

CLASSROOM DESIGN: FACILITY IMPLICATIONS IN A NEW ERA

BY

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Classroom Design: Facility Implications in a New Era

When we think of a classroom we generally think of a room, approximately 30' x 30', with desks and chairs facing a blackboard. Though this model has been implemented for generations, it is surprising we still use it given the research demonstrating how our brains learn.

The learning environment has been acknowledged as important at the early childhood level - issues such as comfort and scale are recognized as key to making a place conducive to learning. Understanding that transitions from home to school can be stressful is also important. While it is known in early childhood research, it is not often acknowledged in institutional school settings. Given that it helps the learning process, making children feel comfortable, welcome, and creating a sense of belonging in the environment in which they spend a minimum of five to six hours a day should be a priority.

Why then do we continue to produce elementary classrooms that echo the classrooms in which our grandparents sat? What new research can we apply to learning environments at the elementary level? This paper documents the benefits of — and makes recommendations for — the incorporation of elements that enhance the teaching and learning processes.

How do we learn?

“Learning is experience. Everything else is information.” — Albert Einstein¹

Research indicates that learning happens in different ways. Howard Gardner’s theory of multiple intelligences has been translated into practical applications including the use of different learning centers that reflect kinesthetic, visual-spatial, mathematical-logical, musical, linguistic, interpersonal and intrapersonal learning.² But beyond this, the brain needs different types of activity and movement to help create new synapses between neurons.³ Movement is especially important as learning is not a process of the mind alone – learning involves the body through our senses and emotions.⁴ Thus, environments for learning need to accommodate movement and be adaptable to different types of hands-on, active learning.

Linking Environment to Learning

But does the environment contribute to learning? Isn’t it the teacher that matters? Yes and yes. While the teacher’s skill and experience is considered to be the main contributing factor for student learning, according to a New Zealand study, one out of three principals and teachers considered the teaching space itself to be a contributor to student learning outcomes.⁵ There have also been a number of studies that have reinforced the importance of learning environments. These include *Daylighting in Schools: An Investigation into the Relationship Between Daylighting and Human Performance*⁶ that measured test results in three districts from the Second to the Fifth grades and found a statistical relationship between daylighting and improved scores. Acoustics have also

¹ <http://libweb.sfasu.edu/aarc/WhoWeAre/philosophy.htm> accessed 1.03.06

² Campbell, Bruce, “Multiple Intelligence in the Classroom”, 1989.

<http://www.newhorizons.org/strategies/mi/campbell2.htm>, accessed 01.03.06

³ Valiant, Dr. Bob, “Turn on the Lights! Using What We Know About the Brain and Learning to Design Learning Environments”, August 1996, Issue Trak Briefing Paper, CEFPI.

⁴ Hannaford, Carla, PhD, “Smart Moves: Why Learning Is Not All in Your Head”, http://www.wellspring.com/Cat/Adult_books/smart_moves.html, accessed 01.03.06

⁵ Best Practice in School Design, NZ Minister of Education, ACNielsen, 2004, p 6.

⁶ Heschong Mahone Group, *Daylighting in Schools: An Investigation into the Relationship Between Daylighting and Human Performance*, Pacific Gas and Electric Company, 1999.

been studied and indicate that children in schools exposed to noise such as from an airport, have poorer reading skills.⁷ The place students learn contributes or detracts from the learning experience. Including but not limited to daylighting and acoustics, there are multiple environmental needs that should be considered in classroom design to help foster effective teaching and learning.

Basic Comfort

Many parents do not have a chance to sit in their child's classroom for a full day. Schedules don't often allow for it and attendance at evening conferences are concentrated on a student's achievements, not the physical characteristics of the classroom environment itself. Therefore, they may not necessarily know that the room is hot or cold or that there is a glare on the teaching wall in the morning. These are some of the basics that need to be addressed for learning to occur.

Basic comfort issues to consider:

- ***Climate Control/Temperature:*** Maintaining a comfortable temperature in the room may include local control for the classroom and good building insulation to reduce summer heat and minimize winter cold. Airflow to remove hot air and provide cooling breezes are important and to this end operable windows with screens to protect from insects should be included in each room. Sun screens and window blinds can help prevent south and west side heat gain.
- ***Ventilation/Air Quality:*** Current codes need to be met to minimize stuffiness and CO2 build-up. Ventilation needs to be quiet and uniform throughout the space to prevent localized cool spots. Odors and smells can be problematic particularly in older schools and students can be more affected by these than adults. Ventilation can help alleviate smells.
- ***Acoustics/Noise Management:*** There are three aspects of noise management: minimizing noise from within the classroom, from surrounding functions, and from the outside. Minimizing the impact of noise within the classroom is the highest priority: Student voices or movement along with mechanical and computer equipment create a level of background noise that can interfere with learning. Material choices can help reduce this noise, such as carpeting, acoustical ceiling tile and soft materials on the walls. Higher ceilings can also lessen the sound reverberation within the room. Noise from outside the classroom can also be mitigated through construction materials that absorb sound and detailing to prevent the transfer of noise. Doors, glazing, and wall construction/materials should be addressed. Locating programs that may be noisy adjacent to classrooms should be re-considered.

Increasingly schools are turning to active acoustical management, simply because student-produced sounds (e.g., shuffling feet, moving in seats, breathing) cannot be controlled. Voice amplification systems for teachers have proven to be effective in helping students to hear, particularly by distributing sound evenly within a room. They also help prevent voice strain in teachers.

- ***Day Lighting:*** According to a New Zealand classroom study⁸ lighting is one of the top three factors in creating a "positive learning environment." Daylight was preferred in this study by both teachers and students and there was "an active dislike of fluorescent lighting (glare, flicker)."⁹ Natural light should be uniform and consistent. Light control is important as glare on learning surfaces and light in eyes can distract from learning.

⁷ Maxwell, Dr. Lorraine E & Evans, Dr. Gary W., Design of Child Care Centers and Effects of Noise on Young Children, <http://www.designshare.com/Research/Lmaxwell/NoiseChildren.htm>, accessed 1.03.06

⁸ Best Practice in School Design, NZ Minister of Education, ACNielsen, 2004, p 11.

⁹ Best Practice in School Design, NZ Minister of Education, ACNielsen, 2004, p. 11.

- **Lighting:** Artificial lighting should be flexible and adequate for the tasks taking place in the room. Switching options and/or dimming capabilities should be considered. Lighting needs to take into account location of computers and screens/whiteboards. Energy efficiency should be considered. Glare and overly bright lighting can be as detrimental as inadequate lighting.

Well-Being

In addition to the above basic comforts, there are other influences that affect how one feels about his/her environment. Is it welcoming? Is it pleasant? Does one feel comfortable in it? Research regarding the design of children's hospitals¹⁰ asserts that a comfortable child-oriented environment considers the following design issues: social interaction, family support, security, territorial privacy, independence, access to outdoors, and opportunities to personalize space.¹¹ According to Linda Cain Ruth, AIA, in her article "Designing Environments for Young Children", "each of these elements represent an attempt to create an aspect typically found in home environments." In thinking about schools, the same considerations should be discussed. These issues speak to the psychological comfort of children in institutional spaces.

Well-being issues include:

- **Scale:** Children are a different size than adults. An environment that acknowledges this difference communicates that the primary users of the space are children and that their comfort and needs are important. Windows children can see out of, counters that can be reached, facet handles that can be accessed without standing on a stool, all talk about a place that is child-friendly and not a place to which children have to adapt. Safety is also a consideration, as children do not need to stretch and reach when their environment is appropriate to their size. It should also be noted that children use their environments differently and the floor, for example, is an important place in early elementary classrooms.
- **Visual comfort:** Two aspects of visual comfort are important to identify, one is long-range viewing and the other, visual clutter.

Long range viewing out of windows allows the eye to focus not just on task work but at longer ranges giving the eye muscle exercise and providing visual relief.

Visual clutter is a common issue in US classrooms. Brightly printed alphabet cards, colorful bulletin boards, and paper items hanging from the ceiling all contribute to visual clutter. We live in a society that values stimulation. There is an entertainment aspect to education, similar to Sesame Street – catch their attention with bright colors and then teach them something. Young children are still learning about the world through their senses. A calm classroom can help keep their attention on learning. Decorating with natural materials, art that might be found in a home, and student work are examples of an attitude supported by both Reggio Emilio and Waldorf classrooms. Geri Ihara, a teacher with the Honolulu Waldorf School says when children come to a classroom devoid of bells and whistles, "they relate to (the materials), and they're more into the function rather than the attraction. It draws them in naturally. It's like the beach. There's no need for fancy toys. They just dig in the sand and play in the water."¹² In addition, a recent article notes, "...a sterile, cluttered

¹⁰ Malkin, *Hospital Interior Architecture*, Wiley 1992

¹¹ Ruth, Linda Cain, *Designing Environments for Young Children: Leading Issues*, <http://www.hichumanities.org/AHproceedings/Linda%20Cain%20Ruth.pdf>, accessed 1.03.06

¹² <http://starbulletin.com/2003/11/13/features/story2.html>, accessed 1.04.06

classroom limits students' ability to learn, while a more relaxed, attractive classroom decorated in ways that focus on what the class is studying helps."¹³

- **Natural materials:** Young children are still learning about their world. Creating a classroom environment rich in natural materials makes the space less institutional and engages the senses. Consider the warmth of natural wood furnishings and wicker baskets instead of brightly colored plastic. Include fresh flowers and other sensory stimulants including music. Direct access to the outside should also be considered.
- **Access to toilets, drinking fountains:** According to an article entitled "Redesigning the Classroom Environment"¹⁴ research has shown that many children in schools are dehydrated.¹⁵ Access to drinking water within the classroom has many benefits and contributes to healthy habits.

Space and Program

The question often comes to, finally, how much space should be in each classroom? And to this question there is not one answer. There are guidelines that vary from state to state and districts often have their own specifications. However, the important issues to consider are what do you want to do in the space and how can it be made flexible for the future.

The classroom of 50 years ago was used for the same basic function – for students to learn in – but the resources and teaching options were different then. While at the elementary level it is still usually a teacher with 20 to 30 students, there may also be an assistant teacher, a special education teacher or an aide also teaching in the same room. The needs of the students are different too – it should be recognized that students learn in different ways, that inclusion is important, that students do projects and work in small and large groups. And of course technology has made access to learning different and is a different kind of tool. Other considerations include testing requirements, English Language Learning, and storage of both teaching materials and student work.

- **Program Space:** It is important to consider what will be done within the classroom when determining size. For example, stations, or 'centers' for learning in addition to desk or table work drives the typical kindergarten classroom size of approximately 1,200 SF in many places. Computers and TVs within the classroom also require additional space. Other questions are: Will there be a story area or small group area? How will movement be accommodated? Where will testing happen? Should a toilet be included in the area? The range of size for rooms may also vary with the age level.

As movement and project-based learning have changed activities within the classroom, square footage requirements are also being rethought. The following chart notes current Texas minimum classroom areas with adjustments and comparison to Minnesota guidelines. Other recommendations include classrooms of a minimum of 1,000 SF in size.¹⁶

¹³ "Reading, 'Riting, Redecorating: School Decor for Better Scores?" Minneapolis Star Tribune December 18, 2005, page A1

¹⁴ <http://www.schoolzone.co.uk/resources/articles/Good Practices/classroom/Redesigning.asp>, accessed 12.27.05

¹⁵ *ibid*, p.3.

¹⁶ Recommendation from Legat Architects, a member of the American Schoolhouse Council

Grade level	Texas Ed. Agency <i>minimum</i> ¹⁷	+ 15% ¹⁸	Minnesota Guidelines ¹⁹	National observations ²⁰
Pre-Kindergarten – 1 st	800 SF (assumes 22 students) or 36 SF/Std. (under 22 students)	920 SF 41 SF/Std.	1,000 - 1,500 SF (assumes 15 to 25 students)	45-50 SF/Std.
Elementary (2 nd – 5 th grade)	700 SF or 32 SF/Std.	800 SF	850 - 950 SF	35-45 SF/Std.

- Room Arrangement and Shape:** The shape and arrangement of the room is also important. Having adequate space for activities and the number of students, providing flexibility in room and desk layout, and the ability to change this during the year are especially important. In a New Zealand study it was noted that the ability to “create separate specialist areas within the bigger space is important... Ideally, this would include the opportunity for work centers, group work, withdrawal groups, study bays, tables and special resources displayed, computer area, etc...”²¹

Rectangular rooms that are long and narrow can be difficult if there is a teaching wall and either the distance or the angle makes it difficult for students to see. According to an article by Franklin Hill and Sarah Cohen, students were asked to identify basic shapes in the First through Third grade classes and a “...significant number of students could not differentiate a square from a rectangle or an oval from a circle simply because of where they were sitting.”²² As a guideline, the length to width ratio should be no greater than three-to-two (3:2).²³

Other classroom shapes include the “Fat-L” shaped classroom originally described by James A. Dyck as a classroom that allows for the formation of small groups, provides flexibility, and can be managed as by a single teacher.²⁴ Unlike a passive industrial model of education where students were likened to containers being filled by teachers, Dyck viewed learning as active and this required different spaces to accommodate different activities.

¹⁷ Texas Education Agency, <http://www.tea.state.tx.us/school.finance/facilities/standards.pdf>. Section 61.1036. School Facilities Standards for Construction on or after January 1, 2004. p. 7.

¹⁸ Dan Butin of the Thomas Jefferson Center for Educational Design at University of Virginia suggests adding 15% to standard classroom sizes for technology, project-centered instruction, and inclusion of special education students. Butin, Dan, “Classrooms.” Washington D.C. National Clearinghouse for Educational Facilities, July, 2000. p. 2

¹⁹ Minnesota Department of Education, Guide for Planning School Construction Projects in Minnesota, Updated January 2003. p. 83. Guideline area does allow for inclusion, project-based learning. http://education.state.mn.us/mde/Accountability_Programs/Program_Finance/Facilities_Health_Safety/School_Construction/index.html.

²⁰ Recommendation from BRPH Companies, Inc., a member of the American Schoolhouse Council

²¹ Best Practice in School Design, NZ Minister of Education, ACNielsen, 2004, p 8

²² Hill, Franklin and Cohen, Sarah, “School Design Impacts upon Cognitive Learning: Defining ‘equal educational opportunity for the new millennium’” http://www.schoolfacilities.com/_coreModules/content/contentDisplay_print.aspx?contented=1792, accessed 12.27.05

²³ Butin, *ibid*, p. 2

²⁴ Lippman, Peter C., “The L-shaped Classroom: Pattern for Promoting Learning” DesignShare, Inc., p. 2. See also Dyck, James A., “The Case for the L-Shaped Classroom: Does the Shape of a Classroom affect the Quality of Learning that Goes Inside It?” In Principle Magazine, November 1994, pp.41-45.

- **Storage:** Storage for both teaching materials and student work needs to be accommodated. Items not accessed regularly can be stored in cabinets or a storeroom, ideally locked. Access to items used for teaching by students is important as they grow and can increasingly take care of and be responsible for items. A designated space for storage for each student and for the teacher should be made available.
- **Teacher Space:** In some cases it may be appropriate for teachers to have a professional workspace separate from the classroom. These spaces encourage teacher collaboration and provide a place for planning away from students. Teacher support spaces should include access to phones, computers, and storage of teaching resources and personal items. This space may also incorporate specialists and itinerant staff, providing a place for teacher discussion of students.
- **Student Space:** Within the classroom, a place to personalize whether it be a desk or a cubby helps create a sense of belonging and identity. For older elementary students, socializing space outside the classroom may also be important.
- **Transparency/Adjacencies:** In addition to the classroom itself, pull-out space for small group work adjacent to the classroom is recommended for one-on-one tutoring, itinerant staff work, project work and testing. This space should be observable from the classroom for supervision of small group work. Larger group space may also be desired and may depend on the arrangement of classrooms (i.e., together in a team or grade level grouping).

Furnishings and Technology

Good furnishings help create a learning environment that is attractive and comfortable. The use of durable, quality furniture of the appropriate size for children is important. Each student should have enough room to work comfortably. Desks are often preferred to tables as they provide more flexibility for arrangement. Increasing the space between desks may discourage unnecessary talking and allow for testing in the classroom while moving desks together can provide opportunities for collaboration. Fixed furniture is generally not liked at the elementary level as it limits flexibility. To provide the most opportunity for movement within the classroom "...each piece of furniture should have a clear purpose and be used regularly or it should go...do you, for instance, really need a teacher's desk in the classroom – exactly what function does it fulfill?"²⁵ Including plants may also be desirable as they add a natural element to the classroom and learning opportunity for students.

Technology should be used as a tool in classrooms. Wireless technology may provide access for all students within a classroom when using laptops while a hardwired connection may provide the speed needed for research at the upper elementary grades. In addition to student laptops and computers, interactive white boards and video projection are currently being designed in new classrooms. A classroom phone provides access for safety and security and a teacher workstation or laptop should be included.

Conclusions

As demonstrated, research supports the movement away from a traditional classroom to one that considers tangible characteristics that help foster effective teaching and learning. No one formula exists but attention to details regarding the comfort and well-being of students as well as space and program requirements can positively affect learning at the elementary level.

²⁵ http://www.schoolzone.co.uk/resources/articles/Good_Practices/classroom/Redesigning.asp, accessed 12.27.05