

## A Review of the Research Literature on Classroom Spaces

Donna Murray-Tiedge, MFA, Industrial Design  
Doctoral Student, Aesthetic Ed, C&I, University of Illinois

DIG Classroom Design Workshop, NAEA National Convention 2012

## Introduction

- Scholars have cited a general neglect in interest surrounding the influence of physical space on learning which has led to low awareness and minimal understanding (Banning & Canard, 1986; Van Note Chism, 2002).
- Empirical research surrounding physical space in educational environments has been conducted on several levels (Lackney, 1999).
- Much of this research is over 30 years old, but has not been displaced by more current findings.



Review of the Research Literature: Classroom Spaces  
DIG Classroom Design Workshop, NAEA National Convention 2012

Donna Murray-Tiedge, MFA 2

## General Environmental Variables

- Temperature
- Air Quality
- Noise
- Lighting
- Color
- Structural Building Characteristics

These variables are not always in the control of the classroom teacher, however, due to empirical findings linking these variables to student behavior & performance, classroom teachers may be interested.



Review of the Research Literature: Classroom Spaces  
DIG Classroom Design Workshop, NAEA National Convention 2012

Donna Murray-Tiedge, MFA 3

## Temperature

- Temperature, heating, and air quality are rated as the most important individual environmental elements connected to student achievement (Earthman, as cited in Higgins et al, 2005).
- The temperature range best suited for learning is 68-74 °F (Hamer, as cited in Schneider, 2002).



Review of the Research Literature: Classroom Spaces  
DIG Classroom Design Workshop, NAEA National Convention 2012

Donna Murray-Tiedge, MFA 4

## Air Quality

- Research consensus connects air quality to health, and health to attitude, behavior, and absenteeism.
- Poor attitude affects health, health affects attendance.



Review of the Research Literature: Classroom Spaces  
DIG Classroom Design Workshop, NAEA National Convention 2012

Donna Murray-Tiedge, MFA 5

## Noise



- Research has found a connection between chronic noise exposure and impaired cognitive functioning (Higgins et al, 2005).
- Several noise-related studies connect to deficiencies in pre-reading skills and reading problems (p. 18).




Review of the Research Literature: Classroom Spaces  
DIG Classroom Design Workshop, NAEA National Convention 2012

Donna Murray-Tiedge, MFA 6


## Lighting

- Researchers disagree on the lighting source of choice (Higgins et al, 2005).
- Natural light yields positive biological effects (Wurtman, 1975), but is difficult to control.
- Good lighting combines both direct and indirect sources (Barnitt, 2003).



Review of the Research Literature: Classroom Spaces  
DIG Classroom Design Workshop, NAEA National Convention 2012 Donna Murray-Tiedge, MFA 7

## Windows



- Students & parents prefer a windowed classroom (Larson, as cited in Weinstein, 1979).
- Teachers prefer a windowless classroom based on minimized distraction from weather changes and outside noise (Weinstein, 1979).
- Minimizing windows maximizes bulletin board space (Weinstein, 1979).

Review of the Research Literature: Classroom Spaces  
DIG Classroom Design Workshop, NAEA National Convention 2012 Donna Murray-Tiedge, MFA 8


## Color

Conflicting evidence exists relating the effect of color on learning.

Research shows classroom wall color affects:


- Children's cooperative behavior (Read, Sugawara, Brandt, 1999).
- Productivity and accuracy (Engelbrecht, 2003).
- Mood, mental clarity, and energy level (Higgins et al, 2005).

Color stimulation varies by age (Engelbrecht, 2003).



Review of the Research Literature: Classroom Spaces  
DIG Classroom Design Workshop, NAEA National Convention 2012 Donna Murray-Tiedge, MFA 9

## Eyestrain Relief




Eyestrain can be relieved by painting the wall directly behind the teacher a different color.

(Engelbrecht 2003; Brubaker, 1998; Pile, 1997, as cited in Higgins et al., 2005, p. 22).

Review of the Research Literature: Classroom Spaces  
DIG Classroom Design Workshop, NAEA National Convention 2012 Donna Murray-Tiedge, MFA 10

## Ceiling Height



High ceilings offer:

- Decreased perceptions of crowding; increased teacher satisfaction with the room (Ahrentzen & Evans, 1984).
- Decreased cooperative behavior among preschool students. As the ceiling gets higher, cooperation decreases (Read et al, 1999).
- Acoustic and lighting issues (Earthman, 2004).

Review of the Research Literature: Classroom Spaces  
DIG Classroom Design Workshop, NAEA National Convention 2012 Donna Murray-Tiedge, MFA 11

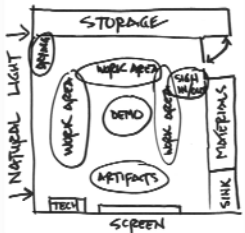
## Physical Classroom Variables

- Design (space-planning)
- Furniture Arrangement
- Seating Location
- Aesthetic Treatment

These variables are potentially available as teacher and/or student resources, as empirical findings link these variables to student behavior & performance.

Review of the Research Literature: Classroom Spaces  
DIG Classroom Design Workshop, NAEA National Convention 2012 Donna Murray-Tiedge, MFA 12

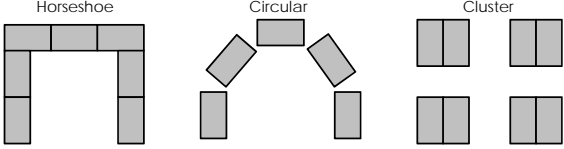
### Space-Planning: Design of Existing Space



- Spatial arrangement flexibility offers considerate placement of equipment to reinforce work area boundaries.
- Spatial arrangement has been linked empirically to student behaviors relating to: attention span, noise levels and class interruptions, movement range, interest level, and frequency of verbal participation (Kritchevsky & Prescott, 1969; Zifferblatt, 1972; Weinstein, 1977; Evans & Lovell, 1979; Sommer & Olsen, 1980).

Review of the Research Literature: Classroom Spaces  
DIG Classroom Design Workshop, NAEA National Convention 2012  
Donna Murray-Tiedge, MFA 13

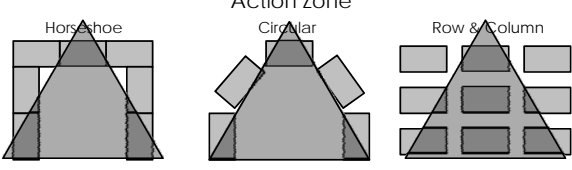
### Furniture Arrangement



- Furniture arrangement has been widely studied. The horseshoe is appreciated by both students and teachers because it permits conversation and control (Alexander, 1992; McNamera & Waugh, 1993; Marx et al., 2000; Horne-Martin, 2002).
- On-task behavior (primary students) is lowest in rows, increased in clusters, and highest in circular formations (Rosenfield, 1985).

Review of the Research Literature: Classroom Spaces  
DIG Classroom Design Workshop, NAEA National Convention 2012  
Donna Murray-Tiedge, MFA 14


### Seating Position



- Seating position has been widely studied. Empirical findings relate to frequency of participation, level of attentiveness, level of self-esteem, valuation of learning, and course grade.
- Research consensus confirms an "action zone" of increased participation (Adams & Biddle, 1970; Koneya, 1976; Marx et al, 2000).

Review of the Research Literature: Classroom Spaces  
DIG Classroom Design Workshop, NAEA National Convention 2012  
Donna Murray-Tiedge, MFA 15

### Aesthetic Treatment



- Seminal studies:
  - Evaluations done in a "beautified" room were more positive than those done in an "uglified" room (Maslow & Mintz, 1956)
  - People spend more time in a "beautified" room than in an "uglified" room (Mintz, 1956).
- An aesthetized environment relates to increased participation in frequency & sample (Sommer & Olsen, 1980); and higher test scores, positive teacher evaluations, and positive student attitudes (Wollin & Montagne, 1981).

Review of the Research Literature: Classroom Spaces  
DIG Classroom Design Workshop, NAEA National Convention 2012  
Donna Murray-Tiedge, MFA 16

### Take Aways

- Spatial considerations of teaching involve contents arrangement, varieties & frequencies of behavior, & patterns of travel (Hall & Hall, 1977; Sommer, 1977; Weinstein, 1977; Susi, 1985, Araca, 1986).
- Physical space is particularly significant to the art educator due to the varied behaviors (i.e. making, collaborating, critiquing, viewing) associated with art education (Susi, 1986).
- Research surrounding the relationship between environment and attitude, behavior, and emotion is particularly valuable to an art educator.
- Much of this research is over 30 years old, but has not been displaced by more current findings.

Review of the Research Literature: Classroom Spaces  
DIG Classroom Design Workshop, NAEA National Convention 2012  
Donna Murray-Tiedge, MFA 17

## References

- Adams, R., & Biddle, B. (1970). *Realities of teaching: Explorations with video tape*. New York: Holt, Rinehart and Wilson.
- Ahrentzen, S., & Evans, W. (1984). Distraction, privacy and classroom design. *Environment and Behavior*, 16 (4), 437-454.
- Alexander, R. (1992). *Policy and practice in primary education*. New York: Routledge.
- Araca, A. (1986). An index method for examining secondary art classroom furniture, facilities, and spaces. *Art Education*, 39(2), 13-17.
- Banning, J. H., & Canard, M. R. (1986). The physical environment supports student development. *Campus Ecologist*, IV(1), . Retrieved May 16, 2008, from Campus Ecologist Web Site: <http://www.campusecologist.org/cen/v4n1.htm>
- Barnitt, H. (2003). Lighting for the future. *Building Services Journal: The magazine for the CIBSE*, 25(1), 38-39.
- Brubaker, C. (1998). *Planning and designing schools*. New York: McGraw-Hill.
- Earthman, G. (2004). Prioritization of 31 criteria for school building adequacy. Retrieved January 12, 2004 from [http://www.aclumd.org/facilities\\_report.pdf](http://www.aclumd.org/facilities_report.pdf)
- Engelbrecht, K. (2003). The impact of colour on learning. Retrieved March 11, 2004, from <http://www.merchandise-mart.com/neocon/NeoConConfPro/W305.pdf>
- Evans, G., & Lovell, B. (1979). Design modification in an open-plan school. *Journal of Educational Psychology*, 71(1), 41-49.
- Hall, E., & Hall, M. (1977). Nonverbal communication for educators. *Theory Into Practice*, 16(3), 141-144.
- Hamer, D. (1974). Effects of thermal environment on learning skills. *The Educational Facility Planner*, 12(2), 4-6.
- Higgins, S., Hall, E., Wall, K., Woolner, P., & McCaughey, C. (2005). *The impact of school environments: A literature review*. London: Design Council.
- Horne-Martin, S. (2002). The classroom environment and its effects on the practice of teachers. *Journal of Environmental Psychology*, 22, 1-2.
- Koneya, M. (1976). Location and interaction in row and column seating arrangements. *Environment and Behavior*, 8(2), 265-282.
- Kritchevsky, S., & Prescott, E. (1969). *Planning environments for young children: Physical space*. Washington D.C.: National Association for Education of Young Children.
- Lackney, J. (1999, July 1). Bibliography of empirical research investigating the relationship between the physical environment of educational settings and educational outcomes. N/A. Educational Resources Information Center database (ED441331).
- Larsen, C. (Ed.). (1965). *The effect of windowless classrooms on elementary school children*. Ann Arbor, MI: University of Michigan, Architectural Research laboratory, Department of Architecture.
- Marx, A., Fuhrer, U., & Hartig, T. (2000). Effects of classroom seating arrangements on children's question-asking. *Learning Environments Research*, 2, 249-263.
- McNamera, D., & Waugh, D. (1993). Classroom organization. *School Organization*, 13(1), 41-50.
- Maslow, A., & Mintz, N. (1956). Effects of esthetic surroundings I: Initial short-term effects of three esthetic conditions upon perceiving energy and well-being in faces. *Journal of Psychology*, 41, 247-254.
- Mintz, N. (1956). Effects of esthetic surrounding II: Prolonged and repeated experience in beautiful and ugly rooms. *Journal of Psychology*, 41, 459-466.
- Pile, J. (1997). *Color in interior design*. McGraw-Hill: New York.
- Read, M., Sugawara, A., & Brandt, J. (1999). Impact of space and color in the physical environment on pre-school children's cooperative behavior. *Environment and Behavior*, 31(3), 413-428.
- Rosenfield, P., Lambert, N., & Black, A. (1985). Desk arrangement effects on pupil classroom behavior. *Journal of Educational Psychology*, 77(1), 101-108.
- Schneider, M. (2002, November). *Do facilities affect academic outcomes?* Washington DC: National Clearinghouse for Educational Facilities.
- Sommer, R. (1977). Classroom layout. *Theory Into Practice*, 16(3), 174-175.
- Sommer, R., & Olsen, H. (1980). The soft classroom. *Environment and Behavior*, 12(3), 3-16.
- Susi, F. (1985). Spatial mapping as a method for observing classroom art instruction. *Studies in Art Education*, 26(3), 163-168.
- Susi, F. (1986). Physical space and the teaching of art. *Art Education*, 39(2), 6-9.
- Van Note Chism, N. (2002). A tale of two classrooms. *New Directions for Teaching and Learning*, 92(7), 5-12.
- Weinstein, C. (1977). Modifying student behavior in an open classroom through changes in the physical design. *American Educational Research Journal*, 14(3), 249-262.
- Weinstein, C. (1979). The physical environment of the school: A review of the research. *Review of Educational Research*, 49(4), 577-610.
- Wollin, D., & Montagne, M. (1981). College classroom environment: Effects of sterility versus amiability on student and teacher performance. *Environment and Behavior*, 12, 707-716.
- Wurtman, R. (1975). The effects of light on the human body. *Scientific American*, 233(1), 68-77.
- Zifferblatt, S. (1972). Architecture and human behavior: Toward increased understanding of a functional relationship. *Educational Technology*, 12(8), 54-57.