

Dian A. Roginski, TSHH, M.Ed.
MTP 2 2008
Literature Review

Unlocking the Power of the Brain: The Next Great Educational Paradigm Shift

In the past decade there has been significant inquiry into the quality of undergraduate education. More specifically, faculty responsibility for effective teaching at this level has been under review. At many universities, instructors place primary importance on research pursuits, leaving minimal time or concern for use of effective practices and student learning (Umbach & Wawrzynski, 2005). This review will highlight current issues regarding effective strategies for lifelong learning and diversity in intelligence. Current research in the areas of education and neuropsychology propose a reconsideration of the traditional role of teachers with respect to content delivery and environment in the classroom. Several proposals have been made in the educational arena, including a paradigm shift from the traditional instructor-centered model of knowledge dissemination to a more student-centered process of syllabus construction, rate of learning and social environment (August, Hurtado, Wimsatt & Dey, 2002). A related technique addressed by Collins (2004), is based on the theory of adult learning as described by Dr. Malcolm Knowles. This concept also puts increased focus on the learner as a respected counterpart with shared responsibility for course design and content. Finally, research in cognitive neuroscience is being more positively regarded as improvement in physical evidence of findings is disclosed, examining the educational techniques favorable for brain-based learning (Phillips, 2005).

History of Practice

The traditional role of instructors is typically that of “dispenser of knowledge”, resulting in students that have become dependent on their instructors for what they should accept as “real” learning. Students demonstrate learned helplessness and become a passive entity, absorbing information with minimal interaction with other students or the instructor (Howell, 2006). When the role of teaching consists primarily of dispensing content, student comprehension is maximized at the level of memorization and recall (August, Hurtado, Wimsatt & Dey, 2002). A shift away from this type of traditional instruction must occur to support student learning and improve the quality of undergraduate education.

Another topic gaining attention is the traditional concept of intelligence. Williams (2002) points out that traditional Intelligence Quotient (IQ) is measured by tests that measure only characteristics of what is considered to be academic intelligence based in verbal/linguistic and logic/mathematical skills. This portrayal of intelligence fails to measure other skill sets including practical intelligence, emotional intelligence, social intelligence, or creative intelligence. Likewise, these assessments neglect to determine strengths in any of the other “multiple intelligences” as described by Howard Gardner (Klopp, Toole, & Toole, 2001). Furthermore, additional contemporary definitions of intelligence are proposed by studies in brain-based research that redefine intelligences as

encompassing the whole person, or as the authors discuss it, the “brain-body-environment structure and function system” (Madrado & Motz, 2005).

Practice Variations

A shift from traditional instructor-centered classroom techniques relying primarily on lectures to a more student-centered classroom environment foster, the development of intrinsically motivated students with a deeper understanding of content and how to actually use the learned skills. A learning environment such as this would result increased student collaboration with peers as well as instructors, active learning experiences, and greater student responsibility for concept development and acquisition. These modifications would require the instructor to possess a better understanding of how students learn (Umbach & Wawrzynski, 2005).

Similar in approach, Collins (2004) describes a course design that encompasses many of the previously stated principles as they pertain to the philosophy of andragogy, the study of how adults learn, as coined by Dr. Malcolm Knowles. The author differentiates between andragogy and pedagogy by stating that pedagogy, the study of how children learn, features a teacher-centered dynamic whereas andragogy is more learner-centered. Collins’ model includes the following features of adult learning necessary for the development of mature, life-long learners:

- 1) instructor as facilitator, not dispenser of knowledge,
- 2) validation and respect for individual past experiences and prior knowledge of the learner,
- 3) learner designed composition of long term goals and learning objectives,
- 4) active participation in personally relevant and real learning situations,
- 5) collaborative interactions and idea sharing among peers,
- 6) input from instructors and experts, course design favoring diverse learning styles and intelligences,
- 7) frequent feedback by self/student, peers and instructors.

Leith (2002) describes specific examples of activities for each aspect of the previously mentioned model: using the syllabus as a learning contract to discern amount of work, resulting evaluations and how much each will be weighted, application of learned material to real life problems within the scope of individual interests and/or community needs, projects and papers that apply learned material to interests or jobs, and using critical thinking skills to reflect upon and evaluate hypothetical real life problems.

Some controversy exists in transitioning from primarily instructor-centered to more learner-centered philosophies. Howell (2006) outlines the reality of resistance to change on behalf of both instructors and students. Faculty and students can be unsure of new territories and rules of engagement and therefore be reluctant to embark upon such a novel pursuit. Additionally, students exhibit anxiety regarding greater expectations in the classroom such as higher level of thinking processes and collaboration of ideas. They feel vulnerable and exposed when revealing person opinions or misconceptions in the classroom. Lastly, some students may not be able to handle increased discipline and cognitive demands of such a loosely structured protocol.

Another variation of instruction comes from research in brain-based studies. During the Decade of the Brain (1990-1999), research in the area of neurological science

grew immensely. Educational implications in this area focus on diversifying teaching routines, teaching to individual differences and maximizing the brain's innate potential for learning (Madrazo and Motz, 2005). Student and environmental characteristics which ordinarily would not be taken into consideration are thrust into the spotlight. Phillips' (2005) article evaluates various studies on brain-based learning research and generates 9 principles for guidance in practice:

- 1) the brain is a parallel processor which learns best using multi-sensory examples and environments,
- 2) utilization of a variety of teaching strategies encompassing the whole body (including states not directly involved in learning but for the body to revitalize in order to prepare for optimal learning such as diet, exercise and sleep),
- 3) the innate process of deriving meaning is done through patterning based on coordination with prior knowledge and experiences,
- 4) emotions are critical to patterning which occurs most readily in calm, optimistic environments,
- 5) presenting both discrete details and generalized concepts is beneficial as both sides of the brain are involved in almost every activity,
- 6) focused and peripheral attention are both factors in learning therefore classroom aesthetics are equally as important as the main learning activity
- 7) increased retention occurs when new information is related to contextual memory,
- 8) learning increases with challenge yet is obstructed by fear and
- 9) diversity is key as every brain is exclusive in functioning dependent on genetics, prior experiences and environment.

Practical examples given in her article include allowing students to make decisions about learning based on student motivations and interests, designing classroom time to engage in both short term learning and longer term projects and engaging in experiential learning activities.

In general, to most effectively educate diverse learners, instructors should remain abreast of current research in brain-based learning as it explains different ways in which people's thought patterns and capacity to learn can be distinctive, based on the nature of individual genetics and social environments in which a person is reared. For example, in a review by Stickel (2005) several philosophies were discussed defining such diversity including Gardner's multiple intelligences (linguistic, musical, logical-mathematical, spatial, bodily kinesthetic and inter and intra- personal), modes of learning (auditory, visual, kinesthetic), selected types of memory (semantic, episodic, factual) and Goleman's Emotional Intelligence. No longer is the traditional concept of intelligence adequate as a measure of what a person "knows".

There are numerous beneficial attributes to employing classroom techniques advocated by both adult learning theory and brain-based learning research. Active participation and collaborative learning activities demonstrated improvement in overall educational gains such as cognitive development, affective proficiency and tolerance for increased diversity (August, Hurtado, Wimsatt & Dey, 2002). A learner-centered approach empowers students to collaboratively design learning environments and content and in turn develop a community of learners (Howell, 2006). Leigh (2002) found that

when addressing factors conducive to adult learning enhanced level of learning, social relationships, creativity and motivation were noted.

An example of application of both adult learning characteristics and brain based research includes differentiated, experiential learning activities such as the “Service-Learning” project proposed by Klopp, Toole and Toole (2001). Service Learning infuses experiential learning with multiple intelligences with the additional benefits of social/community importance, personally engaging pursuits and educationally sound practice. As described in Klopp, Toole & Toole (2001) Service Learning is an educational model in which participants learn and develop through active participation in organized, necessary community service. The service is coordinated with an educational institution integrating academic curriculum with educational components of community service to help foster responsibility.

Controversy about research in brain-based learning is widespread in the field of education. In the 1990’s, during the “Decade of the Brain,” many assumptions were made prematurely which were oversimplified and erroneously applied research findings. These results were recognized by field professionals as “neuromyths”, or neurological falsehoods (Phillips, 2005). Despite discrepancies in actual research findings and consequent misinterpretation and improper application of the results, current studies in cognitive neuroscience may be able to provide new evidence for genuine brain-based applications for educational practice. Posner (2003) reveals that with the aid of electrical or magnetic recording, images of brain activity can be observed through cerebral blood flow. In his interpretation, Posner clarifies the scientific basis for Gardner’s multiple intelligences and utilization of several neural networks (intelligences) simultaneously, as well as the study of functional anatomy of the neural networks and genetic differences in potentials to acquire and perform various skills.

Traditional institutional techniques used in college classrooms are no longer adequate. The quality of student learning at the undergraduate level has taken a back seat to research pursuits at many institutions. Instructors have weighted their priorities based on academy demands and financial and occupational securities. As a result, students lack intrinsic motivation to become mature, educated life-long learners. Student command of content knowledge reaches a ceiling at the lower levels of critical thinking and use of concepts in real life experiences is severely limited. Contemporary research in adult learning and brain-based learning has outlined numerous aspects of human behavior, neurological processes and competencies, and environmental considerations which are novel factors for contemplation in designing any curriculum. Professional undergraduate educators should consider less how they want to teach and more how their students learn.

Annotated bibliography

August, L., Hurtado, S., Wimsatt, L.A. & Dey, E.L. (2002) Learning Styles: Student preferences vs. Faculty Perceptions. Paper presented at the Annual Forum for the Association for Institutional Research. Toronto: June 2. Available on-line at http://www.eric.ed.gov/ERICDocs/data/ericdocs2sql/content_storage_01/0000019b/80/1a/b7/57.pdf

This study examined the reactions and experiences of students and faculty regarding student-centered instructional methods including collaborative learning, increased student involvement and active learning. This paper highlights that each group believes collaborative environments, active participation in learning, and effective peer/peer and peer/instructor relationships are important. Differences among student and staff opinion concerning the frequency of use of these practices used in the classroom are discussed.

Collins, J. (2004) "Education Techniques for Lifelong Learning: Principles of Adult Learning. Paper presented in the RSNA Faculty Development Workshop, September 2004. Available on-line at <http://radiographics.rsnaajnl.org/cgi/content/full/24/5/1483> .

This paper addresses adult education literature and draws upon differences between teaching children and preteens versus adults. Although aspects of effective teaching apply to both groups, adults should be respected for their varied life experiences and intrinsic motivation to learn. Self-initiated and directed learning that is applicable to the learner's career field is most successful. Teachers of adults should act as facilitators of desired learning objectives by creating interactive activities relevant to the students' goals. As in most effective teaching methods the instructor should understand the needs of diverse learners utilizing strategically designed methods to engage and challenge unique adult learning characteristics.

Howell, C.L. (2006) Student Perception of Learner-Centered Education. Paper presented at the 2006 Annual Conference of The Northern Rocky Mountain Educational Research Association. October 2006. Available on-line at http://www.eric.ed.gov/ERICDocs/data/ericdocs2sql/content_storage_01/0000019b/80/27/fb/67.pdf

College students' perceptions of learner-centered educational practices are useful in assisting instructors in making changes to this type of educational protocol. College students were enrolled in a workshop describing the characteristics of a learner-centered course which illustrated the premises for this type of instruction. They were then asked to give opinions of courses they were taking regarding the use of learner-centered educational practices. Student goals were reviewed at various intervals of the semester. Anxiety was noted upon transition to learner-centered course study however students' progress toward more independent thinking was demonstrated. With increased responsibility for learning, students became more motivated, interactive and engaged.

Klopp, C., Toole, P., & Toole, J. (2001) Pondering Learning: Connecting Multiple Intelligences and Service-Learning. National Dropout Prevention Center, Clemson, SC.; Corporation for National Service, Washington, DC.

“Service learning” is a method of instruction that gives students learning opportunities that are based on individual interests and pursuits, aligned with educational goals, require higher level critical thinking skills, and benefit the learner as well as the community as a whole. Service learning offers students avenues to investigate and develop areas of intellectual strength which are "brain compatible strategies" for effective learning. This article addresses the beneficial relationship between multiple intelligences and community service learning projects.

Leith, K. P. (2002) Adult Learning Styles and the College Classroom. Paper presented at the 110th Annual Meeting of the American Psychological Association. Chicago: August 22. Available on-line at http://www.eric.ed.gov/ERICDocs/data/ericdocs2sql/content_storage_01/0000019b/80/1a/84/02.pdf.

This paper differentiates between pedagogy, how a child learns, and andragogy, how an adult learns. According to Dr. Malcolm Knowles, in his theory of adult learning (1972, revised 1980), adults are intrinsically motivated and independent learners. Adults should be utilized as co-authors of course content and direction within pre-established guidelines set by the instructor. To facilitate student transition to more mature adult roles and responsibilities, individual personal experiences, interests, and motivation to learn should be valued and developed. Leith describes three types of learning that must be regarded. Affective learning which entails attitudes and preferences, behavioral learning or the development of abilities in procedures and techniques, and cognitive learning, which includes conceptual knowledge of course content. Addressing unique learning needs of adult learners should include all aspects of the course including development of syllabi, student/student and student/instructor interactions in the classroom, and course requirements. Responsibility of the learning process is transferred to the student with the instructor acting as facilitator. This paper contains descriptive examples of activities that could be utilized to promote principles of adult learning which facilitate interactive relationships, increased motivation innovative idea exchange among participants.

Madrazo, G.M. & Motz, L.L. (2005) Brain Research: Implications for Diverse Learners. *Science Educator*, 14 no.1, 56-60. Available on-line at http://www.eric.ed.gov/ERICDocs/data/ericdocs2sql/content_storage_01/0000019b/80/2a/b8/9e.pdf.

This article describes “brain-based education” as the use of research in neuroscience to understand how students learn and develop in the classroom and how teachers can use this information to determine the best teaching methods for diverse learners. The author focuses on the importance of HOW students learn. Topics include relevance of student experiences and prior knowledge, climate of learning environments and the resulting emotional experience in the classroom, modes of learning, constructivism, active participation and interactions, learning styles and multiple intelligences. In summary the author emphasizes the importance of keeping abreast of current neurological science research and it’s implications for learning and teaching.

Phillips, J.M. (2005) From Neurons to Brainpower: Cognitive Neuroscience and Brain-Based Learning. Indiana University, August: 2005. Available on-line at http://eric.ed.gov/ERICDocs/data/ericdocs2sql/content_storage_01/0000019b/80/1b/c2/43.pdf

There have been various developments in neuroscience during the "Decade of the Brain" igniting numerous avenues of "brain-based learning" resulting in recommendations for educational theories. Research in these areas continues to flourish, recommending possible applications of brain science in education. With the intention of bringing together current brain based learning studies and educational practice, interdisciplinary approaches to teaching and learning techniques are best method to converge cognitive neuroscience theory and educational practice.

Posner, M.I. (2003) Neural Systems and Individual Differences: A Commentary on Frames of Mind: The Theory of Multiple Intelligences. Paper presented at the Annual Meeting of the American Educational Research Association. Chicago: April 2003. Available on-line at http://www.eric.ed.gov/ERICDocs/data/ericdocs2sql/content_storage_01/0000019b/80/1a/f5/3a.pdf.

In this paper, the author gives scientific support for Garner's Multiple Intelligences (MI) as given by studies from neuroimaging machines. Two major developments have verified connections between neuropsychology and theories of differences in how people differ in intelligence. These events include the electrical/magnetic recording used to investigate neuron activation inside the brain as people think. Another significant development is the sequencing of the entire human genome demonstrating that it is possible to examine individual brain efficiency through both brain imaging and genetic studies. Attention to task is discussed as an area of study that is currently being researched regarding to individual differences. Research on attention is noted to have important implications for educators in early childhood.

Stickel, S.A. (2005) Advances in Brain Research: Implications for Educators. Paper presented at the Michigan Academy of Science, Arts & Letters. Michigan: March 2005. Available on-line at http://www.eric.ed.gov/ERICDocs/data/ericdocs2sql/content_storage_01/0000019b/80/1b/c4/58.pdf.

This paper discussed the Decade of the Brain (1990-1999) and its developments in brain research which influence current changes in educational practices. Brain anatomy, function and development are reviewed as to relevance in educational pursuits. Important aspects of nature and nurture of specific skills, critical periods of learning and implications for teaching styles and methods are reviewed. The author discusses key controversial aspects educational methods of instruction based on brain research conclusions including brain dominance, multiple intelligences, modes of learning, emotional intelligence and collaborative learning. The author attests to the importance of brain research and its implications in educational reform.

Umbach, P.D. & Wawrzynski, M.R. () Faculty Do Matter: The Role of College Faculty in Student Learning and Engagement. *Research in Higher Education*, 46 No.2, 153-184. Available on-line at http://www.eric.ed.gov/ERICDocs/data/ericdocs2sql/content_storage_01/0000019b/80/1b/c5/8a.pdf

Use of challenging, interactive learning techniques which engage students in higher-order cognitive experiences are shown to significantly increase student engagement and in turn learning. This article advocates the importance of effective teaching practice over institutional emphasis on research pursuits.

Williams, W.M. (1998) Democratizing Our Concept of Human Intelligence. In P.Miller (ed.) (2002) Does IQ Mean You're Smart? *MENSA: Research Journal*, 33 No.3, 10-13. Available on-line at http://www.eric.ed.gov/ERICDocs/data/ericdocs2sql/content_storage_01/0000019b/80/1a/d4/5c.pdf

This paper shows that studies of traditional IQ tests indicate that similar raw scores of decades past result in a higher percentile rank for today's test takers. Thus IQ does not reveal an adequate measure of "intelligence". The author advocates broadened definitions and concepts of what intelligence which includes not only the traditional measure of verbal and mathematical competencies but also practical, emotional and creative intelligences.

Additional Resources

Bain, K. (2004) *What the Best College Teachers Do*, Massachusetts: Harvard University Press.

Mayer, J.D., Caruso, D.R. & Peter Salovey (2000) Emotional Intelligence Meets Traditional Standards for an Intelligence. . In P.Miller (ed.) (2002) Does IQ Mean You're Smart? *MENSA: Research Journal*, 33 No.3, 10-13. Available on-line at http://www.eric.ed.gov/ERICDocs/data/ericdocs2sql/content_storage_01/0000019b/80/1a/d4/5c.pdf

Nelson, D.B. & Nelson, K.W. (2003) Emotional Intelligence Skills: Significant Factors in Freshmen Achievement and Retention. Paper presented at the American Counseling Association Conference. Anaheim, CA: March 21.

Palmer, P.J., (1993) Good Talk About Good Teaching: Improving Teaching through Conversation and Community. *Change Magazine*, 25, #6, 8-13.

Palmer, Parker. J. (1998) *The Courage to Teach. Exploring the inner landscape of a teacher's life*, San Francisco: Jossey-Bass. Based on the premise that good teaching cannot be reduced to technique, but comes from the identity and integrity of the teacher, this book explores a number of themes central to informal education and to Christian teaching.