BRAIN-BASED EDUCATION: ITS PEDAGOGICAL IMPLICATIONS AND RESEARCH RELEVANCE

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ABSTRACT

The brain, being the organ of learning, must be understood if classrooms are to be places of meaningful learning. Understanding the brain has the potential to alter the foundation of education, transform traditional classrooms to interactive learning environments and promote better instructional approaches amongst teachers. Brain-based education is the application of strategies based on principles derived from an understanding of the functionalities of the brain. Brain-based education informs an educator on the modalities of the brain to be able to effectively leverage upon a particular instructional strategy that is aligned with the learning conditions. In this paper, the affordances of brain-based education in enhancing educational processes and the research potential of brain-linked education are explored.

Keywords: Brain-based Education, Brain-based Learning, Effective Learning.

INTRODUCTION

Hart (1983) had argued that teaching without an awareness of how the brain learns is like designing a glove with no sense of what a hand looks like. The brain, being the organ of learning, must be understood if classrooms are to be places of meaningful learning. Understanding the brain has the potential to alter the nature of education, transform traditional classrooms to interactive learning environments, change the way tests measure intelligence or learning, and promote better health and behaviour in children and teens. Advances in brain research technologies have allowed researchers to observe more clearly patterns of brain activity during the learning process. The brain is now seen as a living, unique, ever-changing organism that grows and reshapes itself in response to challenges. Recent neuro-cognitive research suggests that the richness of early learning experiences affects the physical development of the brain and may be a major cause of intellectual development. If these new theories linking learning experiences with brain development come to be accepted, the optimal match between characteristics of the learner and the learning environment might be seen as a strong factor for school success. Brain research is not going to provide all the answers, but it certainly is going to give us a more informed knowledge-base on which to make our decisions. A theoretical foundation of brain-based learning would offer guidelines and a framework for teaching and learning. Current brain research is still in its infancy and the link between brain functions and development with learning science has yet to be fully understood. At this early stage, it would appear timely that we embark on initial research studies that could lead to a better understanding of brain-based learning in science education.

Brain-based Education and its Scope

Brain-based education is the "engagement of strategies based on principles derived from an understanding of the brain. "The brain plays a central strategic role in shaping the dynamics of learning. Therefore a good understanding of the functional attributes and modalities of the brain is essential for an educator to be able to coherently buttress the use of a particular instructional strategy that meets the learning expectations of a learning condition (Jensen, 2008).

Teachers need to substantiate the selection of an instructional method over another based upon what she/he knows as to how the brain works in processing knowledge (Stevens & Goldberg, 2001).

Brain-based learning has been called a combination of brain science and common sense. Caine and Caine (1991) developed twelve principles that apply what we

know about the function of the brain to teaching and learning. These principles were derived from an exploration of many disciplines and are viewed as a framework for thinking about teaching methodology. The principles are:

- The brain is a complex adaptive system.
- The brain is a social brain.
- The search for meaning is innate.
- The search for meaning occurs through patterning.
- Emotions are critical to patterning.
- Every brain simultaneously perceives and creates parts and wholes.
- Learning involves both focused attention and peripheral attention.
- Learning always involves conscious and unconscious processes.
- We have at least two ways of organizing memory.
- Learning is developmental.
- Complex learning is enhanced by challenge and inhibited by threat.
- Every brain is uniquely organized.

Brain-based education has evolved as a discipline over the years and encompasses a number of connected domains of expertise. From an initial singular-level "turf-based" approach to brain-based understanding, the current model is highly inter-disciplinary involving sociology, pedagogy, psychiatry, nutrition, psychology and cognitive sciences (Jensen, 2008). (Dr Antonio Damasio explains that "the relation between brain systems and complex cognition and behavior can only be explained satisfactorily by a comprehensive blend of theories and facts related to all the levels of organization of the nervous system, from molecules, and cells and circuits to large-scale systems and physical and social environments we must be aware of explanations that rely on data from one single level, whatever the level may be."

Brain-based or brain-compatible instruction requires instructors to understand how the brain works and thus, design instruction with that information in mind (Stevens & Goldberg, 2001). Teachers have been encouraged to combine knowledge about their profession with findings from brain research to create learner-centered environments – whether online or in physical classrooms. Applying brain research to instructional design can result in the practice of brain-compatible instruction instead of brain-antagonistic instruction (Stevens & Goldberg, 2001).

Brain-based Learning Strategies

It has been found that neuronal growth is highly correlated with memory, mood and learning. The developmental process can be enhanced by exercise, lower levels of stress and good nutrition. Schools can manipulate these variables to bring about improved learning processes and outcomes (Jensen, 2008). Physical motions help to improve blood circulation and brain functions. One brain-based learning strategy involving bodily movements that is changing learning today is Brain Gym. It consists of a series of simple movements to enhance the experience of whole-brain learning by emphasizing the interdependence of physical development and academic achievement (Dennison & Dennison, 1989). Body movements enable students to access parts of the brain that previously were not being used to facilitate re-patterning and learning. Chronic stress brings about a revised metabolic state called "allostasis", an adjusted new baseline for stress (McEwen & Wingfield, 2003). These pathogenic allostatic stress loads in the brains need to be managed by staff and students since they can have a serious impact on health, learning and behavior.

The ability of the brain to rewire and reconfigure itself by means of neuroplasticity has wider implications in educational practices. Schools can add value to the processes of neuroplasticity through skill building, reading, meditation, the arts and technical education (Jensen, 2008). When these strategies are effectively employed, positive and significant changes can be effected in the brains in a short period of time. The brain has been known to change physiologically due to a change in experience. Hence, when teachers provide a stimulating learning environment that is both challenging and relaxing, students see the connections between the learned concepts and its practical applications, in order to better understand the knowledge or skill (Caulfield,

Kidd, & Kocher, 2000).

Another important application of brain based education is the understanding that intelligence is multi-faceted. Educators need to recognize the differentiation of instructional methods to address the learning needs of a diversity of learners. Hence providing learners with greater choices and pathways of learning in alignment with students' intelligence levels makes learning more meaningful and authentic (Kallenbach, 1999).

Social conditions and experiences also invariably affect the ways in which the brain is molded. An overwhelming body of evidence shows our brains to be altered by everyday experiences and changing our experiences will change the brains. School behaviours are highly social in nature and they become encoded in long term memory through our sense of reward, acceptance, pain, pleasure and stress. This understanding intimates that educators actively manage the social context of the learning environment students are placed in and strengthen learning conditions.

Brain based strategies can be used to reduce the amount of rote memorization required since such strategies help students access and use more effective types of memory storage and retrieval. These strategies help students to recognize patterns and then make connections between prior knowledge and new knowledge to be integrated in the brain's long-term memory storage areas. Willis (2006) recommends some brain-based learning strategies such as creating positive neural circuits through positive emotional experiences invoking a sense of accomplishment, acknowledgment and praise, making curriculum more thematic and multidisciplinary and providing opportunities for students to visualize mental models of the concepts being studied. Brain-based education requires instructors to understand how the brain works and thus, design instructions with that information in mind (Stevens & Goldberg, 2001). Teachers have been encouraged to combine knowledge about their profession with findings from brain research to create learner-centered environments – whether online or in physical classrooms. Applying brain research to instructional design can result in the practice of brain-compatible instruction instead of brain-antagonistic instruction (Stevens & Goldberg, 2001).

Physical Education as Supported by Brain Research

While many schools are reducing physical activity because of time constraints created by the No Child Left Behind Act, a large group of studies has linked physical activity with cognition. The researchers have come at the topic from a wide range of disciplines. Some are cognitive scientists or exercise physiologists. Other advocates are educational psychologists, neurobiologists, or physical educators. They are all correct in revealing how physical experience affects the brain. Each of their viewpoints is valid, yet incomplete by itself.

Now let's add the neuroscience perspective. It reveals information that other disciplines cannot reveal. For example, we know that exercise is highly correlated with neurogenesis, the production of new brain cells. We know exercise regulates a critical compound called brain-derived neurotrophic factor. We also know that neurogenesis is correlated with improved learning and memory. In addition, neurogenesis appears to be inversely correlated with depression. While careless policy makers reduce physical activity, many administrators are unaware of the inverse correlations with adolescent depression. This information would suggest that educators might want to foster neurogenesis with physical education. But educators and policy makers can't see the new brain cells being produced. That's one reason to know the science, to show everyday, easy-to-influence school factors that regulate neurogenesis and, subsequently, cognition, memory, and mood. Those are the kinds of connections that should be made. Our brains respond better to meaningful activities with appropriate duration and intensity over enough time to make changes. So the interdisciplinary promotion of physical activity as a "brain-compatible" activity is well founded. Again, we see the brain involved in everything we do at school. Thus a brain-based perspective strengthens the case for maintaining or enhancing physical activities in school (Jensen, 2008).

Conclusion

Now there is a better appreciation of brain-based education and its utility in advancing the quality of instructional development. Increasingly new cognitive neuroscience and neuropsychology findings are being incorporated in education to gain new insights on the interdisciplinary connections between the brain, the mind and education. As the field of brain-based education continues to mature, greater credence is given to its importance in a learner's holistic intellectual growth. A continued application of brain research on memory, retention and cognitive development enables educators to energize and enliven the minds of their students. There is great potential in the education field in tapping the future research findings on the functional workings of the brain in designing effective instructional approaches that strengthen the ways in which students learn and grow.

Education is connected to real life experiences. The learning and teaching process is based on exploration and inquiry. Since the brain inquires meaning and attempts to set associations in a natural way, education could be consistently linked to principles of brain-based learning approach. In order to teach and learn, the brain's thinking processes should be known. Teaching and learning mostly depends on the use of social and emotional learning processes and brain-based learning has immense potential in enriching teaching approaches while establishing a secure classroom environment where learners are encouraged to be risk-takers.

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