Brain-Based Learning With Technological Support

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Introduction

Utilization of technology in secondary schools is varied and depends on the training and interest of the individual instructors. Even though technology has advanced way beyond its utilitarian roots of being viewed solely by educators as a useful machine for teachers to key exams and worksheets on, there are still many secondary educators who still only view it as such. These educators have not recognized the growing role that technology is taking on in today's classrooms of being a cognitive tool that when partnered with learning theory can help educators enhance learning and maximize the learning potential of their students. As a teacher education professor, I was experiencing this lack of acceptance of technology's new role in my students. When I asked them if they utilized technology in their classrooms, they would say that, of course they do. Then, when I would ask them how they utilized it, they would say, to type exams, worksheets, and have their students type papers. They do not utilize it as a cognitive tool to enhance learning. Concerned with this phenomenon, I proposed to find and research teachers who did recognize and utilize technology as a cognitive tool to enhance learning for their students. My search resulted in an investigation of instructors who believed in and implemented Brain-Based Learning with technological support and had positive results. The primary question guiding this study was, "How is Brain-Based Learning with technological support being implemented by selected teachers in their classrooms?" The corollary questions included: What is the nature of the environment, that is, the classroom, in a Brain-Based Learning environment utilizing technology? What is the role of the instructor in a Brain-Based Learning classroom utilizing technology? What is the role of the students in a Brain-Based Learning classroom utilizing technology? What are the roles of the school administrator and technology coordinator in the Brain-Based Learning classroom utilizing technology? and What are the problems encountered by teachers when utilizing Brain-Based Learning with technological support in the classrooms and how can these problems be overcome?

Literature Review

Brain-Based Learning Research

Researchers, such as Geoffrey Caine and Renate Nummela Caine, recognized that the brain has a virtually inexhaustible capacity to learn, and that each healthy human brain, irrespective of a person's age, sex, nationality, or cultural background, comes with the following features: the ability to detect patterns and to make approximations; a phenomenal capacity for various types of memory; the ability to self-correct and learn from experience by way of analysis of external data and self-reflection; and an inexhaustible capacity to create. They could not, though, understand why, if everyone has these features, we are struggling with the ability to educate. Caine and Caine (1994) found the answer to this was that educators did not know and understand the complexity and elegance of the way the brain learns, especially when it is functioning optimally. Their research presented this information and how it could be utilized to enhance learning for all students. For example, teachers need to provide learning activities and experiences that immerse learners in curricular content and context, such as encouraging them to talk, listen, read, view, act, and value what is being learned (1994). In other words, they needed to implement a brain-based education for all students. A brain-based education, according to Caine and Caine (1994), involved designing and orchestrating lifelike, enriching, and appropriate experiences for learners and ensuring that students process experiences in such a way as to increase the extraction of meaning. This, they indicated, could be accomplished by providing a variety of learning activities and projects, and choices where those activities and projects would take place.

Another researcher, Howard Gardner (1999), added to the concept of Brain-Based Learning by establishing his theory of "multiple intelligences," a theory that indicates that there is not just one form of intelligence based on verbal and reasoning abilities, but rather eight different intelligences, each having a unique neurological pattern and course of development. The eight intelligences include: linguistic, musical, logical-mathematical, spatial, bodily-kinesthetic, interpersonal, intrapersonal, and naturalistic. Gardner (1999) believed that the educational system of the 1970s favored children who were skilled at reading and writing, and

did not address a student who was considered "poor" in school due to his/her limited reading and writing skills, but who could, in fact, operate a film projector without instruction, which takes spatial intelligence. In other words, Gardner felt that there were too many children just like this one whose educational needs were not being met due to the narrow view of intelligence. To meet all children's learning needs teachers needed to present a variety of learning activities, such as individual and group projects, apprenticeships, and hand-on activities, which addressed all eight of the intelligences.

Lastly, a researcher and educator, Kathy Nunley (2001), who was concerned that teachers did not have the education and training to help them find new ways to meet the needs of their increasingly diverse groups of students with a wide variety of abilities, cultures, and languages, began to research a way to provide these for them. Her research, based on knowledge of the brain and Gardner's Multiple Intelligences Theory, resulted in the development of a curriculum entitled "The Layered Curriculum." This curriculum involves presenting students with learning in three distinct layers. Each layer represents a different depth of study in a topic or unit of learning as it is geared toward a different kind and level of learning. Students can choose how deep they wish to examine a topic and which way best fits their learning style and ability, thereby choosing the grade (A-F) they will earn as well. Also, there is a broad range of learning tools available to the student to assist in completing their assignments. These tools include a wide use of technology, from taped lectures to computer programs.

The Role of Technology in the Learning Process

Technology has long been a support tool in education (Lockard & Abrams, 2001). Its functions are deeply embedded in school administrative and instructional environments. Classrooms, too, are places where technology is found. From movie and overhead projectors, televisions, VCRs, and tape recorders, to DVDs and computers, teachers have long found technology to be a tool that enhances content. Its use in the classroom has led to technology being referred to as a cognitive tool. Jonassen and Reeves (1996) stated that "cognitive tools refer to technologies, tangible or intangible, that enhance the cognitive powers of human beings during thinking, problem solving, and learning. Written language, mathematical notation, and, most recently, the universal computer are examples of cognitive tools" (p. 693). Jonassen went on to describe technology as "mindtools." The idea of technology as mindtools parallels the newer view of learning that has changed from being viewed solely as a passive activity, where learners sit at desks listening, taking notes, studying, and taking tests to measure the learning that has taken place, to being viewed as an active process, where students actively are engaged in the learning process and in constructing their own knowledge. This active view of learning often is called constructivism and it "is grounded in the research of Piaget, Vygotsky, the Gestalt psychologists, Bartlett, and Bruner as well as the educational philosophy of John Dewey" (Woolfolk, 2001, p. 329). Constructivism is defined by Woolfolk (2001) as "a view that emphasizes the active role of the learner in building understanding and making sense of information" (p. 329). Constructivist learning, as an active student centered learning process, has several characteristics. They are that it should involve "complex, challenging learning environments and authentic tasks; social negotiation and shared responsibility as a part of learning; multiple representations of content; understanding that knowledge is constructed; and student-centered instruction" (Woolfolk, 2001, pp. 334-336). Mindtools are cognitive tools that students utilize as they are engaged in a constructivist learning environment.

Brain-Based Learning is student centered learning that utilizes the whole brain and recognizes that not all students learn in the same way. It is also an active process where students are actively engaged in constructing their own knowledge in a variety of learning situations and contexts (Caine & Caine, 1994). Mindtools are the cognitive tools that can support Brain-Based Learning.

Method

Participants

The participants for this case were unique or "based on unique, atypical, perhaps rare attributes or occurrences of the phenomenon of interest" (Merriam, 1998, p. 62). The six teachers were unique in that they had embraced Brain-Based Learning with technological support and were utilizing it in their classroom teaching. They were also a network sample or a "sample that is based on each participant or group of participants referring you to other participants" (Merriam, 1998, p. 63). They were chosen based on recommendations by the principal, as they had studied and embraced Brain-Based Learning with technological support and had implemented its use in their classrooms. The six teachers were from the following disciplines: health education, physics, engineering graphics/CAD/Manufacturing, French, history, and information systems

The administrator constituted a unique sample because he was a strong advocate of Brain-Based Learning with technological support and was instrumental in bringing BBL to his school. He had taken numerous workshops on Brain-Based Learning, had conducted his own workshops on "Creating a Brain-Friendly Instructional Climate" for local educators, and had implemented his concept of a Brain-Friendly Instructional Climate at the high school for the 2000-2001 academic year.

The technology coordinator constituted a unique sample because he was the only technology coordinator at the high school. He worked closely with the principal and the teachers mentioned above to assist in the implementation of Brain-Based Learning with technological support.

Data Collection

Data collection employed the strategies of interviewing, observing, and completing a checklist. The interviews involved meeting with each of the six teachers, the administrator, and the technology coordinator and having them discuss their individual roles in Brain-Based Learning with technological support, how such learning can be implemented, the problems that were encountered, and possible solutions to these problems. The observations involved observing the six teachers as they were implementing Brain-Based Learning with technological support. Lastly, the checklist involved recording the Brain-Based methods utilized by teachers in the classrooms during the observations.

Results

The data collected from interviews, observations, checklists, and questionnaires were analyzed and consolidated, and the findings organized and presented as they relate to the research questions.

Corollary Question 1

Corollary Question 1 asked, "What is the nature of the environment, that is, the classroom, in a brain-based learning environment utilizing technology?" The data indicated that the nature of the classroom in a brain-based learning environment is one that is active and learner-centered. It is visually appealing, warm, and conducive to interaction, whether it be student-to-student or student-to-teacher. It is an environment where students are not just sitting passively taking notes and listening to a teacher lecture. It is where students are actively engaged in learning, interacting with a variety of learning tools, their peers, and the teacher. The teacher is not only seen in the front of the classroom, but is frequently seen walking around the classroom talking to students and helping them with problems, answering questions, and offering feedback. The BBL classroom is an environment where as students enter through the classroom doors, they are transported into the world of the subject being taught. Lastly, it is an environment that is computer-based. All of the classrooms have computers in them or have access to a computer lab, where students frequently are actively engaged in working through learning modules, in doing research, or in a variety of creative endeavors.

Corollary Question 2

Corollary Question 2 asked, "What is the role of the instructor in a Brain-Based Learning classroom with technological support?" The data indicated that the role of the instructor in a Brain-Based Learning classroom with technological support is as a guide and facilitator to the students as they are actively engaged in the learning process. In this role the instructor provides direction, answers questions, guides collaborative problem solving, and offers feedback. The instructor has as his/her philosophy the knowledge that all students are individuals with individual brain dominance and intelligence(s), information processing abilities, and learning styles, and that learning needs to be adapted so that all students can have learning experiences that enable them to learn to the best of their abilities. This can be accomplished through varying activities, learning tools, and approaches.

Corollary Question 3

Corollary Question 3 asks, "What is the role of the students in a Brain-Based Learning classroom with technological support?" The data indicated the role of the students in a Brain-Based Learning classroom with technological support is that of active learners engaged in the learning process, learning to the best of their individual abilities.

Corollary Question 4

Corollary Question 4 asked, "What are the roles of the school administrator and technology coordinator in the Brain-Based Learning classroom with technological support?" The role of the administrator

committed to Brain-Based Learning with technological support is, according to the principal, "to try to create a risk free climate where a teacher is not afraid to try something new or different, and to provide the support elements for that teacher who wants to try it. If a teacher wants to try something with technology, then they have to have the technology, they have to have the skills, and they have to have the training. So, as an Administrator, my responsibility is to facilitate that climate so that that teacher can take advantage of those things so they can utilize it and have a better opportunity for success."

The role of the technology coordinator in a Brain-Based Learning environment with technological support is, according to the technology coordinator, someone who wears "many hats." He oversees all hardware and software purchasing and budgeting for both the administrative and the teaching sides of the building, and he coordinates all the technology within the building. One of the additional hats the technology coordinator wears is that of helping teachers who want to utilize technology in the learning/teaching process.

Corollary Question 5

Corollary Question 5 asked, "What are the problems encountered by teachers when implementing Brain-Based Learning with technological support in the classrooms and how can these problems be overcome?" The data indicated that the problems encountered by the teachers involved in the implementation of Brain-Based Learning with technological support in classrooms were of two types. They were: (1) technical problems and (2) student problems.

The technical problems encountered by the teachers when implementing Brain-Based Learning with technological support were: (1) the network was down, (2) the CD was not working, (3) there was a lack of color printing capabilities, (4) the font was too small, and (5) there was software incompatibility. These problems were observed to be intermittent and none interrupted the teaching/learning process for very long. In most cases, the instructor was able to work around these technological problems by having an alternate method for accomplishing a goal or changing to another task for the class.

The student problems encountered by teachers in using technology to support Brain-Based Learning were: (1) the students were "surfing" the web, (2) there were multiple simultaneous questions, and (3) there were noisy students. As with the technical problems, these problems were observed to be intermittent and none interrupted the teaching/learning process for very long. In most cases, the instructor was able to work around these technological problems by having an alternate method for accomplishing a goal or changing to another task for the class.

Discussion

During the months of collecting and analyzing data and reporting the findings of this study, as the researcher, I found that my personal beliefs and thoughts on secondary education and how it could be improved to meet the needs of our increasingly diverse high school student population were reinforced and strengthened. I would like to discuss some of the more important ones.

First, learning for secondary students can no longer be considered a passive activity where teachers lecture and students sit in desks taking notes, studying, and taking tests. Instead, learning should be viewed as a constructivist process, an active and engaging process, one that emphasizes the active role of learners in building, understanding and making sense of information and reality (Woolfolk, 2001). As active learners, students may work independently and, at times, cooperatively on a variety of learning activities utilizing many different learning materials and modes of instruction. Their teachers in the learning process no longer just stand in front of the classroom. They now move about it, stop by students and answer questions, help the students problem solve, and offer them feedback. They are viewed as guides, facilitators, managers, supervisors, and models.

Second, each student processes information differently and learns differently, so a "one-size-fits-all" curriculum is no longer the way to plan instruction. As the principal in this study stated, "We have students that walk into this building and it doesn't make a difference what we do, they're going to perform at high levels. But it is public education's responsibility to deliver the educational services to all of the students who walk in, not just the smart ones, not just the pretty ones, not just the ones who get along with people, all the students who walk into this building. In order to do that, from my experience and from what I've learned, and things like that, the way to do that is to create that brain friendly environment, that environment that has mutual trust and respect, where students feel connected, where their whole basic needs are met so they can move forward from the emotional to the intellectual and things like that. That's the only way to do it." This means that teachers need to change their view of teaching and what it involves.

Third, teachers in their new roles and with their new views of teaching and the learning process need to

recognize that this involves no longer depending solely on lectures and books to deliver knowledge. They need to utilize a variety of cognitive tools, technology among them (Jonassen & Reeves, 1996). As Howard Gardner (1999) states: "One fact that will make individually configured education a reality in my lifetime: the ready availability of new and flexible technologies. Technology can be 'smart': It can adjust on the basis of earlier learning experiences, ensuring that a student receives lessons that are optimally and individually crafted" (pp. 153-154).

In addition to being a tool that can adapt to individual learners, technology is a tool that creates new opportunities for curriculum and instruction by bringing real-world problems into the classroom for students to explore and solve. For example, students no longer just read about people, places and events. They can, via technology, visit specific parts of the environment that they have studied to explore them more fully, to test ideas, and to receive feedback (Bransford, Brown, and Cocking, 1999). They can work on projects independently or cooperatively with technological components including databases, spreadsheets, semantic networks, expert systems, multimedia/hypermedia construction software, computer-based conferencing, collaborative knowledge construction environments, computer programming languages, and microworlds (Jonassen & Reeves, 1996). They can utilize "visualization and modeling software that is similar to the tools used in non-school environments, increasing their understanding and the likelihood of transfer from school to non-school settings" (Bransford, Brown, and Cocking, 1999, p. 195), or in other words, students can acquire knowledge of tools and experience in school that can be transferred to the real world environment of work.

Fourth, this study, examined a high school, its administrator (principal), and its technology coordinator, all of whom had embraced Brain-Based Learning, were utilizing it in their classrooms to meet the varied learning needs of their students, and were encountering very few problems in the process. It provides some of the needed supporting evidence for Brain-Based Learning with technological support to be viewed as a viable alternative to the traditional "one-size-fits-all" thinking present in many of today's classrooms.

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