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The Impact of Brain Compatible Learning (BCL) Philosophy in 3 Elementary Schools: What Mattered Most?

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Abstract

Over two decades of research has consistently confirmed that the physical environment impacts the learning environment and student achievement, but what is it that makes one learning environment more engaging than another? This paper will provide additional insight on the impact incorporation of a Brain Compatible Learning (BCL) philosophy in 3 elementary schools with similar demographics affected student engagement in learning, school climate, teacher retention, and community satisfaction.

"Wow! What a beautiful school! It's like a dream come true! Light and bright! I bet the kids just love coming here!" Parent comment to a teacher at Have-It-All Elementary School

The first thing one might notice when walking into a school is how friendly and warm the reception area is to visitors, all visitors. The architecture may be stunning, light and bright, the colors warm, the furnishings inviting, the ambiance appealing, but is the place welcoming like a great restaurant? Instead of great food, does the entry say, we like you! We really like you! Come join us! A second thing one might note when strolling down the hallways is whether or not the facility supports and invites learning. However, most importantly is the third question one might ask and that is, what effect, if any, does this environment have on student and teacher engagement and achievement?

The following is a reflection contributed by the first author, "What I remember most about a place called school is how comfortable my favorite teachers were in it. When they were happy within their teaching space, the rest of us [students] were happy in our learning spaces. It didn't matter to me that my school was built during the depression with a floor plan stamped from a factory style template. The richly carved banisters, the smell of freshly polished wood stairs and paneling, as well as the glorious smell of fresh baked bread floating from the school basement cafeteria were what I remember most. Every classroom had large narrow paned windows that could be opened to let fall or spring breezes float through the classroom. The schools I loved best reflected the culture of the community that I either wanted to be a part of or was a part of. The safe home-like atmosphere many of us remember about a place called school is a memorable experience today's teachers and school leaders alike would probably like to re-capture."

As we speed through the decades - - - 50 years later, one would think that after years of researching facility designs and construction, we now have the list of what a great school facility should include in order to impact teacher instruction and student learning. Obviously the same questions school boards and communities asked in the 20th century are the same questions we are asking in the 21st: (1) Will this facility actually enhance instruction and engage learning?, (2) Is there a focus on a particular philosophy or learning theory in the design?, and (3) Does the facility design adequately mirror the philosophy or learning theory? These three questions are most important, but often over shadowed by facility cost and completion time. More importantly concern should be focused on whether or not sticking to a particular learning theory in designing

a facility actually makes a difference in teacher instruction and student achievement (Hardman, 2009), and, if so, in what ways?

The phenomenon covered in this study addresses how a particular learning theory, brain-compatible learning (BCL), was applied in the design of three elementary schools with similar demographics and if the design was perceived to have made a difference in student achievement. The researchers reviewed current literature on BCL, reviewed the specific design and learning philosophy applied to all three campuses, and conducted on-site observations and interviews with key building staff. The research team included a practicing professional architect/professor of educational administration, a college professor in educational administration, and a doctoral student in educational administration. All three researchers were interested in school design and the effects of design on student and teacher engagement, learning, and instruction. The study would hopefully serve to connect existing research with practice.

The Box We Call School

> *"If we are to improve it [school], we must understand it. If we are to improve schooling, we must improve individual schools"* (John Goodlad, 1984, p. xvi).

Some 27 years ago, John Goodlad in conjunction with members of the Institute for Development of Educational Activities, Inc., formerly a division of the Charles F. Kettering Foundation provided us results of a study focused on just what makes an effective school. Goodlad's (1984) conclusion was that the one-size fits all approach to schooling is *not* effective. Instead, more importantly we should be looking at how all elements (staff, leadership, parents, community, resources, and environment) work together in an individual school (Goodlad, 1984). Therefore, an important first step in this study was getting acquainted with all the particulars of each school site. From personal experience over the years, the researchers found consistency in teacher and administrator comments regarding new and refurbished school facility designing. Basically, facility construction begins with excitement and often ends with compromised acceptance by its benefactors.

One needs to remember how excited everyone (children, parents, teachers, community) are when facility designs and blue prints first appear. Anticipation of a new school and all it has to offer by way of change and renewal is greeted with enthusiasm. However, there is often disappointment when the final project emerges after months of tweaks, cutbacks in budget, or administrator modifications. At every level of education, the physical environment appears to be an important factor to consider when educating students and engaging the community it serves. There seems to be ". . . clear evidence that extremes of environmental elements have negative effects on students and teacher" (Higgins, Hall, Wall, Woolner, & McCaughey, 2005, p. 6). Unfortunately, one of the predictors of a quality school facility is the environment and its effect on those who work and learn within it (Earthman & Lemasters, 2011; Hanrahan, 1998; Lippman, 2010; Oliver & Lippman, 2007). Earthman and Lemasters (2011) suggested that the building condition influences the attitudes of parents, students, and teachers and the "resultant attitudes students have about the school building influence to a certain extent their achievement" (p. 22.)

On May 22, 2011, one of the most shattering disasters took place in Joplin, Missouri. A tornado ripped through the heart of Joplin destroying or damaging 10 of the 19 buildings in the school district and left half of its 7,700 students without a school to return to on May 23rd. With Superintendent C. J. Huff at the helm, the devastating experience became an opportunity for

Joplin to focus on building facilities [schools] focused on a vision instead of building a vision focused on current structures.

> We need to build the "box" we call school around the vision, not the vision around the box! For schools to be engaging, we [teachers and school administrators] can no longer close our doors and say, "Trust us, we are the experts!" nor can we get the community to feel ownership in the school unless they see school as part of their lives. (C. J. Huff, Ed.D., Superintendent, Joplin, Missouri, keynote address at the 2012 NCPEA conference)

The traumatic experience in Joplin provided an unexpected opportunity to now do it right, build schools that would address the emotional, psychological, and physical needs of its children, its teachers, and most importantly, its community. School design would not only be part of the healing process, it would give Joplin hope for building future student achievement. Sometimes you need an unexpected event to provide an opportunity to do it right! This was the case for at least one of the school sites examined in this study. A commonality of all three school sites in this investigation was that their campus leaders embraced the philosophy that there is a connection between the brain and the learning environment. For this reason, the principals on these campuses appeared to be determined to infuse BCL into their vision of what school should be. As one principal during an interview said,

> It is our responsibility to meet the needs of all our students on this campus. We need to utilize every resource that can make that possible! . . . our environment must be made to support learning. In looking at what helps our kids learn best we are using the work of Eric Jensen, David Sousa, and the Caines as our guides.

Building a Connection between the Brain and the Learning Environment

Associated with environmental effects on students and teachers, is how environment affects the learning brain. Advances in neuroscience continue to provide insight into how our brains process learning. Understanding the workings of the mind in the classroom should provide support for adaptations of how and what we teach (Caine, 2000). Yet, little study has been performed on "where" we teach. Neuroscientist (i.e., Marian Diamond), popular authors, and teachers (i.e., Martha Kaufeldt, Geofrey and Renata Caine, and Eric Jenson), refer to the environment for teaching as needing consideration and enrichment. However, these educators typically have defined enrichment in terms of decoration rather than design and construction. In recent years some school designs have focused on the quality of light and atmosphere, but few have examined the form of the space, the infrastructure, nor the relationship of the physical environment to the tenets of brain compatible learning (Caine & Caine, 1990; Diamond & Hopson, 1999; Jensen, 2003, 2005; Kaufeldt, 2009; Valiant, 1996).

By definition, brain-compatible learning (BCL) refers to the incorporation of important principles about learning and the function of the brain (Jensen, 2005). A BCL environment must present a multitude of learning opportunities that can extend learning beyond the classroom walls. The brain responds positively to accomplishment, novelty, variety, and challenging activities in a safe environment (Diamond & Hopson, 1999; Jensen, 2005; Sousa, 2011). Stimulation with light, nourishment, and hydration, plus instruction coordinated with body rhythms and the cycle of the day support a friendlier and more productive learning environment. Creating a physical environment compatible with the needs of a learning brain is the challenge educators face each day in their classrooms (Milkie & Warner, 2011).

If learning consists of the development of connections between neural networks, our question is whether or not this growth can be enhanced through a more supportive and responsive school setting. An environment where teachers and students are attentive to teaching and learning creates more positive outcomes (Higgins et al., 2005; Kumar, O'Malley, & Johnston, 2008). The role of the teacher is to create an atmosphere conducive to learning and encourage the development of student achievement (Sylwester, 2000). If BCL is to be compatible with education, then there needs to be more interaction with the environment than current school facilities allow (Buckley, Schneider, & Shang, 2004; Earthman & Lemasters, 2009; Picus, Marion, Calvo, & Glenn, 2005; Sousa, 2011).

Emphasis on creating a learning community within the walls of the school facility necessitates engagement by teachers, students, administrators, staff, and community. Observers of school settings deemed learning communities would have students actively engaged in the learning process and teachers actively engaged in teaching. There would be signs of focused purposeful instruction, and a visible achievement plan for student success, a safe comfortable environment, and opportunities for student movement. There would be places for interactive learning as well as spaces for quiet activities (Duran-Narucki, 2008; Higgins et al., 2005; Sousa, 2011).

Teacher preparation programs encourage aspiring teachers to integrate content areas with context and real world experiences.

> An integrated curriculum model provides the knowledge and skills to teach children how to learn and explore information in more than one subject area at a time and across content disciplines. Content, such as arts education, reading/literacy, and mathematics are integrated and applied as thematic areas. Teacher candidates learn to organize subject matter by bringing various aspects of the curriculum into meaningful association. (Hardman, 2009, p. 584)

The single story egg carton school facility design of the 50s, 60s, and 70s does not lend well to the teaching philosophy professed in today's teacher preparation courses (Wise, 2004). The egg carton and egg crate models basically consist of one self-contained classroom next to another without any inside connection between classrooms. Egg carton models are single story shoeboxes that include exits to an outside walkway. Egg crate models look like 3 to 4 story factory constructions, commonly built during the 1930s, 40s, and early 50s. These linear models were designed for economy and efficiency, not always compatible with the other three "E's", effective education environment (Duran-Narucki, 2008). As educators recognized the importance of encouraging teamwork and cooperative learning among teachers and students, the linear egg carton design obviously would not work (Wise, 2004).

Today, contemporary educators and architects are looking for school facility designs that encourage viable teaching and learning environments while meeting budgetary constraints (Tanner, 2009; Uline, 2009). As pointed out by Earthman and Lemasters (2011),

> In school buildings of good condition, students perform better because of building features and condition that assist in the learning process. Students perform better when the proper equipment is available to them, the environment is conducive to efficient bodily functioning, and the building is clean and an inviting place to live. Student performance can be enhanced if the building has those components that research has demonstrated to be necessary for efficient and effective learning. . . . Further, the building should have student-friendly colors in the classrooms as well as functional furniture and equipment in good condition. Finally, there should be sufficient space for

> the student population, and the building should be clean, light, and well maintained. (p. 22)

Carol Venolia (1988), *Healing Environments*, notes that disharmony in a place can be a source of physical and mental stress. Martha Kaufeldt (2009) also supports this notion with her view that "brain compatible learning environments are places where students' curiosities are not piqued with potential anxiety, frustration, or confusion. Instead they are places where annoyance is diminished and curiosity is celebrated" (p. 133). Further, Robert Sylwester (2000) noted that the challenge is to create a stimulating space that gets, "as close as possible to the natural environment to which our brain is innately tuned" (p. 93). All three researchers in this study passionately agreed that the physical environment plays an important part in teacher instruction and student learning. Let's now take yet a closer look at the school sites that incorporated BCL in their philosophical vision.

The School Sites under the Microscope

The three elementary schools in this study were situated in central Texas in two adjoining school districts. Two of the selected school sites were located in the most impoverished sections of a mid-sized east Texas town. The third site, another older school facility served a diverse population of students from low to middle income homes. None of the three sites had similar blue prints in design, but each site catered to a similar philosophical vision of what the school box should be. Like Sherlock Holmes and John H. Watson, the researchers looked for connections between teaching, learning, and application of BCL philosophy within the selected three sites. Researchers and participants alike agreed that pseudo names for the schools should be used so more open discussions could take place! Sites included:

1. *Have-It-All Elementary*, a facility built from the ground up with the BCL philosophy at its core.
2. *International-With-A-Facelift Elementary*, a 1960s single story egg carton facility design retrofitted to reflect the BCL philosophy; and
3. *Over-The-Hill Elementary*, another early 1960 single story egg carton facility design modified to incorporate some of the tenets of BCL.

Have-It-All Elementary. In 2011, of the 488 students who attend Have-It-All Elementary, 26% are African American, 69% Hispanic/bilingual, and 3% White & Other. Schools are ranked according to how students scored on the Texas basic skills tests, TAKS (Texas Assessment of Knowledge and Skills). The student population meets the criteria for economically disadvantaged and has shown little fluctuation in status (90-96%) over the last 15 years. Increased test scores are attributed to the school's almost perfect attendance average from 2002-2011. Even though Have-It-All Elementary is considered to be in a low socio-economic area with limited resources, the school was awarded for its "Recognized" status in 2004 and 2010 and its "Exemplary" status in 2009 and 2011 (Texas Education Agency, 2012).

The surrounding neighborhood is noted for its high crime rate, neglected neighborhoods, and streets in need of repair. However, vandalism has been nonexistent in this school since its opening day 15 years ago. Student achievement and attendance has remained high for over 12 years. This accomplishment is in spite of the many challenges the school faces every day.

Presently the student population has shifted from predominantly African-American in 2000 to predominantly Hispanic in 2012. Today, addressing the needs of the school's growing LEP (Limited English Proficiency) student population is the primary focus.

Have-It-All Elementary is one of 16 district elementary schools located in one of the poorest neighborhoods in a town of 76,200 residents (U.S. Census Bureau, 2010). Even though a large land grant university with 46,618 students (Texas A&M University, 2012) is located in a nearby sister city, most children in this part of town have never visited the university campus. Over-all state test scores have consistently remained above the state average from 2003 to 2011. In 2010, the state test (TAKS) passing average was 77% while Have-It-All Elementary's 2010 passing rate was 79% (Texas Education Agency, 2012).

The school represents the surrounding community's best efforts in providing an exceptional education in the best learning environment possible. Building a school that fostered BCL principles was not only a community choice, it was a community demand. This particular elementary school has support from several near-by community churches and organizations. Inclusion of a Boys and Girls Club facility with a park and playground adjoining Have-it-All Elementary were part of the architectural plan. An important variable to note is that leadership has been consistent from the school's inception to present day with the same principal, who led the community effort for the school construction, still at the helm.

This facility, the newest of the three in the study, is a 15-year old school specifically designed with the tenets of brain compatible learning in mind. It was built on the site where one of the first community schools stood for over 50 years. The facility features murals and sculptured figures representing the seven continents of Africa, Antarctica, Asia, Australia, Europe, North American, and South America. The 12 acre site was the location of a junior-senior high school built in 1931. After a fire destroyed much of the original building in 1970, the remaining structure served a variety of different programs. In 1997 the surrounding community wanted a new school on this site. Like the town of Joplin, Missouri, the community surrounding Have-it-All Elementary School did not want just a basic replacement facility. The school board in conjunction with members of the surrounding Have-it-All Elementary community selected school designs that reflected current research on the effect of environment on learning. Interestingly, the majority of the faculty had little if any input into the facility design. They knew little to nothing about BCL until the school administrator, several community members, and two members of the faculty attended a workshop two years prior to the school's construction.

The school entrance opens into a large open foyer with three hallways. Panning the room from a clockwise direction, you see the reception area at 9 o'clock on the left and a corridor leading to a pod of classrooms, kindergarten through 1st grade, at the 11 o'clock position. Moving straight ahead at the 12 o'clock position is a wide-open corridor leading to the library. On either side of the corridor is a conference area for volunteers, a computer lab, and a teacher work/training room. At the 1 o'clock position from the foyer is a glass enclosed atrium with patio furniture and umbrella. The room is used for "lunch with the principal" or as a special meeting place for students to hang out. At the 3 o'clock position is a corridor to the cafeteria/ multiuse room. The corridor has a hand painted scene that illustrates the concept of visual perspective. Depending upon if you are walking from the cafeteria to the foyer or walking to the cafeteria from the foyer you visually think you are walking uphill. No matter where you are in the building the architecture either beckons or provides spaces for engagement in learning. The walls and structures within structures are eye candy. For example, the library has an 8x10 room

shaped like a house complete with windows, curtains, and décor. Students use if for curling up with a good book, or for a variety of small group activities.

The facility is composed of four learning pods connected by corridors that lead to the center of learning, the library. Like spokes on a wheel, classrooms are connected to a room that serves as office and workspace for 4 to 5 teachers. The shared space is designed to promote collaboration among grade level teachers in each pod. Each teacher has their own desk and cabinets in this space. Inside the classroom, you will not find a teacher desk at the head of the class. Instead you might find a work station or several work stations where teachers, teacher aides, or small groups of students work together. No wall or corridor is without a theme. One corridor has a life size replica of the U.S. Statue of Liberty. Another corridor entrance has a three dimensional globe with children encompassing it plastered to the wall. The other two corridors have either a huge dinosaur display or a 3-dimensional solar system.

With the library serving as a hub for learning, all students pass through the library on their way to or from class or other parts of the building. Within the library are multiple spaces, nooks, and comfortable furniture. Faculty meetings are held in the library as well as class activities.

International-With-A-Face-Lift Elementary. Participants in this study described this school as the most inner-city school of their mid-sized town. The language diversity of the student population is what is unique about this elementary school. International-With-A-Facelift Elementary has 592 students enrolled and serves many low socioeconomic children of varying nationalities (Texas Education Agency, 2012). Twenty-one different languages are spoken at this elementary school. The campus is considered to be a school with a large diverse student population residing in a highly international college student housing development near a large university. Student demographics have changed over the years from 45% of the student population in 2003 classified as economically disadvantaged to 62% in 2011. In 2010, 21% were listed as at risk for school failure. In spite of the changes in demographics and community economy, the school has celebrated its "Recognized" status five times in the last eight years and was awarded "Exemplary" status in 2011 (Texas Education Agency, 2012). Several teachers provided the research team with their views as to why the school has been able to provide a quality learning experience to its students over the years. One teacher commented, "Our teachers work hand-in-hand with the parents of our students. We work together to make sure everyone gets the help they need." Another teacher said, "Our teachers work together really well. We share ideas and give presentations about teaching strategies during our faculty meetings. Also, our specialists [ESL, Bilingual, Special Education] are really helpful."

Remodeling and additions were made 12 years ago. Prior to remodeling, classrooms, library, and office were laid out in a typical single story egg carton arrangement (Tanner, 2009). The low cost and simplicity of this particular school design has been popular in the U.S. since the mid-20th century. It was quick to construct and cheap to build (Duran-Narucki, 2008; Wise, 2004). Halls and ceilings at International-With-A-Facelift were long and narrow with windows on every internal wall of the hallways. It was obvious that economy of design took priority over more effective learner centered models. To curb possible student distractions, teachers had curtains to block views to hallway traffic. After 30 years, the school received its second face lift with the addition of wider halls, softer lighting, colorful walls, rooms, and floor tiles. The new improved retrofit facility now has very few windows in the halls. An outside garden replaced a once stark open area between buildings. When asked, students and teachers alike said they view

the facility as a friendly, safe, pleasant environment. Wide halls have become additional learning spaces for small groups. Children's artwork covers the halls and classroom walls. Every inch of space was observed to be utilized in this school. When the research team was learning the history of this school, the principal shared how the administration, not the community, pushed for the school remodeling to represent tenets of BCL. The entire faculty, through a series of workshops, was educated in the philosophy of brain compatible learning and the importance of creating an environment that is conducive to teaching and learning.

Remodeling the facility to fit the philosophy included the addition of teacher workspaces for collaboration and professional development; redesigning the school entrance; and redirecting student traffic flow to the library, the focal point of the school. In keeping with BCL, more natural lighting sources were utilized in hallways and spaces for learning (Caine & Caine, 1990; Valiant, 1996). With hydration being an important part of BLC philosophy, easy access to water bottles and/or a water fountain are available to all students (Jensen, 2005). Like Have-It-All-Elementary School, International-With-A-Facelift Elementary focused on creating a variety of meeting areas and learning spaces to provide areas where teachers can collaborate in their work and students can engage in collaborative projects. When wondering through the classrooms, the research team observed teachers including music, in some cases candles, and soft desk lighting in the classroom. Since the building had extensive windows and natural lighting throughout the facility, florescent lighting was rarely used or non-existent within most of the building.

When walking through the facility, students were observed working in hallways, in corners, on bean-bag chairs, or on couches in classrooms. The variety of languages spoken and cultures represented is acknowledged in newsletters to parents, and signs and labels in hallways and in classrooms. As one teacher said, "It is our job to celebrate cultural diversity here. We encourage our students to share customs they are familiar with from their home and native countries. It is a great opportunity to learn about customs and cultures different from our own. Our students and teachers learn so much from each other!"

Over-The-Hill Elementary School. Over- The-Hill Elementary is a 36 year old school that was remodeled in 1999. Faculty input was not included in the modeling of the facility. As one researcher summarized, "This is a 1960s egg carton school design retrofitted to adapt to 21st Century needs!" Some of the tenets of BCL theory were considered, but economics and costs demanded a more scaled down version of the dream school. As reported by the principal, her wish to create more usable spaces and professional work areas for the teaching staff was all but shelved in the 1999 re-construction process.

Over-the-Hill Elementary is half a mile from Have-It-All Elementary and has similar demographics and needs. However, due to an increasing need to offer more dual-language classes, Over-The-Hill Elementary has expanded its dual language program to meet the needs of its ever-increasing bi-lingual student population. This particular campus was a Pre-K to 2nd grade campus from 1997 to 2007. After 2007, a grade level was added each year until 2010. Redistricting created the need for the school to become a Pre K-5th grade campus. According to the principal, "Grade level additions haven't affected the student population or create overcrowding."

Currently, Over-The- Hill Elementary has 658 students enrolled and serves mostly low socioeconomic from predominantly bi-lingual homes. The student population consists of approximately 13.7% African American (30.3% in 2002), 82% Hispanic/bilingual (63.7% in 2002), and 5% White & Other (5.8% in 2002). Ninety-three percent of the students are on free and reduced lunch compared to 80% in 2002 (Texas Education Agency, 2012). Increased

student performance over the years is attributed to the almost perfect average daily attendance. Even though Over-The-Hill Elementary is considered to be in a low socio-economic area with limited resources, grant funding has increased the number of special programs and services for children. Interestingly, all teachers have a specialization on this campus. The surrounding neighborhood is noted for its high crime rate, neglected neighborhood, but that perception is slowly changing. New housing has been introduced and older abandoned apartments and homes were removed. A beautiful park has taken the place of a trashy vacant lot. Student achievement and school attendance has been steadily on target from 2002 to 2010. It is the belief of the principal that the stability in achievement and school attendance is due to parental and community support of the school.

School attendance has hovered around 96% over the past eight years. According to reported AEIS scores, 3rd, 4th, and 5th grade students who attended Over-The-Hill Elementary have shown increased academic performance (Texas Education Agency, 2012). However, the school principal commented, "Our academic success should only be linked to the special programs and individual attention our students receive, however the use of the space we have provided does help our teachers be more effective in their job." The State has given the school an "Academically Acceptable" rating from 2003 to 2011 (Texas Education Agency, 2012). The number of students who fell into the economically disadvantaged category rose from 91% in 2003 to 94% in 2011. The number of students with limited English language increased over the years from 41% in 2003 to 56% in 2011 (Texas Education Agency, 2012).

Over-The-Hill Elementary is half a mile from Have-It-All Elementary and has similar demographics and needs. Over-The-Hill Elementary has implemented a dual language program for its ever-increasing bi-lingual student population. This particular campus was a Pre-K to 2nd grade campus from 1997 to 2007. After 2007, a grade level was added each year until 2010. Redistricting created the need for the school to become a Pre K-5th grade campus. The grade level additions did not affect the student population or create overcrowding. The original egg carton design of the building is still in place, but as observed by our research team, connections between classroom spaces are now more prevalent. Some walls were removed to encourage collaborative activities among teachers and students. The long outside walkways were covered providing protection from the elements. In keeping with the importance of creating an inviting learning environment, modifications were made to classroom lighting, furniture, and access to resources. Students are provided nutritional snacks and allowed to keep water bottles for hydration at their desks during the day. Just like the other school sites in the study, the school principals viewed adequate hydration and nutrition to be key factors in promoting readiness for learning. Their [the principals] view is a major component of BCL philosophy (Caine, 2000; Diamond & Hopson, 1999; Jensen, 2008).

Method

The study sought to identify the individual and corporate places where children are learning and examine the relationship of these physical spaces to the education process. The study proceeded through three phases. Initially, the researchers examined the 3 selected school sites using a criteria referenced evaluation instrument developed by Dr. Harold Hawkins and Dr. Ed Lilly (1998) for the Council of Educational Facility Planners, International. Through use of a survey process, the instrument was used to measure perceptions of school building adequacy and

quality from teachers using these facilities. Appraisal criteria are categorized into six areas: the school site; structural and mechanical features; plant maintainability; school building safety and security; educational adequacy; and environment for education. Scores from all three-school sites fell within acceptable to exemplary range with Have-It-all Elementary School receiving the highest scores and Over-The-Hill Elementary the lowest. In the second phase of the study, extensive time was spent observing classrooms, visiting the school sites, and conducting interviews. Interviews were held with the principals at these facilities as well as 20 randomly selected teachers to determine their awareness of BCL tenets and relationship to the physical environment (Hawkins & Lilley, 1998). The 20 teachers from the three school sites voluntarily agreed to be interviewed and seemed to enjoy talking about brain compatible learning philosophy and its effects within their individual classrooms (See Appendix A for the complete list of questions used as conversational starting points during interviews).

Besides interviews with principals and teachers at each of the three selected school sites, our research team spent several days looking for examples of application of BCL. This was accomplished through observing teacher and student behavior within classrooms of the selected schools and comparing researcher notes. The intent was to identify possible connections between teaching, and student learning within the physical environment. Each selected school had a significant number of variables that are often noted to influence a teachers' attitude, use of instructional strategies, job satisfaction, and retention in the profession. Other variables noted included student attention, enthusiasm for learning, student academic performance, attendance, and attitude. These variables are often associated with schools where the learning environment is considered safe, supportive, and enriched (21st Century School Fund, 2009; Delpit, 1995; Donaldson, 2001; Jensen, 2008; Pellicer & Anderson, 1995; Sousa, 2011).

Results

Prior to facility renovations and/or construction, the learning community at each of the three sites faced challenges that many impoverished and depressed communities face: student engagement and achievement, teacher retention, overall school performance, and community support. With facility construction or improvement, it was obvious that something was making a difference in addressing these challenges. First visits to the two improved school sites and the one newly built school provided interesting impressions that immediately begged the researchers to investigate why these campuses were experiencing success in student achievement, teacher retention, and community satisfaction. The mystery was there for the research team to solve!

Contributing comments by teachers from each school site were derived from their responses to the following questions posed during interviews: 1. Do you believe the school facility contributes to school success; 2. Do you believe that the school facility affects teacher, student, and surrounding community attitudes; 3. What is your opinion regarding how facility design and space affect learning; and 4. In what ways does the building principal impact the facilitation of BCL philosophy in the facility design and teacher practice?

Even though each school in this study shared a common BCL philosophy, there were some interesting differences in how this philosophy was incorporated into facility design. Retrofitting existing buildings to support BCL was a challenge for two of the school sites (International-With-A-Facelift and Over-the-Hill). Philosophical interpretation became a challenge for the facility built specifically to support BCL.

1. Do you believe the school facility contributes to school success?

Principals and their teachers were asked this question at all three-school sites. At Have-it-All Elementary student and teacher attendance is at a 98% average which the principal attributes to the steady increase in state test scores over the past six years (2006-2012). She noted,

> Pride in our school, by both our teachers and students, is what matters. I have to believe that the pride we have in our school building somewhat contributed to our success and our student performance. Our school has become the hub of our community! We are proud to have a state of the art school in this part of town.

Teachers describe the Have-It-All Elementary facility as comfortable and challenging to the mind. One teacher said, "The very nature of its design creates levels of comfort for the children and doesn't have that factory look about it." Several teachers indicated that ". . . higher levels of thinking [by students] are possibly due to the comfort, space, and safety of the school." As noted by a teacher team leader, "The school is designed very well for movement and learning. The traffic pattern and space allows us to work and move from area to area without disruption or inconvenience to others." According to the principal at International-With-A-Facelift, "We have made great progress in retrofitting our campus to reflect our learning philosophy. Yes, having space and an atmosphere conducive to learning is bound to affect learning. I truly believe this." When asked this same question, the principal at Over-the Hill Elementary said, "When you work and learn in an environment that is inviting and comfortable, you probably will be able to concentrate more on learning. I think the on-going remodeling we are doing is improving the learning for our students." Teachers at Over-The-Hill Elementary described it as an egg carton school that tried to be a cathedral. The six teachers who voluntarily participated in the interviews did not link facility improvement to their students' achievement. Instead they linked school success to the hard work teachers were doing to help students achieve within the limitations of the facility. The addition of spaces for collaboration among teachers and students was viewed to be beneficial, but not the sole reason for the schools' success. As one teacher said, "We [teachers] love the work spaces. It is what we are able to accomplish in these spaces that counts. Our teachers are the ones making a difference with our students." Classroom observations by the researchers confirmed this.

An art teacher, a second grade teacher, two first grade dual language teachers, and a reading specialist were among those interviewed. These particular teachers had worked on this campus during the school's transition from three grade levels to six grade levels (Pre-K–5th). Most teachers at Over-The-Hill are certified in one or more specialization fields. Certifications included, ESL, Bi-lingual Education, reading, and/or special education. Emphasis on the number of highly trained staff was viewed to be the predominant reason for the school's success, not the facility.

2. Do you believe that the school facility effects teacher, student, and surrounding community attitudes?

Perceptions of the facility, and its impact on student learning and teacher instruction, were another predominant topic covered during teacher interviews at each school site. The staff at Have-It-All Elementary said they believed that construction of the school facility has had a

definite impact on faculty, students, and community attitudes. At Have-It-All Elementary, one researcher said, "I was greeted with hugs every time I entered the building and offered a tour by more than one student. Faculty and students alike view the facility as their home away from home and the reception room as their living room." Several teachers and parent volunteers indicated that the school helped create a more positive perception of the surrounding community which had been neglected and in disrepair for decades. Parent school volunteers and some of the teachers interviewed attributed the revitalization of the neighborhood to be due in part to the community link with the school. Pride in the school was a prevalent theme during informal conversations, formal interviews, and classroom observations. The fact that new housing development has occurred during the last eight years in this most impoverished area of town is a testimony to how a school facility can impact a community.

Teachers interviewed at International-With-A-Facelift attribute the success of their school in part to professional freedom rather than the remodeled school facility. According to the school principal, teachers are allowed flexibility within the classroom to utilize resources and spaces to fit lesson goals and student learning. It was her belief that flexibility in how resources and space is utilized supports good instruction. One teacher stated, "Being flexible with time and instruction allows connections to be made with our kids. Some of our best lessons have come out of discussions and having the flexibility to go on and try things even if it's not science time or math time." Another teacher expressed his gratitude for the freedom he's allowed to teach in his own style. This individual stated, "I am not just allowed to do this. I've been encouraged to do this!" A 3rd grade teacher stated, "There are so many teaching styles in our school. So many schools are so TAKS [Texas Assessment of Knowledge and Skills] oriented that you can go into several classrooms and they're teaching the same thing. It's like a factory assembly line! Do this first then this next . . . ! I believe we meet student needs when that happens. The freedom we have here allows us to focus on what our students need. It becomes more personal." These teachers brag that TAKS scores have steadily increased since BCL was introduced in 2001. As one 4th grade teacher said, "I believe we are meeting campus and district goals in new and innovative ways. Our success with TAKS is because we are using a variety of resources with our students."

At Over-The-Hill Elementary, none of the teachers directly addressed this question. During group interviews, teachers said the school facility was one they had to "work with" not "work in". The remodeling that was occurring over the years was primarily done to accommodate the change from being a Pre-K–2nd grade facility to a Pre-K–5th grade facility. Incorporation of the BCL philosophy was a goal of the campus leadership and not fully infused within the teaching staff. The dedication of its teachers and staff were viewed to be the strength of Over-The-Hill Elementary, not the facility.

3. What is your opinion regarding how facility designs and space affect learning?

Teachers at Have-It-All Elementary reported they have their students use the surrounding artwork (murals, paintings, etc.) in the halls and on the walls to enhance student-learning experiences. The three-dimensional artwork in the school environment is used daily for creating many active hands-on learning experiences by both teachers and students. The difference in the design of Have-It-All Elementary in comparison to other elementary school facilities is that the facility design is credited for supporting a positive attitude in staff and students alike. One teacher said, "It [facility design] creates a sense of, ownership among our students." Another

teacher said, "Students as well as people in our community are very proud of their school and its state of the art design. It is nothing that they have ever seen in a school before."

Some teachers did voice concern regarding the open concept design of the library and the fact that all traffic to and from classes pass through it. However, these concerns were not the predominant view of most teachers interviewed. As one teacher stated, "The library should be the hub! It should be an active lively place. It should be a place where students and teachers engage in conversation and learning." Another teacher said, "Teachers more than students are affected by the noise level! Students should be surrounded by books and see people reading and working together. Noise isn't the problem!"

Other discussions with teachers at Have-it-All Elementary referenced windows, open spaces, nooks, and crannies for a variety of learning settings. Student and teacher friendly furniture is located throughout the school. Several statements by teachers and staff referred to the perception that the building allowed for a variety of learning spaces. "You can go and sit on the couches, and you can curl up in the library . . . there are so many places you can work one-on-one in a non-threatening way."

In the case of International-With-A-Facelift Elementary, the environment of the school facility was physically changed as much as possible to fit the belief system of the learning community [teachers, staff, and students]. The rationale behind the flexibility afforded teachers within their classrooms was said to be due to emphasis on engaging all students in learning. Teachers were happy with the 1999 remodeling of the building. However, some teachers were not fond of the long hallways, others wished there were still windows in the halls to view individual classrooms, and most teachers agreed that more storage space was needed. None of the teachers interviewed said the building captured their view of an ideal BCL school. Most teachers indicated they were very pleased with the colors in the classrooms, the new flooring, lighting, and enlarged halls. One teacher said, "The colors make the building light and bright for teachers and students." Teachers also indicated their satisfaction with the exchange of florescent lighting for softer indirect lighting in most classrooms. The garden area appeared to provide both students and teachers with a sense of pride as well as providing learning opportunities. One teacher said, "The additional learning spaces within the school and library provide our students places to work individually or in groups. This is a plus!" When not in use, the science lab is used as a study hall for children who want to work in a quieter environment. Another teacher expressed, "There's a freedom to use the new spaces however you want to as long as it doesn't bother others."

In Over-The-Hill Elementary, teachers were happy with the continued remodeling of the school, but saddened by the cost cuts. Little was done to improve the accessibility to materials and resources for the teachers. There are still few professional spaces for planning and working. Students still have to walk outside the classroom to the bathrooms and gym by way of an outside walkway. Some teachers are not happy with the huge rambling layout of the facility; others wished the district had torn down the old school and started over with a new one. The assistant principal and executive principal were frustrated with the outcome of the first remodeling in 1999 as well as the continued remodeling over the years to 2011. The school administration has been continually trying to make modifications that will have a more learner-centered focus within the confines of the current building structure. It is the opinion of the research team that this endeavor has not been an easy task.

4. In what ways does the building principal impact the facilitation of BCL philosophy in the facility design and teacher practice?

Both teachers and principals referenced the important role school leadership has played in maintaining the goals and philosophy of the school over the years. Building a learning community where students, parents, teachers, staff, and leadership are supported was a consistent teacher response in all three schools. As one teacher from Have-It-All Elementary said, "Everyone is encouraged to do their best, be their best and to help each other meet their potential." This philosophy has been emphasized by the principal at Have-It-All Elementary School since opening day 15 years ago. The importance of consistency in philosophy was noted during informal conversations with teachers, parent mentors, and teaching staff.

Teachers at International-With-A-Facelift Elementary stated that BCL has been successful in their school due to strong leadership over the years (2002-2011). Extraordinary leadership provided by principals and team leaders has encouraged teachers to embrace the tenets of brain compatible learning over the years. As one teacher put it, "Strong principals challenged our teachers to think about learning in new and exciting ways. Looking at our achievement scores over the past 3 years shows continued growth in student achievement."

Teachers at International-With-A-Facelift Elementary expressed their fondness of staff development meetings. As one 4th grade teacher said, "We study child development and the developing mind. We are asked to apply this knowledge in our teaching." Another teacher said, "Our faculty meetings are mainly staff development meetings. Most of time, they are interesting. We all take turns planning topics and book studies." During faculty meetings, the researchers observed teachers discussing topics together, addressing issues, planning future professional development activities, and reviewing data on student performance. Bi-weekly activities included, Chalk Talks. This activity allows teachers who are interested in similar topics to come together and discuss what has been successful in their classrooms. Staff development activities are often held in lieu of faculty meetings. Teachers at the other two elementary schools in the study shared similar positive reflections regarding the importance of leadership in sustaining the BCL philosophy through engaging staff development experiences.

In comparing observations and interview notes, Over-The- Hill Elementary appears to be at the beginning stages of exploring how it can incorporate effective BCL learning strategies into its curriculum. Several teachers credited their school leaders for training and encouraging teachers to study how the brain learns. Similar to International-With-A-Facelift Elementary, the principal at Over-The-Hill is encouraging more teacher involvement in learning and applying BCL. Professional development topics and book studies focus on BCL. Teachers share teaching strategies that are working at faculty meetings. One teacher shared, "Thanks to our principal, our meetings [faculty meetings] are not a waste of time! We share a strategy or what we learned at a conference or work shop." Grant funding provided the teachers with workshops and staff development in BCL. Several teachers at Over-The-Hill said they attended training in BCL theory and practice and seemed to be enthusiastic about its application. Teachers were observed providing student's opportunities to move about their classrooms and to stay hydrated. Water bottles for hydration were readily available to students in many of the classrooms.

Summary of Differences and Similarities of the School Sites

At all three school sites, the research team observed hands-on learning occurring in each classroom where teachers have embraced the BCL philosophy. Teachers who were observed to be more familiar with the BCL philosophy had a wide variety of activities for their students. Music and lighting appeared to be intentionally used as a strategy for engaging students in classroom activities at both Over-The-Hill and International-With-A-Facelift elementary schools. Florescent lighting was said to be kept at a minimum within the classrooms.

The predominant theme that emerged from interviews and observations indicate that Have-It-All is the result of strong leadership and community action. The surrounding community wanted a neighborhood school that represented the BCL philosophy, promoted student success, encouraged parental involvement, and embraced the cultural diversity and community heritage. Their determined efforts seemed to produce the desired outcome. Regarding design, space, lighting, and structure, the facility truly reflects the BCL philosophy described in the literature (Caine, 2000; Earthman & Lemasters, 2009; Oliver & Lippman, 2007; Picus et al., 2005; Sylwester, 2000; Uline, 2009; Valiant, 1996). Have-It-All Elementary represents what the other two schools in this study hoped to create with remodeling. Consistent leadership, low teacher turn over, and continuous "recognized" ratings illustrate how effective the school has been in creating a learning community over the years since its inception.

Similar to Have-It-All and Over-the-Hill elementary schools, students and teachers at International-With-A-Facelift have embraced brain compatible learning strategies. It was their belief that success with BCL strategies would improve academic performance, student attendance, and student engagement in learning tasks. Behavioral problems have decreased and state assessment scores have increased since BCL was introduced 12 years ago. As summarized by several teachers, this phenomenon was due to the fact that their students hated to be pulled from the classroom. The researchers observed children truly enjoying learning and teachers enjoying the flexibility to accommodate individual students. International-With-A-Facelift appeared to be a BCL theory success story.

From the researchers' perspective students and teachers at Over-The-Hill embraced the learning strategies of brain compatible learning, but did not have the opportunity to utilize what they learned during their training in BCL strategies. According to teachers interviewed, this was due to the continual building modifications being made during the last six years. Classrooms, doors, furniture, and restrooms designed for younger children in grades Pre-K–2nd had to be redesigned to fit the needs of additional grade levels 3rd-5th.

Discussion

Preliminary findings show a connection between indirect and/or direct application of BCL affecting teacher and student perceptions of learning and teaching in some settings. Teachers working in facilities that have been specifically designed with the learner and the process of engaged learning in mind seem to be able to move beyond the very things that get in the way of instruction. For example, teachers in Over-the- Hill Elementary still had to work within the confines of a set space. The library was still far from most classrooms so they had to plan time within their lessons to make those trips. Time away from instruction seems to be a key factor in teaching and student learning on this campus. Teachers at Over-The-Hill had to spend

their time planning for use of available space and resources, bathroom breaks, filling of water bottles, learning centers within small rooms, etc.

On the other hand, teachers in International-With-A-Facelift Elementary were able to give input into how the original facility could and should be modified to meet their instructional needs. Student learning was the primary target at International-With-A-Facelift. The teachers had training and expertise in BCL and embraced the theory. When it came time to make decisions about remodeling, they knew what they needed and wanted. They were given a voice in the remodeling process. They wanted International-With-A-Facelift to be compatible with their goals and beliefs about learning. Even though the majority of the teaching staff in Have-It-All Elementary had not studied the theory of BCL, the majority of teachers interviewed embraced the results of its application to the school's design. Leadership and community support were the key factors in learning about the connection between BCL theory and its application at this facility. The school administrator had teachers learn how to work within the BCL building design. In the case of Have-It-All Elementary, the principal and community were instrumental in securing a school facility that would project the best researched design for their students. 2012 marks the 15th anniversary of Have-It-All Elementary's existence as well as its principal's tenure as school leader. Over the years she has had her teachers engage in book studies about learning and the BCL philosophy. Through her efforts, the school has become a center for learning and community celebrations.

What Mattered Most?

There are several factors that contributed to why each school site in this study has consistently demonstrated success in student performance, teacher retention, and an engaged learning community. Even though this particular study is limited to three elementary schools grounded in similar demographics and philosophy, the fact that all three sites recognized the importance of connecting environment and learning is what matters most. The school leader and in one case the surrounding school community (Have-It-All Elementary) persistently sought ways to provide a conducive learning environment for the students they served. Their efforts are noteworthy! As one teacher said, "It is important to both teachers and students to have happy brains! Just look what we all can do when we have a great place to teach and learn."

The following summarizes the themes that kept reappearing during the study at each school site. These are what mattered most in establishing a productive learning environment:

1. Each school site adopted and promoted a philosophy that focused on how the brain learns best, on what teachers and students need to be successful, and where learning and work spaces should be within a school facility. The BCL philosophy remained even when leadership changed over the years.
2. Each school site recognized the importance of creating a learning environment that supports the tenets of a particular learning philosophy. In this case all three schools constructed or reconstructed their facility to reflect a BCL philosophy.
3. Each school site had school leaders who supported and tenaciously encouraged the constructs of the BCL philosophy. Leadership was key in how predominant the philosophy was applied among teachers and within classrooms; and
4. The greater the incorporation of adequate spaces for learning, teaching, and collaboration, the greater the satisfaction seemed to be among students, teachers, and the community.

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