabled students were exposed to two different classroom environments, one a resource room with learning disabled students, the other being a regular education classroom. The students perception of difficulty and completion of a task was always lower in the regular education classroom than in the resource room. Their goal in either class was to complete the work, whether it was correct or reproducible was not important in the outcome. Their need for belonging was so strong that the fear of failure in the regular education classroom became a strong deterrent for their learning.

All the physical and emotional components that work together to create the learning environment impact student learning. It is with great care that educators need to put together and attend to the environment and make it safe for students to learn in. Content is extremely important, as without skills and knowledge, learning cannot occur. However, environment must not be sacrificed for content, as a flawed environment will create a maelstrom of uncoordinated activity in the brain that will not allow learning to take place.

### *Unvaried Modalities of Learning*

Howard Gardener proposed his theory of multiple intelligences in 1983 and has been at the forefront of educational theory ever since. His theories opened the minds of educators everywhere and gave credence to the use of multiple modalities in the classroom. As stated in Guild (1997) too many students in our schools are not learning for a variety of reasons. Applying various teaching modalities provides greater opportunities for students to learn and it focuses directly on how they learn. Without focusing on the students and their learning styles there is much less chance for any individual to learn. Providing various techniques increases everyone in the classes chances of success as their probability of experiencing an event in a way they learn best is increased.

An interesting feature of the theory of multiple intelligences is explained in Armstrong (1994) where it provides for eight different potential pathways of learning. The theory suggests that whatever you are teaching or learning you should attempt to connect it with:

- words (linguistic intelligence)
- numbers or logic (logical-mathematical intelligence)
- pictures (spatial intelligence)
- music (musical intelligence)
- self reflection (intrapersonal intelligence)
- a physical experience (bodily-kinesthetic intelligence)
- a social experience (interpersonal intelligence)
- an experience in the natural world (naturalist intelligence)

Without the varied modalities educators limit their students as a whole as chances at learning a concept are reduced. As Armstrong (1994) states, even if a student doesn't learn in all eight methodologies, the exposures expand their horizons. As will be discussed later in the review, it will be seen that when you factor in the biological aspects

of learning without various teaching techniques, the brain is limited in the number of pathways that can access a learning experience. Therefore the limiting of modalities will deter a student's learning experience.

### ***How the Brain Learns***

Until recently brain research for the most part has been relegated to the realm of qualitative research. Now with the advent of new technologies such as cat-scans and magnetic resonance imaging allowing us to peer into the functioning of the brain itself, more brain research has been in the area of quantitative research and is moving out of the psychology field. All areas of biology, physiology, and genetics are at the center of current research and scientists are now beginning to be able to visualize how learning takes place.

Understanding all of the complexities of how the brain functions and work together is not and may never be totally understood. The discussion of function will be limited to areas of research scientists believe to be areas of the brain most important in the function of memory storage and recall. By no means is the discussion comprehensive, yet for this discussion, will be relevant to the learning environment. The structures discussed will be the cerebral cortex, and the limbic system which is composed of the hippocampus, and the amygdala.

### ***Cerebrum (Cerebral Cortex)***

The cerebral cortex, composed of what is referred to as gray matter, is composed of all the neurons associated with stored information. Neurons in the approximately first one-quarter of an inch layer are constantly searching for associations with other neurons and making connections with dendrites of other neurons with similar memories. As is

described in Wesson (2002), neurons continue to grow and add surface area to the brain, as evidenced by the many folds that have to develop in the outer cortex as the cortex grows in surface area throughout ones life as new experiences and learning take place.

Wesson (2002) stated that physiologically, we cannot store and recall anything that has not been properly attended to and therefore not encoded by the cerebral cortex. Every new experience and association with past experiences increases dendritic connections between neurons of similar associations and therefore increases an individuals ability to recall a specific event. This occurs as any of the neural pathways associated with a related event will have the possibility of triggering the memory an individual wants to recall. The more pathways that are created, the greater the ability there is to get to that event. Along with neurons, glial cells are the most dominant cells in the cortex, actually outnumbering neurons at a ration of 10:1 as described in Wesson (2001). The glial cells function is to nourish and mylenate the neurons. Myelin is a fatty tissue which grows around the neuron insulating it much like insulation over a wire. It does not allow the electrical impulse to escape and stimulate nearby neurons, only ones that are connected by dendrites, and therefore appropriate associated neurons. As reported in Wesson (2001) the frequency of recalled memories prompts glial cells to myelinate neurons even more to hard wire the memory in a manner that it will be easier to recall from storage.

### ***Limbic System***

Mammals are blessed or cursed, dependent on ones viewpoint, with a structure in the brain absent from the reptilian brain called the limbic system. The two structures dominating this portion of the brain are the hippocampus and the amygdala. These

portions of the brain are interconnected with all of the other brains constituent parts and in turn also deeply interconnected with the cerebral cortex. Wesson (2002) states that mammals benefit from this structure in that it enables them to engage in a long-term investment with their offspring and remain close, nurturing their young until they can fend for themselves. Reptiles on the other hand which do not have a limbic system do not care for their young and in fact can even be cannibalistic of their own young.

The reason for this is that the limbic system has been identified as the emotional center of the brain. Having a limbic system then allows for mammals to develop that emotional attachment to their young and since they have fewer young give them a better chance at survival. Wesson (2002) stated that this is what also enables mammals to give emotional attachment to a stored memory. Proof of this is that humans or other mammals with damage to their limbic system show no emotional attachment to their offspring and will not care for their young. Studies of people with damaged limbic systems helped researchers to understand and identify that emotion is centered in the limbic system. Events that are emotional and stressful whether they be joyous or frightening, are always events that are more readily recalled. Therefore emotion has a great impact on what and how an experience is stored and how easy it will be accessed. In the words of Kenneth Wesson "Do emotions influence memory? They drive memory" Wesson (2002).

Keeping this in mind it is important to understand how the hippocampus and the amygdala function in the emotion and the memory allocation business. The evolutionary trait of evolving an emotional center to the brain has enhanced the ability of humans to store vast amounts of knowledge. For humans to recall facts without the ability to reflect

on the emotion attached to the memory would inhibit our ability to think and reason through a set of problems.

### *Hippocampus*

The hippocampus is one of the structures in the brain buried beneath the much larger cerebrum and cerebral cortex. It is one of the seemingly unspectacular structures in the brain defined by Dorland's Illustrated Medical Dictionary, 28<sup>th</sup> edition (1994), as a curved elevation of gray matter extending the entire length of the temporal horn of the lateral ventricle. Nowhere in the definition is there even suggested as to the function of the structure. In the past decade much has been determined as the function of the structure but clues as to the function were known as early as the 1950's. Kandel and Hawkins, 1992 (as cited in Scientific American, 1999) refer to a treatment once used to treat epileptic seizures which was to remove the hippocampus and surrounding areas of the brain. A case study of an assembly-line worker who had suffered from debilitating seizures underwent the surgery to treat his condition but immediately suffered a devastating memory deficit involving the total loss of being able to create "new" long term memories. He had no difficulties in recalling past events before his operation and seemingly no problem with short term memory. This was evidenced by his ability to have a totally normal vocabulary and ability to construct complete sentences in a conversation whereas people with short term memory deficits cannot even remember the start of a sentence to complete a thought properly. The deficit the patient incurred was the inability to take those short term memories and store them in long term memory. It was also shown by the fact he could hold long conversations with the hospital staff and

the next day not even remember the conversation or even recall staff members and their names.

The hippocampus as suggested by Kandel and Hawkins (1992) is only a temporary depository for long term memory until they can be transferred to the cerebral cortex in long term memory storage. The structure itself has demonstrated highly plastic capabilities or an ability to change structure and physical connections which is an ability which is highly required for new learning. It was found the brain activity in the hippocampus is elevated by an event and is continued to be elevated for days or even weeks. It is believed that the hippocampus processes new stimuli and learning and searches out associations that can be built into the long term memory. Without the ability to process the new information long term memory would be impossible. This also gives credence to repetitious learning incorporated with alternative methodologies to strengthen and myelinate new pathways, especially during the first days of new conceptual learning.

### *Amygdala*

The amygdala consists of two almond shaped structures straddling the hippocampus, by all accounts appears to be the center of emotion in the brain. It cannot be overstated as to the importance emotion plays in the ability of an individual to learn and store new memories. Emotion is what determines what we physically attend to and lack of it determines what we will ignore as background stimuli. As was previously stated, you cannot learn what you have not attentively lent your senses to. An apathetic ear is no more likely to learn than a person who is an uninterested and unintended recipient of a conversation. As in the discussion of the limbic system, emotion drives memory, and at the center of that emotion is the amygdala.

The amygdala itself is believed to be the major component in the limbic system responsible for, and the controller of, a persons emotions. As Wesson (2002) describes it, it is more like an emotional thermostat with a hair trigger firing device. The amygdala responds much faster than the cerebral cortex and in essence hijacks the cerebral cortex to make decisions for us without much deliberate processing. This has been an advantageous evolutionary adaptation which has allowed for much faster decision-making and responses which has allowed for the survival of animals in stressful situations. The most commonly known response and the easiest one for researchers to test is the amygdalas response to the emotion of fear. In this instance the amygdala stimulates the adrenal glands to release adrenaline (also known as epinephrine) into the bloodstream. This in turn increases heart rate, respiration rate, blood pressure, and dilates blood vessels allowing more blood to the muscles. The entire sensory system is then put on alert and places the body into the more commonly known state of “flight or fight”. Humans and other animals with limbic systems benefit from this as it can provide the individual with an edge at surviving in dangerous situations by acting upon and even anticipating upcoming events. Another benefit of that emotional experience is of the amygdala, the hippocampus, and the cerebral cortex working in tandem and prioritizing the event and encoding it into memory more efficiently and quickly. Therefore the emotional attachment to the memory makes for a memorable event and is beneficial to the individual to remember it to enhance their future chances at surviving the same or similar situations.

But as aforementioned, the amygdala is like an emotional thermostat and is not an all or none proposition. Any level of emotional arousal to an experience concurrent with

other stimuli can promote memory and trigger that same memory in the future. An example of this is the study mentioned in Bower (2003) where men and women were asked to view words flashed on a computer screen and then recall as many of them as possible. The men and women in the study when asked to recall as many of the words as possible recalled the emotional words much more than they did the neutral words. One must be careful not to generalize but this does seem to be good evidence that even low levels of emotion can reinforce even small events as being more memorable.

But is the ability to have emotions also a curse? The amygdala releases other hormones and chemicals into synapses that can inhibit or enhance connections in neural pathways not intended to be stimulated on a regular basis. An individual living in a stressful environment can pay a terrible price for living in an environment that is unrelenting in fear and other stressful situations. Paying the price for living in a chemical sea of a composition unintended for long term exposure is the brain and as a consequence of that, memory will also suffer.

### ***Hormone Function in Memory***

A discussion of the chemical cocktail involved in the storage of events into memory and the withdrawal of those same events would involve undoubtedly a myriad of various hormones. This discussion will be limited to only a few of these which by research are perceived to be the most important in memory function. In an article by Salzano (2003) the most commonly accepted hormones that immediately affect memory are identified as epinephrine and cortisol. These are both released in lesser or greater amounts, dependent on external reactions due to fear or excitement, by the adrenal glands which receive its cue from the emotion center of the brain the amygdala.

Once stimulated to be released these hormones trigger the emotional event and prepare the body to receive stimuli from all sources and attend external events. In essence these hormones help to drive what will be stored in short term memory and eventually long term memory. But as reported by Murray (1999) a study of more than fifty subjects convinced researchers that consistently high levels of cortisol – emitted due to the bodies response to stress – can briefly inhibit memory recall. This can be a double edged sword as the cortisol that helped to attend to a stimuli and create a new memory can also briefly inhibit the minds ability to recall other events. In fact persistent high levels of cortisol due to chronic stress as reported by Salzano (2003) says cortisol exposure can impair long term potentiation in the hippocampus as well as causing atrophy of the neurons there. As evidence for long term stress and high levels of cortisol exposures as being harmful, a study directed by Tamara V. Gurvits of the Veterans Affairs Medical Center in Manchester, NH, (cited in Bower, 1996) found a 24% smaller hippocampus in Vietnam combat veterans suffering from PTSD (Post Traumatic Stress Disorder) than veterans who were not suffering from PTSD and men who had never served in the military. The effect of stress and the consistent levels of cortisol though beneficial in the “flight or fight” scenario of implicit memory are not beneficial when it comes to withdrawal of those memories in explicit or declarative memory and can even deteriorate the very organ vital for long term memory.

Interestingly enough Salzano (2003) also stated that the stress response in primates, of which we belong, can be triggered not only by a concrete event, but by the mere anticipation or imagined event. The implication this may have in reported cases of

test anxiety in students is beginning to be understood as a true physiological response for a student rather than an emotional obstacle a student needs to hurdle and move on.

### *Memory*

At this point researchers have been able to separate our ability to store information into different types of memory. The first type of memory is referred to as long term memory which is also referred to by researchers as associative or declarative memory. The second type of memory is working memory or short term memory. They both work in conjunction with each other as the working memory allows you to place things into it to be used by providing for short term activation and storage of symbolic information as well as permitting manipulation of that information. The long term memory is the vault in which all of our accessible facts and memories are held, which the short term memory can call on and use immediately or in the near future.

The areas of the brain that seem to house the different types of memory are the cerebral cortex as the long term associative memory and the hippocampus and amygdala as being responsible for the short term acquisition and recall. Evidence to support the latter was previously stated as in the case of the assembly worker who suffered from epileptic seizures, underwent the resection of the hippocampus and amygdala and retained all of his long term memory but had no recollections of short term events.

Each of the areas that support both forms of memory as well as all other areas of the brain are interconnected by many neurons growing new neural pathways and dendritic connections that build new associations with other neurons. The ability of the brain to form these new connections seem to be the impetus for creating new memory and thus learning. The brain has shown to be more plastic than researchers had ever

imagined and is changing and growing throughout our lives. In fact, evidence is strong that neurogenesis is occurring on a daily basis, which we never thought took place much beyond the stages of early development.

In the educational setting it is the educators goal and also their role to effect a change in their students memory. As has been discussed, this is a change in the physiology of the brain. A neverending process of new neural pathways being laid down seeking out neural connections that have associations and then making those connections stronger. As Kenneth Wesson stated, “Neurons that fire together, wire together” Wesson (2002), and the firing and wiring is what builds memory and learning.

If a person was to follow an experience and imagine it being stored into memory it would appear as something like this. First the bodies peripheral nervous system, which are sophisticated extensions of the brain designated as specific stimuli receptors, would detect a stimuli. The stimuli would be analyzed quickly for recognition of shapes, spatial arrangements, odors, tactile sensations, sounds, etc.... anything that may be recognizable. This would take place in parts of the brain that deal with implicit types of memory, areas such as the amygdala that would stimulate the hippocampus to bring up any other relevant associative memories that one should be aware of and place them in the working (short term) memory of the hippocampus. Meanwhile the cerebral cortex would methodically (relative to the limbic system) plod along seeking out all the association it could come up with. The event upon being found as something totally original would be stored in the hippocampus for further analysis. If the event was attached to great emotion the amygdala may even decide to bypass the hippocampus to some extent and urge the cerebral cortex to already start encoding the new event into long term memory. Usually

this step doesn't occur until the hippocampus has experienced the event several times and deemed it relevant to be stored, usually during sleep cycles. It is then that the all important physical growth occurs that cause dendrites from neurons that have information that are associated with each other to grow and connect with each other. Of course the more associations that occur, the better the possibility of an event to be recalled in the future. It is because of this that the event can be reached from many possible entry points or memories. Then the first part of making the long term memory more accessible would be to myelinate the neural network so the pathway is relatively well insulated and doesn't initiate axon potentials in other nearby neurons when the memory is being recalled.

The fundamental components of learning rely on an individual's ability to attend to an event and associate that event with previous knowledge. Then the physiology of the brain takes over and strengthens those connections that form the memory. The challenge is to make long term memories from short term memories. It isn't until that takes place that learning occurs.

### *Models in the Study of Persistence*

In models used to study the persistence of a task, with persistence being defined in Pittenger, (2002) as the extent to which an individual pursues reinforcement that is no longer available, there are two basic models or constructs of research that are followed. These constructs are the experimental paradigm and the cognitive/individual differences paradigm. They are both models designed to test the effect of each study on the partial reinforcement extinction effect. This phenomena has been observed by individuals who experience the extinction of a given response, in this case the extinction of persisting at a

task, after all reinforcement has been removed. In Pittenger, (2002) it is discussed that in the past 70 years that several psychologist's have developed theoretical accounts for the effect. Those of importance to this review being Amsel's frustration theory, Seligman's theory of learned helplessness, and Eisenberger's theory of learned industriousness. Appropriate levels of understanding of each of these theories are necessary for the understanding of the relative applicability of each to the paradigms of persistence.

### *Amsel's Frustration Theory*

Amsel's frustration theory outlines stages a learner progresses through when given partial reinforcement to complete a specific task. As outlined in Pittenger's (2002) discussion, in the first stages of learning a subject is reinforced for desired behavior only periodically. At first the reinforcement evokes no anticipatory response and the nonreinforcement produces no emotional reaction. Eventually positive emotion is elicited by reinforcement and the subject even anticipates the positive reinforcement when a goal is attained.

During the second stage of development the subject becomes frustrated with completed tasks without reinforcement. It is believed that the frustration is due to the anticipatory response receiving no reinforcement. The response is aversive and encourages avoidance of goal directed behaviors.

In the third stage the reinforcement elicits both an anticipatory response and a frustration response. These two responses are incompatible but the anticipatory response to receive reinforcement is greater than the anticipatory frustration response and the subject continues to pursue the positive reinforcement.

The fourth and final stage is when the individual resolves the conflict between the aversive response and the reinforcement and becomes counterconditioned with the reinforcement. In fact the subject receives reinforcement by both the frustration response and the anticipatory response for reinforcement.

The more intriguing aspect of the study is when different levels of reinforcement such as no reinforcement, partial reinforcement, and continuous reinforcement are applied as independent variables in a study. Each of these elicits different responses in the subject which are to be discussed further in how they will affect the desired response of persistence.

### ***Eisenberger's Theory of Learned Industriousness***

Eisenberger's (1992) theory of learned industriousness (as cited in Pittenger, 2002), suggests that effort associated with a contingent response becomes a secondary reinforcer along with the paired external reinforcement and can elicit the anticipatory response in itself, varying in degrees dependent on something defined as easy or difficult. It also states that the individual is encouraged to persist at responses longer as intermittent reinforcement by its very nature may require multiple responses before it is reinforced. Therefore a subject can be conditioned to become industrious. As in the former case, under the umbrella of continuous reinforcement, nonreinforced behaviors become aversive and extinction of target behavior occurs quickly.

### ***Seligman's Theory of Learned Helplessness***

In a study with mice Seligman, 1975 (as cited in Woolfolk, 1993) subjected his subjects to negative reinforcement, an electrical shock, that the mice had no control over. It did not matter what the mice did whether it was a desired response or an unwanted

response, the mice received a shock. The mice were then removed from the aversive situation and placed in a situation where they could now move to a different location in the cage where they could escape the electrical shock. They were so conditioned to the aversive reinforcement that they did not even attempt to escape the negative effects and remained in one spot continually receiving the electrical shock. They became helpless victims of their situation.

Seligman had reasoned that an individual could be conditioned into a life a learned helplessness where no matter what positive reinforcement that is used the individual will withstand the aversive nature of the reinforcement believing there is no recourse. A student who might receives aversive reinforcement that they are incapable by their parents, by their peers, or even by their teachers combined with other environmental factors which bring about stress in an individual, and a situation is created where it is going to be very difficult for that individual to overcome his learned helplessness and make it difficult for them to achieve in an educational setting.

### ***Persistence and its Effect on Student Performance***

In previous reviews the traits of persistence, motivation and goal setting, self efficacy, and attention span are traits that were identified as being critical components for effective learning. This literature review is attempting to show the relationship between an individuals perception of the difficulty of a task and the trait of persistence. Since self efficacy is the judgement of a persons ability to perform a specific task it is also the relationship between two traits of effective learners, perception and persistence. To be an effective learner there are components of each trait, possibly each affecting the other, and these in turn affect the learners outcome.

There are two basic paradigms for studying persistence by researchers. One being the experimental paradigm and the other being the cognitive/individual differences paradigm. In the former experimental paradigm, the researcher believes that levels of reinforcement affect the outcome, in this case the amount of persistence at a task. In the latter paradigm the researcher is making the assumption that the persistence is due to the individuals unique methodology of learning and interpreting inputs. The cognitive/individual differences paradigm theory fits the rationale of whole brain learning whereas the experimental paradigm believes that regardless of individual differences a person can be conditioned to perform a specific outcome.

### *Experimental Paradigm of Persistence*

When Pavlov rang the bell and caused the dog to salivate without the food even being present the first realization that an individual could be conditioned to respond without the reward being presented was discovered. This led researchers to believe that all sorts of responses could be conditioned, even the response of persisting at a task without the reinforcement being present. What was unexpected is that the level or frequency of the reinforcement was what controlled the continued occurrence of the response, in this case the response of persisting at a task. What was also discovered was a condition known as the partial reinforcement extinction effect (PREE). This is the extinction of the desired behavior, or in this case persistence of the task, in the absence of any reinforcement after conditioning. Pavlov's dog experienced this and so have subjects who have had reinforcement withdrawn from them in studies attempting to show the connection between reinforcement and persistence at a task. In his article discussing the two constructs of persistence, Rescorla, 1999 (as cited in Pittenger, D., 2002) states that

the PREE is one of the more thoroughly studied phenomena in learning. The experimental model studies the PREE in the context of varied reinforcement intervals.

This is where Amsel's frustration theory comes into play when discussing the extinction of a preferred outcome. As discussed in Pittenger (2002), Amsel showed that a person who receives partial reinforcement for a target behavior continues the behavior or displays PREE much later on in the study than a person who receives no reinforcement at all or surprisingly continuous reinforcement. A person who receives continuous reinforcement hasn't been allowed to feel frustration and has never had to resolve the conflict or anticipatory response for reinforcement and frustration. The frustration becomes so aversive that extinction of the behavior comes quickly as the individual avoids the previously reinforced behavior.

Of course this is assuming that the reinforcement is positive or perceived as positive. In a study with mice Seligman, 1975 (as cited in Woolfolk, 1993) subjected his subjects to negative reinforcement, an electrical shock that the mice had no control over. Even when the mice were placed in a situation where they could escape the electrical shock they did not attempt to escape the negative effects. They became helpless victims of their situation. The frustration in itself can become so aversive, as in learning disabled students, that a student may become a victim of learned helplessness. Even when given new skills to cope with their learning disabilities, they will do nothing to further their learning as it is perceived as a hopeless proposition.

On the contrary, Eisenberger's (1992) theory of learned industriousness (as cited in Pittenger, 2002), suggests that effort associated with a contingent response becomes a secondary reinforcer along with the paired external reinforcement and can elicit the

anticipatory response in itself, varying in degrees dependent on something defined as easy or difficult. It also states that the individual is encouraged to persist at responses longer as intermittent reinforcement by its very nature may require multiple responses before it is reinforced. Therefore a subject can be conditioned to become industrious. As in the former case, under the umbrella of continuous reinforcement, nonreinforced behaviors become aversive and extinction of target behavior occurs quickly.

### ***Cognitive/Individual Differences Paradigm of Persistence***

The previous model for persistence relies on the construct that reinforcement drives persistence and that it can be conditioned as a response. As described in Pittenger (2002) the cognitive/individual differences paradigm believes that persistence is an outcome of an individual's cognitive abilities and expectations. This tends to give credence to the whole brain learning philosophy as it believes in the predisposition for learning as an individualistic genetic and behaviorally oriented approach to learning. One is born with inherent abilities and through cognitive dissonance can build self esteem and self efficacy which will in turn become their own reinforcers for persistence.

Individuals however may also display the quality of having a central locus of control, where they perceive their behavior is responsible for an outcome, or the antithesis of this as having an external locus of control and perceiving that their behavior is completely independent of an outcome. Subjects who perceive themselves as having an internal locus of control tended to persist at tasks much longer than the subjects who perceived themselves as having an external locus of control.

The above paradigm makes the argument for "nature vs. nurture". It is not a debate that is going to be resolved in this review but it does show that this is by no means

a new debate that has been created as the result of new studies on how the brain functions. It is in reality a debate that is now being revisited as new technology is enabling researchers to probe the workings of the brain in ways that were never available to researchers in the past. The new techniques in brain imaging can now investigate how the brain is functioning on live subjects with no harm being done to an individual.

Whereas in the past the intrusive nature of resection and the default brain impairment of specific areas of the brain due to injury or stroke where the only possible means of studying how the brain functioned and ultimately learned.

### ***Perception and it's Effect on Student Performance***

The purpose of this study was to determine if a student perceived a problem as less difficult would they persist longer in their attempts to solve a specific problem. As discussed previously in Blinco (1993) persistence was one of the factors identified as a trait that will enable a person to have a greater chance at being successful at a task. Blinco described persistence, along with education, as being instrumental in Japan's formula for economic success. It follows then that if a person perceives competence that they will persist. This will also depend on what others skills, goals, and values to learn that topic the student brings to the specific domain being studied. In a learning situation it is fundamental for a student to attend to a task and give it their best attempt and persist at the task a reasonable amount of time or there is "No" chance of any learning taking place. The goal then is to research if it is possible to somehow get the student to initiate attempts at least and give themselves a better opportunity to learn.

But can a state of self efficacy be put in place to urge the subject to persist and attempt a task again? The role that a persons perceived abilities enhance their abilities

can be manifold. One major benefit, especially in regards to the brain and its ability to learn, is that a perceived competence in an area can put a person at ease and be a much less stressful situation than the opposite situation of perceived incompetence producing a stressful debilitating situation that does not allow the brain to function adeptly in extracting information that may be required to solve a given task.

It needs to be clarified that self efficacy is differentiated from self esteem. Self efficacy as defined in Endler et. al. (2001) is task or domain specific whereas self esteem is a more general feeling of self worth. Having low efficacy in one area may affect task persistence on other preferred outcomes but not affect ones overall self esteem. However a person with low self efficacy in most everything can be predictive of low self esteem and even indicative of an anxiety disorder. The distinction needs to be made as most of the research needs to be specific as the self efficacy at a specific task and cannot generalize that a person with low self esteem has low self efficacy on any given task

A study performed by Bouffard-Bouchard (1990) showed that a students perceived self efficacy was related to both their task persistence and in their ability to evaluate the correctness of their responses. In a study done by Endler (2001S) the same results were found but interestingly self efficacy seemed to be a poor predictor of test performance. An example of this is a low ability student having success performing at a task as different learning modalities are being used in spite of low confidence levels.

When previously discussed, it has been shown that it is of primary essence to lower anxiety and stress to accommodate the brains ability to store memories and more importantly to recall associations with which to encode new information. At this point the very real possibility of priming the individual to build self efficacy and better the

chance for learning seem a reality. In a study done by Knoll (1991) that tried to determine whether or not a person would persist at a task even after failure, subjects were given unsolvable priming tasks and target tasks. The group with both tasks described as moderately easy persisted on their target task significantly longer than the group where both tasks were described as highly difficult did. Knoll showed that whether the primary task was easy or difficult the perception of less difficulty was what caused greater persistence at a task. When individuals perceived the task to be of greater difficulty it discouraged persistence among his subjects.

## **CHAPTER III: DISCUSSION**

### **Introduction**

The purpose of this study was to explore teaching modalities that will promote self-efficacy in students so that they persist longer at a task and become successful problem solvers. A historical literature review of philosophical and research based practices in education are discussed from past to present. From the psychology based research and the philosophies they developed, to the truly remarkable science based understandings of the human brains function in learning, past and current ideas are discussed with teaching modalities in mind for how students learn best. The research and history helps the educator to critique their own style of teaching, and compare it in the context of student learning as we now understand it. It is also meant to be an introspective document to help the reader in a self-evaluative process, and to help modify and restructure the way students are educated in their classrooms.

### **Summary**

In the past the educational research which helped develop educational philosophies of the time, were relegated to the realm of psychology. Early influences such as Pavlov and Skinner believed in an extrinsic reward system which could condition a response in an individuals behavior and develop a learning style which could be predictable and sustainable given appropriate reinforcement. It wasn't until the ideas of Piaget's developmental stages and Maslow's hierarchy of need were being widely accepted that educators believed that students of different ages needed to be taught differently. In fact it was now accepted that certain curriculum should receive greater

emphasis at various stages of ones development. The remarkable insights of these early pioneers in education have bore fruit as recent brain research has shown that specific areas of the brain develop and are receptive to learning at various stages in a persons life.

Modern day educational research would truly be remiss if it would not account for and apply what has been observed and learned through biological research or how the brain actually functions. It was Howard Gardener that observed the studies of the brain on stroke victims and persons with brain trauma and compiled data that lead him to believe in each persons own individuality in how their brain forms and learns and is therefore hardwired to learn in a certain manner. It was this insight that led him to develop his theory of multiple intelligences and also helped give rise to the constructivist educational techniques now employed by educators. The time for teaching the whole person had come of age.

In the literature review the characteristics of successful and unsuccessful learners was attempted to be ascertained and the characteristics identified to be most critical to becoming a successful learner were the ability of a student to persist at a task, the ability to be motivated and set goals, and self efficacy. The major deterrents to learning were identified as stress, the learning environment, and limited modalities of learning. This study is attempting to determine whether an individuals perceptions of the difficulty of a task would affect their persistence at attempting to complete that specific task. In essence a persons perception affects and ultimately becomes their self efficacy. It shows how two components of successful learning may affect the other, in this instance the persistence at the task and a persons perception of the ability to perform the task.

It was described by Blinco (1993) that the Japanese societies key ingredient to success in the last several decades was persistence. In fact it wasn't even persistence at difficult tasks but the persistence at tasks most would feel to be drudgery and unchallenging. Nevertheless, persistence at all tasks was identified as what made Japanese people as a culture more successful than their counterparts.

Persistence itself can be researched and described as two separate paradigms. One being the experimental paradigm and the other being the cognitive/individual differences paradigm. The former believes that it is the reinforcement or the type of reinforcement that determines the persistence whereas the latter believes that the persistence is due to an individuals unique style of learning and interpreting inputs.

A persons perceptions of the ability to perform at a given task is influenced by multiple factors and cannot be reduced to a simple equation. That perception can be influenced by the learners environment(s) the student lives in, stressors they encounter, various modalities of teaching they have been exposed to and their successes at each, and even by the way that person is hardwired to learn.

According to Amsel's frustration theory, once a persons frustration becomes aversive a conditioned response which in our scenario is persistence at a task, is quickly lost. Whether it be intrinsic or extrinsic, reinforcement is the motivation that encourages learners to continue to learn. Studies showed that without reinforcement there is no motivation to learn and as with the mouse in the cage, if negative reinforcement is used, a state of conditioned helplessness may even occur. The antithesis of that response is continuous positive reinforcement which also causes rapid extinction of a behavior because as soon as reinforcement is removed the frustration for not being reinforced

becomes so aversive all conditioned learning stops. Research showed only partial or intermittent positive reinforcement elicits the conditioned response to persist at a task beyond the extinction of reinforcement. It can even bring about the condition of learned industriousness as an individual realizes they may have to persist and succeed multiple times before the reinforcement may occur. It is in fact the anticipation of being positively reinforced that becomes the secondary conditioned response as well as the targeted response being reinforced.

As it was eluded to earlier, perception is similar to self efficacy in that they are both task specific. A person can perceive themselves as competent in one area and not in another. The research has shown that the brain functions physically in a manner where stress can be the double edged sword as it can make the memory more likely to be encoded. At the same time it causes the production of cortisol which inhibits memory recall among associated neural pathways that at that specific moment in the learning experience could help understanding of a concept and blocks new learning. It is for this reason that anxiety levels need to be lessened so a student can physically learn and store new ideas and recall memories important to specific thought processes. The confidence an individual learner brings to the learning process lowers their stress levels and with proper reinforcement is the impetus to persist at a task as the individual seeks the extrinsic or intrinsic rewards they can harvest from the experience.

## Conclusions

In pursuing the answer to the proposed thesis question it was necessary to have an understanding of characteristics of successful and unsuccessful learners as well as what factors physically controlled a learners perceptions of their ability at a specific task. The more research that was done the clearer it became that it was the physical that needs to be understood before how we learn will ever be understood.

Early educational research was dealt with in the realm of psychology as the technology was not available for scientists to truly understand how learning took place. Therefore most research was relegated to educational theory and the simple facts that learning can become a conditioned response. Unaware that they were touching on how the brain itself works, these limited experiments as to how learning takes place had to give way to trial and error experimentation of which educational philosophies would work best for the masses. Various techniques were adopted and abandoned as successful and unsuccessful ways of teaching until the technology caught up with research. Now educational research is being overtaken by the biological and chemical realms of science as the best ways for us to understand how new learning takes place and how the brain functions as a whole.

In the context of the research questioned proposed it was found that to be successful in learning, persistence is a dynamic that cannot be overlooked as its importance is crucial in the final outcome. The self efficacy or perception of an individuals ability at a specific task was also found to be important in learning and specifically prompted a person to persist at the task longer and therefore become successful in solving a problem. Interesting enough it was the persistence that was found

to be the greater factor in success at the task and although self efficacy or perception of being less difficult tended to be a factor that compelled many to persist it was not always found to be so. The seeking of reinforcement, whether it be extrinsic or intrinsic became the motivating factor. As long as the frustration, as referred to in Amsel's Frustration theory, did not become too aversive, with proper intermittent reinforcement the individual can be conditioned to persist and even develop where the frustration becomes the motivation as suggested by Eisenberger's theory of learned industriousness.

Stressors to learning can become debilitating for a student and in serious cases can even cause as Seligman, 1975 (as cited in Woolfolk, 1993) suggested, a condition of learned helplessness. This condition can develop as an aversive environment can condition a student to avoid learning as all learning experiences are so aversive that the student cannot move past the frustration to even accept help. Such serious cases need multiple exposures to success before a student can even begin to accept the fact that they can learn.

The real physical factors in learning are still not identified and will be relegated to the areas of brain research. What educators need to take comfort in is the fact that our experiences do show what is successful in the classroom. Empowering students so they can be a part of the learning process along with old tried and true methods of teaching mixed with new and varied modalities with multiple intelligences and whole brain learning in mind makes the brain do what it does best. It experiences and learns, recalls and thinks through problems. If educators can walk the tightrope of memorable but not too stressful, the brain can and will handle the rest and our children will be richer for the experiences.

## **Limitations of the Study**

The researcher has identified three limitations in the study. They are:

- 1.) The variabilities of learning styles make recommendations for a general population difficult.
- 2.) Brain research and how the brain learns in its infancy and inferences made now may prove to be incorrect in the future.
- 3.) Brain research shows individuals perceive their environment in ways that are as unique as fingerprints which again makes inferences for the general population difficult.

## **Recommendations**

Children need to experience success and need to perceive themselves as capable in order to allow themselves to develop the characteristic of persistence that will help them become successful learners. Keep in mind that varied modalities of teaching reach a greater number of students and creates more associations and neural connectiveness in the physical brain. Along with more neural networks being associated with similar memories the possibilities for new learning and greater understanding as well as creative thought processes, is increased exponentially. Therefore the following recommendations are given:

- Create a classroom environment that is safe for the learner
- Have students set both short and long term goals for their achievement
- Set challenging goals for students
- Make problems challenging
- Use introductory priming activities to build confidence in students  
problem solving abilities
- Use varied modalities to teach the same concept

- Keep multiple intelligences in mind and teach to each intelligence
- Use intermittent reinforcement
- Reinforce persistence at a task
- Build self-efficacy at specific tasks

## References

- Anderson, D. M. (Ed.). (1994). Hippocampus in *Dorland's Illustrated Medical Dictionary (23<sup>rd</sup> Ed.)*. Philadelphia, PA: W. B. Saunders Co.
- Anshel, M.H., & Weinberg, R. (1992, June). The effect of goal difficulty and task complexity on intrinsic motivation and motor performance [Electronic version]. *Journal of Sport Behavior*, 15(2), 159-178.
- Armstrong, T., (1994), *Multiple intelligences in the classroom*. Alexandria, VA: Association for Supervision and Curriculum Development.
- Blinco, P. M. A., (1993). Persistence and education: A formula for Japan's economic success [Electronic version]. *Comparative Education*, 29(2), 171-184.
- Bluestein, J. (2000, June), Memory and the brain [Electronic version]. *Instructor*, 110(2), 35-37.
- Bouffard-Bouchard, T. (1990, June). Influence of self-efficacy on performance in a cognitive task [Electronic version]. *Journal of Social Psychology*, 130, 353-364.
- Bower, B. (1996), Exploring trauma's cerebral side [Electronic version]. *Science News*, 149(20), 315.
- Bower, B. (2003), Forgetting to remember [Electronic version]. *Science News*, 164(19), 93.
- Brooks, J. G., & Brooks, M. G. (1993). *In search of understanding the case for constructivist classrooms*. Alexandria, VA: Association for Supervision and Curriculum Development.
- D'Orio, W., (1999, Spring), 100 years of education leaders [Electronic version]. *Curriculum Administrator*, 35(12), 20-30.
- Dai, D. Y. (2000, Summer). To be or not to be (challenged), that is the question: Task and ego orientations among high-ability, high achieving adolescents. [Electronic version]. *Journal of Experimental Education*, 68(4), 311-331.
- DeBacker, T. K. & Nelson, R. M. (2000, Mar/Apr). Motivation to learn science: Differences related to gender, class type, ability [Electronic version]. *Journal of Educational Research*, 93(4), 245-255.
- DeBell, C. S., & Harless, D. K. (1992, April). B. F. Skinner: Myth and misperception [Electronic version]. *Teaching of Psychology*, 19(2), 68-73.

- Endler, N. S., Speer, R. L., Johnson, J. M., & Flett, G. L. (2001, Spring). General self Efficacy and control in relation to anxiety and cognitive performance [Electronic version]. *Current Psychology*, 20(1), 36-53.
- Gardener, H. (1983), *Frames of mind*. New York, NY, BasisBooks.
- Gardener, H. (1999), *The disciplined mind: What all students should know*. New York, NY, Simon & Schuster.
- Gipps, C., & Tunstall, P. (1998, June). Effort, ability and the teacher: Young children's Explanations success and failure [Electronic version]. *Oxford Review of Education*, 68(4), 311-331.
- Howard-Rose, D. & Rose, C. (1994, Spring). Students' adaptation to task environments in resource room and regular class settings. [Electronic version]. *Journal of Special Education*, 28(1), 3-27.
- Jensen, E. (1998), *Teaching with the brain in mind*. Alexandria, VA: Association for Supervision and Curriculum Development.
- Kandel, E. R., & Hawkins, R. D. (1999). *The Scientific American Book of the Brain*. Guilford, CT: The Lyons Press.
- Kaplan, L. S., & Owings, W. A. (2000, Nov). Helping kids feel safe, valued, and Competent [Electronic version]. *Education Digest*, 66(3), 24-29.
- Knoll, M. D. (1991). Persistence following differential failure [Electronic version]. *Journal of Psychology*, 125(4), 241-252.
- Murray, B. (1999). Forgetful? It could be just stress [Electronic version]. *U. S. News and World Report*, 126(24), 70.
- National Commission on Excellence in Education. (1981, August). A nation at risk. Retrieved August 24, 2004, from <http://www.ed.gov/pubs/NatAtRisk/risk.html>
- Pittenger, D. J. (2002, Aug). The two paradigms of persistence [Electronic version]. *Genetic, Social & General Psychology Monographs*, 128(3), 237-269.
- Salzano, R., (2003, September), Taming stress [Electronic version]. *Scientific American*, 289(3), 88-97.
- Schunk, D. (1991). Self-efficacy and academic motivation [Electronic version]. *Educational Psychologist*, 26(344), 207-231.
- A Science Odyssey: People and Discoveries: Abraham Maslow*. Retrieved July 14, 2004, from <http://www.pbs.org/wgbh/aso/databank/entries/bhmasl.html>

- Wesson, K. A., (2001, Fall). What recent brain research tells us about learning [Electronic version]. *Independent School*, 61(2), 58-70.
- Wesson, K. A., (2002, Winter), Where is God in the brain? [Electronic version]. *Independent School*, 61(2), 70-77.
- Wigfield, A., & Karpathian, M. (1991). Who am I and what can I do? Children's self Concepts and motivation in achievement situations [Electronic version]. *Educational Psychologist*, 26(3&4), 233-261.
- Wolfe, P. (2001). *Brain matters: Translating research into classroom practice*. Alexandria, VA: Association for Supervision and Curriculum Development.
- Woolfolk, A. E., (1993), *Educational Psychology (5<sup>th</sup> Edition)*. Needham Heights, MA: Allyn and Bacon.