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Creating Minds, an Analytical study of Using Brain Based Learning in Visual Arts and Design Education

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Abstraction

"What is creativity?" "How creative can I get?" "I do have many creative ideas, but I can't get my hands to draw them!" As an architecture and interior architecture educator, the author always hears this type of questions from the students especially the freshmen. They always blame their hands and strive to develop their free-hand way of drawing while the problem has nothing to do with these hands. It is their way of thinking and perception which they practice daily while knowing nothing about its course of action. Brain Based Learning offers the knowledge of the structure and functions of the organ of thinking, the brain, and how to utilize that in education.

But to many, the term "brain-based learning" sounds redundant. Isn't all learning and teaching brain-based? The answer is, yes, but there is a difference between "brain-compatible" education, and "brain-antagonistic" teaching practices and methods which can actually prevent learning (Lisa Chipongian). Learning must go beyond memorization to include goal directed learning that allows the student to emerge with a new idea or realization, in another word to be creative.

This study started with the assumption that using brain based learning enhances the capability of visual art and design students to control over their Creativity Progressive Stages. The study started with a deep cross-disciplinary search about the brain creative capabilities and the teaching strategies that get the best use of these capabilities and end up with a new integrated view of the brain based learning for visual art

and design. The study Proposed 6 additional Principles for brain based arts and design education. That led to modification of the brain based learning Instructional Approach to be applicable for art and design education and the result was suggested 6 steps course structure, for beginners, which trains and activate their creative brain and allow them to control over their Creativity Progressive Stages..

1. Introduction

1.1 What is "Brain-Based Learning"?

*People often say that everyone **can** learn. Yet the reality is that everyone **does** learn. Every person is born with a brain that functions as an immensely powerful processor. Traditional schooling, however, often inhibits learning by discouraging, ignoring, or punishing the brain's natural learning processes, (www.ukfootballcoachingnetwork.co.uk/).*

This inhabitation may explain why not long ago, most scientists believed the brain became "hard-wired" during childhood, and that there was little you could do to improve its function once you entered adulthood. Not any more. During the last two decades neuroscientists have been doing research that proved that the brain retains its plasticity (the ability to rewire itself for better function) throughout life, (http://bfc.positscience.com/).

Based on that, professors from major universities have taken this information and incorporated it into books about learning. Some open-minded teachers start applying theses new theories of teaching and learning based on recent findings. The "Brain-based learning" theory started to prove its success as a combination of common sense and brain science.

*This learning theory is based on the structure and function of the brain. Simply it can be stated as, as long as the brain is not prohibited from fulfilling its **normal** processes, learning will occur. This type of education provides a biologically driven framework for teaching and learning, and helps explain recurring learning behaviors. It is a meta-concept that includes and eclectic mix of techniques.*

1.2 What is Creativity?

In her book "Drawing on the Artist Within" Betty Edwards asked "What on earth is creativity? How can a concept be so important in human thinking, so crucial to human history, so dearly valued by nearly every one yet be so elusive?" She also stated "To date we still have no generally accepted definition of creativity- no general agreement on what is it, how to learn it, how to teach it, or if, indeed, it can be ***learned*** *or* ***taught****".*

The steps of the creativity process were not recognized until late 19th century. Throughout the 20th century the number of steps increased and the concept of creativity developed from just solving problems that continually arise in human life with new ideas to the process of searching out and discover problems to solve that no one else has perceived; as Albert Einstein and Max Wertheimer stated "to ask a productive question is a creative act in itself", (Edwards B., 2007).

Except of the Gestalt psychologists (for whom creativity is un-segmented process), researchers have generally agreed on the basic concept that creativity involves five progressive stages which occur over varying lengths of time, figure (1). These stages are:

1. ***First Insight****. A preliminary stage of problem finding (a term that encompasses both problem solving of existing problem and problem finding for asking new productive question).*
2. ***Saturation.*** *The stage of research*
3. ***Incubation.*** *The mulling-over or think-over stage****.***
4. ***Illumination.*** *The sudden solution stage****, or the birth of the idea***
5. ***Verification.*** *A final stage that put the solution into concrete form while checking it for error and usefulness.*

First Insight	Saturation	Incubation	*	Verification
1	2	3	4. Illumination	5

Figure (1): The five stages of creativity

Source: Edwards B., 2007, Drawing on the Artist Within, p. 4

These stages progress over time from one stage to the next. Each stage may occupy varying lengths of time, figure (2). Only Illumination is in almost every case reported to be brief- a flash of light thrown on the subject. Also one project may require repeating the cycle of stages. (Edwards B., 2007)

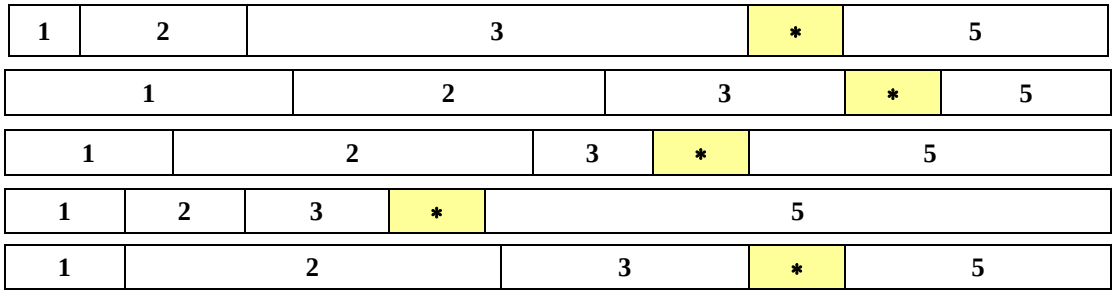

Figure (2): Variations of the creativity process
Source: Edwards B., 2007, Drawing on the Artist Within, p.4

2. Visibility of the Study

The students of first year in Arts and Design field always ask themselves and their teachers "Am I creative?" The answer of this question seems to depend on something we usually call "talent"- the idea that either you have a talent for creativity or you don't. But "Talent is a slippery concept" as Gerhard Gollwitzer said in his book (The Joy of Drawing, 1988), because it varies from hidden to naturally talent.
It is the teachers' task to help the students rediscover these varieties of talent and ***fined a way to shift them to brain modes*** *appropriate for creativity and developing particular skills and to gain greater understanding of creativity and control* ***over*** *the* ***creative process***
Brain based learning is one of the most efficient way that offer a good opportunity to do so. It relays on the idea that how the brain works has a significant impact on what kinds of learning activities are most effective. This information has helped determine how human learning actually occurs. (Spears, et al.)

Yet, it was the consensus of many participants at the brain-based workshops facilitated by Randall Fielding, AIA, (www.designshare.com), that brain-based learning and the strategies that are emerging from it, still requires a more systemic way of conceptualizing how learning takes place and how to facilitate it. Another concern with knowledge emerging from neuroscience is the need for translation into brain-based learning strategies that can be used by educators.

The conclusion reached by both facilitators and general participants was that the issue needs all the efforts to be combined together to establish a concrete base for the future. Educationalist from all specials should try to participate in this interpretation, especially in the Art and Design field, as there are few –but very valuable- studies about using brain based learning in Arts and seldom in Design.

For all of that, this study is trying to take a part in these efforts and insight practicing the brain based learning in the filed of visual arts and design. It can be considered a pioneer study in applying brain based learning in teaching Design, a subject that needs to deal with inelegance and creative talent at the same time.

3. Problem Statement

Teaching visual arts and design such as architecture and interior design need very special capabilities. In addition to intelligence, the students in this field also need a creative brain. They are required all the time to manipulate the information they get from the class and research, and then convert them to creative aesthetical and functional ideas. This manipulation which is called the creative process takes varying lengths of time (as mentioned above), it also needs a lot of concentration and effort, which leave the student emotionally involved, stressed and frustrated if he couldn't reach the Illumination stage soon enough.

The last decade witnessed many successful examples and studies in practicing brain based learning in all levels of education in many subjects. This meta-concept way of learning that includes and eclectic mix of

techniques; reduced the amount of stress in the class rooms and were able to get to the educational goals in the easiest and fastest way. The question now is:

1. Is brain based learning suitable to be used in visual arts and design studies so as to control over the varying lengths of time **of the creativity progressive stages**?
2. Can brain based learning be used to enhance a very slippery concept such as talent?
3. Traditional ways of teaching were able to enhance the students' natural talent. Can brain based learning be used to unveil the hidden talent and upgrade it.

4. Problem Boundaries

Since Architecture is the mother off all Arts, this study will focus on practicing brain based learning in teaching architecture and interior architecture students.

5. Goals and Objectives:

This study aims to:

1. *Proving that brain based learning is a suitable method to be used in visual arts and design education and to control over varying lengths of time **of the creativity progressive stages**.*
2. *Examining the brain/mind learning principles and suggesting new principles for art and design education.*
3. *Deducing a new integrated Instructional Approach of the brain based learning for visual art and design*
4. *Suggesting a course structure for arts and design beginners.*

6. Methodology:

*This analytical study uses a combination of two methods for more in-depth analysis. It is a combination of field experimental and observational study. These methods are often used in the social sciences, and especially in analyses of education or health interventions (Schick, et al., 2002). **Field experiments** have the advantage that outcomes are **observed** in a natural setting rather than in a contrived environment.*

The study experiment the use of brain based learning theory in visual art and design. The author applied this theory on design classes and design related subjects for the last three years. This field experiment took place in the Interior Architecture Department, College of Architecture and Planning, King Faisal University. The average number of students per class were 40. design classes were co-teaching classes with 3 to 4 instructors, and the author was the coordinator. There were four levels of information gathered from students, including getting their:

1. *Reactions and feelings (about their progress, the time they need to reach Illumination stage and positive and negative frustration)*
2. *Learning (how much they know about their mind capabilities, attitudes, perceptions and knowledge)*
3. *Changes in skills (the effect of what they learned on developing and enhancing their hands and drafting skills)*
4. *Effectiveness (the effect of all the above on enhancing their creativity progressive stages and improving their overall performance and behaviors)*

It is well known that the farther the research results get down this list, the more useful is the research results, (Schick, et. al, 2002).

7. Literature Review

During the last two decades neuroscientists have been doing research that has implications for improved teaching practices. They construct clinical studies that use large, diverse, multi-age, multicultural groups of people to gather reliable information. This information has helped determine how human learning actually occurs (Spears, et. al). It was discovered that how the brain works has a significant impact on what kinds of learning activities are most effective.

Specifically based on conclusions from these researches in neuroscience, professors from major universities all over the world have taken this information and incorporated it into books about learning.

Some noted authors in this area are Marian Diamond, U. C., Berkeley; Howard Gardner, Harvard University; Renate and Geoffrey Caine, Eric Jensen; etc. (Spears et. al)

It has to be said that the author found few studies that took brain information and incorporated it into learning in the field of Visual Arts especially drawings, but not of Design. Betty Edwards, California State University and Howard Gardner, Harvard University are among very few authors in this area. Edwards's book "The New, Drawing on the Right Side of the Brain" (2002) is a brilliant approach to recent developments in brain research that relate to developing ***drawing skills****. Also Gardner's book "Art Education and Human Development" (1991) is another pioneering work that links* ***art*** *education with brain capabilities.*

So, the need for such studies and application of brain based learning in visual art (generally) & design (specifically) was an additional motive for the author to get the benefit of this new theory of learning and applies its approach in the visual arts and design studios. In the coming literature, the author will review the most known ***principles*** *and* ***elements*** *of brain based learning in general, so it can be used as a solid scientific core for this study in applying brain based learning in visual arts and design education.*

7.1 Principles and Elements of brain based learning:

The nine brain-compatible elements identified in the ITI (Integrated Thematic Instruction) model designed by ***Susan Kovalik*** *are very well known. They include: Absence of Threat, Meaningful Content, Choices, and Movement to Enhance Learning, Enriched Environment, Adequate Time, Collaboration, Immediate Feedback, and Mastery (application level). (http://www.kovalik.com/)*

Renate and Geoffrey Caine, authors of Making Connections: Teaching and the Human Brain (1991), Unleashing the Power of Perceptual Change: The Potential of Brain-Based Teaching (1997), and Education on the Edge of Possibility (1997) build on the idea of ***brain-compatible*** *learning end up with a list of* ***twelve*** *"brain/mind learning* ***principles****" and* ***three interactive elements*** *emerging out of these principles, figure (3). These principles, according to Caine and Caine, synthesize research related to the*

brain and learning from many disciplines and present it in a form that is useful to educators. These twelve principles are the most well known and used among the many support the approach of educating using the brain's function. They can function as a theoretical foundation for brain-based learning, and offer guidelines and a framework for teaching and learning. (http://www.cainelearning.com)

Caine and Caine did not base the "12 Brain/Mind Learning Principles solely on the findings of neuroscience. Instead, these principles and the ideas generated from them come from a wide range of additional disciplines, including cognitive psychology, sociology, philosophy, education, technology, sports psychology, creativity research, and physics. As Caine and Caine explain, all of the principles are "the result of a cross-disciplinary search."

The principles were originally spelled out in their book Making Connections, Teaching and the Human Brain (1991). *The principles look at all learners as living systems where physical and mental functioning are interconnected (learning is psycho-physiological).*

Caine and Caine do not use these principles to prescribe any single teaching method. Instead, the principles are intended to provide a framework for "selecting the methodologies that will maximize learning and make teaching more effective and fulfilling." They may open doors for educators, increase teaching options, or serve as a guidepost to educators already working to implement brain-compatible teaching practices. Following is the complete list of the twelve brain/mind learning principles, as defined by Caine and Caine: (http://www.cainelearning.com):

Figure (3): The twelve "brain/mind learning principles" and the three interactive elements emerging out of them
http://www.cainelearning.com

Principle #1: All learning engages the physiology

The research on plasticity (it is the fact that all brains are unique and a product of interactions with different environments, generating a lifetime of different and varied experiences) as well as brain research in general, tells us that the body and mind are totally interconnected. When a person is appropriately engaged in a complex experience, including decisions about what to respond to and how to adapt, multiple body/brain/mind systems are integrated, focused and working together naturally.

Educators must begin to understand what this principle is saying and how to translate this information into practice.

Capacity #1*: to translate this principle into practice, it can be said that all students learn more effectively when involved in experiences that naturally call on the use of their senses.*

Principle #2: The brain/mind is social

Every individual on this planet comes complete with what Gopnik, Meltzoff, and Kuhl (1999) have called the "contact urge" (http://www.cainelearning.com). Social relationships, with an emphasis on belonging, being recognized, listened to, and noticed; all contribute to a sense of relaxed alertness. Language, beliefs, our state of mind and access to higher order learning are deeply influenced and affected by the way we relate to others and how others relate to us. The impact of relationships and community on learning in and out of class rooms can not be ignored.

Capacity #2: *All students learn more effectively when their social nature and need for relationship are engaged and honored.*

Principle #3: The search for meaning is innate

The need to make sense of things is characteristic of every human being from infancy to adulthood. It has been called the "explanatory drive" by Gopnik, Meltzoff, and Kuhl, (1999) (http://www.cainelearning.com). The brain is meaning-driven – meaning is more important to the brain than information. The search for meaning is enhanced by – and enhances – relaxed alertness.

Capacity #3: *All students can learn more effectively when their interests and ideas are engaged and honored.*

Principle #4: The search for meaning occurs through patterning

Pattern recognition is the ability to identify and understand the things in the environment. The human brain is constantly seeking patterns in its environment. All human beings are driven by a need to identify, name, and organize the configuration of elements – or patterns – that make up their known world. Patterning refers to the meaningful organization and categorization of information.

All decision making is based on the patterns that a person perceives and the choices that are made about where to focus. The brain is programmed to perceive and generate patterns and resists having meaningless patterns imposed on it. Leslie A. Hart in his book "Human Brain and Human Learning"(1999), has identified six patterns the brain identifies. These are objects, actions, procedures, situations, relationships and systems. The brain does not take in patterns in a logical, sequential manner. It takes them in randomly. In order to determine the patterns in ones environment the brain needs many, many real experiences (http://members.aol.com/). Education is about increasing the patterns students can use, recognize, and communicate. Patterns and programs drive their understanding – intelligence is the ability to elicit and to construct useful patterns

*Capacity #4**:** All students increase learning when new patterns are linked to what they already understand.*

Principle #5: Emotions are critical to patterning

Emotions are central to human life. They are a part of every thought, decision, and response. Powerful learning is enhanced by rich emotional experiences, guided and moderated by higher order functions. They drive our attention, meaning and memory. Relaxed alertness can be facilitated by educators who fully grasp the relationship between the role of various emotions and learning.

Capacity #5: All students can learn more effectively when appropriate emotions are elicited by their experiences.

Principle #6: The brain/mind processes parts and wholes simultaneously

The brain/mind is programmed to make sense of the world. The world that surrounds any one of us at a given time contains an infinite amount of information. Making sense of experience requires both a big picture and paying attention to the individual parts. Teaching needs to begin with an experience for students that provide exposure to the overall nature of the subject. The experience of the whole provides a story, a model, or a fascinating example of what can be achieved. The details or "parts" are taught as students pursue their urge to create or understand something of larger significance to them.

Capacity #6*: All students can learn more effectively when their experience gives them a sense of the whole that links the details (facts and information).*

Principle #7: Learning involves both focused attention and peripheral perception

It is well known that before human beings can learn or make effective decisions, they must pay attention. Attention is a natural phenomenon guided by interest, novelty, emotion, and meaning. Attention is critical to memory. What is less understood is the fact that human beings also learn from a context they rarely consciously attend to.

This is how the nuances of our cultures are taught and how children "pick up" behaviors, beliefs, and preferences or dislikes without ever having paid direct attention to how they were learning these (Schacter, 1996). Educators need to engage students in situations that call for higher order functions invoking and engaging students' natural and inborn need to attend and make decisions. Educators also need to understand how the context teaches and how to use that context to support the more explicit learning required of all students.

*Capacity **#7:** All students can learn more effectively when their attention is deepened and multiple layers of the context are used to support learning.*

Principle #8: Learning is both conscious and unconscious

Learning involves layers of consciousness. Some learning requires a person to consciously attend to a problem that needs to be solved or analyzed. Some learning at a deeper level requires unconscious incubation in the same way that the creative insights of artists and scientists sometimes occur after the mind has done some unconscious processing. Beyond that, really successful learners are also capable of monitoring themselves – a central feature of higher order functions – so that they know their own strengths and weaknesses and can take charge of how they learn. In order to help their students attain high standards, educators must be able to work at all three levels with students.

Capacity #8: *All students can learn more effectively when given time to reflect and acknowledge their own learning.*

Principle #9: There are at least two ways of organizing memory

One is to store or archive isolated facts, skills, and procedures. The other is to simultaneously engage multiple systems in order to make sense of experience.

Memory is what makes any type of performance possible, so memory is indispensable for survival and success. However, there is a great deal of confusion about how memory works, and this confusion is one of the reasons why the goals of education are often conflicted. The key distinction that educators need to make and understand is between rote memorization, which is the hallmark of traditional approaches to teaching, and the dynamic spatial memory that is engaged in everyday experience. Sometimes facts and procedures do need to be memorized, but rote learning is different from dynamic memory, where the learners are more likely to be engaged naturally as they sift through what they recognize in order to make decisions in new contexts.

Capacity #9: *All students can learn more effectively when taught through experiences that engage multiple ways to remember.*

Principle #10: Learning is developmental

Although all human beings have in common a somewhat predictable process of development, rarely do human beings develop in precisely the same way or at exactly the same rate. All learning builds on previous learning, and we now know that this process is accompanied by changes in the physiology and brain which are altered by experience. While most educational systems tend to categorize and organize learners on the basis of their age or in some other logical or sequential fashion, this does not address the vagaries of human development. Performance, not age or grade level provides the best evidence for future learning.

*Capacity **#10:** All students can learn more effectively if individual differences in maturation and development are taken into consideration.*

Principle #11: Complex learning is enhanced by challenge and inhibited by threat associated with helplessness and fatigue

For every human being, from birth 'til death, threat tied to fear and helplessness sabotages the most promising kind of learning, including higher order thinking (executive functions). Relaxed alertness is the ideal mental state for higher order functioning. Creating an environment that fosters this mental state must be a primary goal for teachers and educators.

Capacity #11: All students can learn more effectively in a supportive, empowering and challenging environment. The impact of threat or high stress can alter and impair learning

Principle #12: Each brain is uniquely organized

The paradox that faces education is that human beings are both similar and different. For example, every human being is an expression of DNA, and that process is universal. Yet every individual has a unique genetic blueprint. To genuinely raise standards, educators have to grasp and deal with the commonalities

of their learners and, at the same time, address each student as a unique individual with unique characteristics, capacities, and needs. Ultimately, it is only by adequately developing their unique capacities that students and teachers will be able to cope successfully with the issues of sameness and diversity.

*Capacity #12**:** All students can learn more effectively when their unique, individual talents, abilities, and capacities are engaged.*

These principles are not meant to represent the final word on learning. As more is discovered about the brain, how we learn and remember, educators will need to update their knowledge. It can be said that brain based learning and its principles are new, integrated view of the learning process and the learner. It moves us away from seeing the learner as a blank slate and toward an appreciation of the fact that body, brain, and mind are a dynamic unity.

*Caine and Caine also conclude that "Optimizing the use of the human brain means using the brain's infinite capacity to make connections–and understanding what conditions maximize this process." They identify three interactive and mutually **supportive elements** that should be present and mastered by teachers and understood by all educators in order for complex learning to occur. They are addressed each separately but it is critical to understand that each of these elements has a profound affect on the other two and is in fact never separate (http://www.cainelearning.com):*

1. *Relaxed Alertness (Optimum emotional climate for learning)*
2. *Orchestrated Immersion in Complex Experience (Optimum environment for learning.)*
3. *Active Processing (Optimum conditions for consolidation and expansion of learning.)*

1. Relaxed Alertness – Creating the optimal emotional climate for learning

*There is an optimal emotional state for learning which is affected and moderated by the fear and pleasure centers in the brain. Caine and Caine called this state optimal **Relaxed Alertness**. In their book, Making Connections (1991), they defined it as consisting of low threat and high challenge. This state exists in a*

learner who feels competent and confident, and is interested or intrinsically motivated. Relaxed Alertness is also a state that is present in classrooms and learning environments in which emotional and social competence is the goal. Such an environment allows all students ongoing opportunities to experience competence and confidence accompanied by motivation linked to personal goals and interests.

2. Orchestrated Immersion in Complex Experience - Creating optimal opportunities and environment for learning

*The human brain learns through experience**.** The brain's first contact with the world is through the senses. So learning must engage our senses. These are naturally activated by physical interactions that the learner has with the world at one level then, "orchestration" means that teachers provide experiences that have learners interact with knowledge in ways that are concrete and physical. Based on a physical experience, teachers can help students identify physical attributes of something using descriptions (size, color, and dimension), diagram (draw, mold, shape, build) and helping students create a model of something they need to master.*

*The brain also learns by making connections between what is experienced and what that experience means to the learner**.** Teaching therefore needs to require and invite the learner to make connections to what is already organized and stored in their brain. That happens when students are called on to relate and understand the new in terms of what they already know and care about. This is the basis for the acquisition of technical/scholastic knowledge which is more traditionally academic. It requires the student to grasp the what, how, when and why of information based upon puzzles or dilemmas they encounter. It includes but goes beyond physical attributes of objects and fuels the **search for explanations and understandings** that are deeper and more complex.*

*Ultimately the brain needs to "own" the learning by having the learner do something with what has been learned**.** This means that students need to be given the opportunity and at times be required to use the information to answer personally relevant questions and to act in practical ways to solve problems and*

make things happen in relatively realistic contexts. On the other hand the teacher's job is to create learning experiences and opportunities, and only to lecture when appropriate.

3. Active Processing of Experience – Creating optimal ways to consolidate learning

The brain is better at remembering things that are of meaning to the student. We are after performance knowledge (knowledge that the student can use). This goes far beyond standardized testing as it currently exists.

In order to fully capitalize on experience, there should be "in the moment", ongoing consolidation that solidifies and expands knowledge. Caine and Caine called this Active Processing of Experience.

Using teacher and peer questioning and feedback, students are continually required to think more deeply, identify specific characteristics and see relationships, analyze situations, think on their feet, develop goals and time lines, make critical decisions and communicate their understanding.

7.2 Brain based learning Instructional Approaches...

To maximize learning and make teaching more effective and fulfilling, the educators who practice brain based learning and know how to work with the three supportive elements of teaching modified the traditional model of instructional approach to a brain compatible approach. Table (1) compares the old and new version of traditional instructional approach with the brain based learning. It can be noticed that the student characteristics and needs are the forcing power of the brain based learning instructional approach while the teacher perceptions and judgments are the forcing power of the traditional one.

Table (1): Comparison between the traditional model and brain based model of Instructional Approach

	Instructional Approach One (old traditional model)	Instructional Approach Two(new traditional model)	Instructional Approach Three (brain based learning)
View of learning	**Memorization of facts and skills, and veridical decision making.**	**Intellectual understanding supplemented by memorization, with some opportunities for adaptive decision making.**	**Understanding in order to make sense of experience with strong emphasis on adaptive decision making and development of executive functions.**
Instruction	**Largely focused on teacher presentations followed by repetition and practice.**	**Teacher led experiences orchestrated around concepts and meaning. Includes student choices and input on assignments, class rules and assessment (eg. rubrics).**	**Real world projects with curriculum embedded driven by student choices and interests.**
Academic goals	**Completion of assigned work, high grades based on teacher judgment and standards.**	**Mastering curriculum and standards**	**Going beyond academic school standards through ongoing, authentic questioning, investigation and documentation based on experts in the field.**
Assessment	**Standardized tests**	**Authentic assessment supplements standardized tests**	**Authentic performance of all kinds**

http://www.cainelearning.com/instructionalApproach