

# **Lasting Effects of Creating Classroom Space: A Study of Teacher Behavior**

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## **ABSTRACT**

*Research has shown that rooms with greater amounts of open floor space have higher test results. Four recent trends that have negatively impacted open space in classrooms: (1) storage of CCSS materials in the classroom, (2) storage of science kits in the classroom, (3) inability to remove unwanted material, and (4) inability to remove unneeded furniture from the classroom. Teachers have reacted to the loss of classroom space: (1) desks are rearranged frequently to create specific spaces needed for an activity; (2) daily planning considers the use of space; (3) hallways and the library are used to increase student space; (4) the amount of materials readily available for student use have been reduced. (5) tall book cases have replaced horizontal models; (6) the size of interest/exploration centers had decreased. Administrators need to create a system to dispose of unwanted materials. The center for school improvement resides in the classroom.*

**The ability to simplify means to eliminate the unnecessary  
so that the necessary can speak.  
David Henry Thoreau, 1817 – 1862**

## **INTRODUCTION**

Classroom spaces may not be meeting the needs of small children (Tanner, 2000). Adults look at rooms vertically while ‘rug-rats’ look at and use floor space horizontally. Planning classrooms for use by children tends to be ignored even while new curricula, testing, and accountability are being put in place (Jarman, 2008; NRC, 2000; Sommer, 1977). But that is changing. Researchers are beginning to focus on classroom environment as an important component of the education system. As Achilles (1999) stated, “One place to start observing classrooms is to consider space, space use, and the environment or context of the teaching-learning process” (p. 38).

A greater amount of attention must to be paid to the arrangement of a classroom and how it evolves (Lowe, 1990; Sargent, 1991; Weinstein, 1992). Lacking adequate instruction in teacher preparation programs, teachers copy the structural mistakes they see in other classrooms (Tanner, 2000).

Open space changes classroom dynamics. Teachers who have reduced the amount of material and furniture in their classroom to open floor space have recognized the benefits. Adding just 80 square feet of open space provides benefits for students: extra books permit students to read for fun; students find materials on their own; organizational improvement by the teacher is copied by students; students find a space to read by themselves or with a partner; and distractions lessen when distance between students increases (Duncanson, Volpe, & Achilles, 2009). Researchers are beginning to understand: “The center for school improvement resides in the classroom.”

Research reported in 2012 by the author offered the position that elementary classrooms typically are used as a branch of the school library. Therefore it makes sense to design classrooms after considering the space recommendations for libraries. Using that criteria, a standard 850 square foot classroom would need to be 300 square feet larger to address the education needs of young children (Connecticut State Library, 2002; Duncanson, Tanner, & Achilles, 2012).

While bigger classrooms are needed, teachers are faced with a growing storage problem. Boxes of materials and bookcases full of instructions connected to new programs are being stored in classrooms. This situation makes it more difficult for teachers to maintain space they know is important to students. William McInerney commented, “But the classrooms are already there. Teachers can’t make them bigger. What can they do?” (personal communication, October 10, 2012). That query became a focus for this investigation.

### *Classroom Architecture*

Classrooms start out as empty spaces but soon change. Each room is the total of the fixed architecture and the moveable furniture. Fixed items can include: windows, doors, electrical outlets, shelves and cabinets attached to the walls, computer outlets, overhead projection screens, and projectors mounted on the ceiling. Fixed architecture influences classroom arrangement. Specifically, the position of the classroom door, placement of an emergency exit window, HVAC system, permanent storage cabinets, a sink, computer outlets, wall-mounted smart board, and a ceiling mounted projector reduce the flexibility of furniture arrangements.

Moveable furniture can include: teacher’s desk, student desks, reading table, display/work table, map storage, book cases, soft furniture, easels, storage bins, and plant stands (Duncanson & Achilles, 2006). While moveable furniture can be arranged in a variety of patterns to accommodate different learning activities, furniture arrangement is always influenced by the position of fixed aspects of the room. Arranging desks in clusters rather than rows naturally creates wide pathways that invite students to explore.

Because every classroom is different, planning space cannot follow a cookie cutter design. Classrooms have different sizes, shapes, and include fixed structures in different locations. As part of their job, teachers become the architects of interior space to serve the needs of children.

### *Student-Selected Learning Space*

When given the opportunity students use classroom space to their best advantage. Space is important to teachers who employ a Daily Five teaching format enabling students to use their discretion in selecting a suitable work environment (Boushey & Moser, 2006). A variation of the Daily Five format uses 60 to 80 minute blocks of time with three to five stations each with a different purpose. Students may be asked to work on (for example): a remedial assignment, extended projects, writing skills, silent reading, or group reading with the teacher. Students rotate through each station in 12 to 20 minute blocks of time.

Students select their own space to work based on three criteria: (1) need for a solid work surface: a desk, the floor, or a clipboard; (2) physical comfort to match their personal need; and (3) autonomy – the need for privacy. Students select areas in the classroom in a manner that is highly predictable: corners of the room are a prime work location; tables

are used for projects; desks, clipboards and the floor may be used for writing assignments; children reading will go as far away as possible from the small group reading with the teacher; small groups will move to the largest space available; and children working alone will find a space that is equidistant from other groups.

Teachers can know ahead of time where students will select to work based on the activity and a personal knowledge of the student. That information can be used to effectively plan the activities offered to students so all available space is used. Moveable furniture may be rearranged to create needed spaces. In general, more than one-half the students will select a work space on the floor (Duncanson & Achilles, 2010).

Teachers can set a high priority on having an appropriate amount of space to rearrange student furniture to match spaces needed for student activities (Lang, 2002). Flexible environments are normally good ones for students: flexibility allows for different kinds of learning activities (Casson, 2013).

### *Space, Time, Teaching and Learning: M-time vs. P-time*

Space is a crucial factor determining how teaching time is used. Hall (1976) focused his attention on how people interacted with space and used time. Both factors impact teaching and are within the control of teachers: school days are planned around time and space. The lack of large spaces for student work forces the teacher to schedule all events in a one-size fits all modality: activities are scheduled into fixed slots of time using specific spaces. Hall termed this use of time and space as ‘monochronic’ (M-time): each activity is scheduled for a specific time. In M-time classrooms teachers devote a great deal of time to highly structured activities. These classrooms are arranged so students have little space or opportunity to move around: four rows of student desks face the teacher for whole-group instruction. Therefore an M-time teacher-centered model is falling by the wayside.

Student involvement in active learning, individualized teacher interactions, and a release from monochronic time settings is possible only if the classroom structure is changed. “Structure must change before culture can change” (Ouchi, 2004, p. 18). Classrooms have to change before student achievement will improve. Meier (2008) noted that people will change their behavior if you change the environment.

When teachers have spacious classrooms they shift to a polychronic time system (P-time) and students direct their own activities (Hall, 1976; Hall & Hall, 1975; Manke, 1994). P-time functions in a fluid context in classrooms where space is abundant. P-time systems stress participation in social interactions and completion of projects rather than adherence to a preset deadline. Released from confining structures of time and space, students become curious, independent, open-minded, and questioning individuals. Having ample space in a classroom makes a switch in pedagogy possible. Teachers are able to react with students individually or in small groups while several activities may occur at the same time. In classrooms with ample space, there is a connection between hands-on activities and creativity (Lasky & Yoon, 2011). P-time teaching addresses the needs of students who possess different talents and enables the teacher to become a mentor – coach.

### *Opportunity to Learn*

Today’s youngsters are visually oriented and prefer active learning in a welcoming space. School and classroom environments that accommodate the needs of all students

while promoting student thinking and individualization are necessary for opportunity to learn (OTL) (MAEC, 2008). Six factors that contribute to quality schools can be observed in classrooms: safe and orderly environment; high expectations for student learning; adequate physical space; access to books, technology, and support materials; uninterrupted periods of instruction; and the use of appropriate and varied teaching strategies (Banicky, 2000; Frank, 2007; Schwartz, 1995). Rows of student desks arranged for whole-group-single-size-fits-all instruction is not compatible with brain-based learning (Jensen, 2000; McNeil, 2008). If better results are expected on high-stakes tests, then classrooms with greater amounts of space need to be created (Higgins, et al., 2005). Different size work spaces appropriate to their purposes are required for students: individuals, small groups of 3-5, teams of 5-10, and full class-size groups (Espey, 2008).

OTL is associated with teacher use of time and space (Banicky, 2000; Frank, 2007; Schwartz, 1995). OTL guidelines call for classes in spacious rooms where students are free to use space and can learn well; this open environment promotes active learning (Higgins, et al., 2005; UCLA, 2003). Space invites students to move around: it gives them a break (Jensen, 2000). These conditions are a match for teaching and learning in a P-time system. Easy passage around the room allows students to receive help from their peers in an effort to make their work better: 8 and 9 year old students enjoy the opportunity to work on projects away from their desks (McNeil, 2008; Wood, 2007). When teachers increased the amount of open space in their classroom, they found that several positive changes occurred naturally: organization improved, student behavior improved, the classroom was cleaner, and students managed their own activities (Duncanson, Volpe, & Achilles, 2009; Rourke & Hartzman, 2009).

### *Proof in the Pudding*

Open space on the floor of elementary classrooms contributes to positive outcomes for teachers and students (Tanner, 2000). Research by the author has shown there is a high positive correlation between open floor space and grade 4 student achievement in science skills, and New York State (NYS) English Language Arts (ELA). The science skills of classifying, manipulating materials, measuring, making non-standard measurements, recording data, and questioning are positively correlated to student density (sq. ft./pupil). When student scores are compared to the square feet of space per student in each classroom, there was a Pearson correlation coefficient of +.881 that was significant at the .048 level (2-tailed) ( $r = +.881$ ,  $p = .048$ ). This is a high positive correlation (Hinkle, Wiersma & Jurs, 1998). This means that students have higher scores on tests of science skills in classrooms with greater amounts of empty floor space (Duncanson, 2003a).

After a classroom was redesigned, students showed substantial improvement in test results for NYS ELA Standard #3 (Language for critical analysis and evaluation). A t-test yielded positive results:  $t = -2.303$ ;  $df = 38$ ;  $Sig (2-tailed) = .027$  (Duncanson, 2009). Collectively this means that student test scores are higher in classrooms that have greater amounts of open floor space.

These findings are in line with class size research (e.g. Tennessee's Student Teacher Achievement Ratio [STAR]) which showed that increasing classroom space by having fewer students improves student achievement (Achilles & Boyd-Zaharias, 2008).

### *Guidelines for Creating Space*

Reorganizing a classroom is most easily achieved by first removing everything from the room. Having teachers change classrooms from time to time is a convenient way for administrators to facilitate this important opportunity. Starting with an empty room makes planning a functional layout easier (Zike, 2005).

#### *Step #1: Identify classroom material that will be used in that school year.*

Classrooms should contain only materials that are needed for instructional purposes that year: they should not be storage rooms for unused materials. Shelves of old texts, materials for another grade level, and stuff not used in the previous year should be discarded. Bookcases and shelves that held unneeded materials can be placed in storage. One teacher who emptied her room found boxes holding seven broken staplers, five pencil sharpeners, tests from 15 years ago, old curriculum guides in their original shrink-wrap, and dry ditto masters. Those dusty boxes were not helping the health of young students.

Computer access has changed teaching. The need to hang onto teaching tools has been reduced by the internet: new materials are readily available. It can be easier to find new ideas than to dig old ones out of storage. The internet can replace a file cabinet. Teachers in some classrooms have been able to discard 90% of their holdings when they examined everything before it was placed back in a classroom (Duncanson, Volpe, & Achilles, 2009).

#### *Step #2: Map out the areas needed for instruction and activities.*

Harlan (2000) pointed out that space needs to serve different size groups and meet different needs: direct instruction, class meeting area, small meeting areas, and space for individuals. The curriculum likely requires specialist areas: study bays, work centers, large group work area, displays and interest/discovery/learning centers (BCSE, 2007; Higgins, et. al., 2005; Locker, 2007; Nielson, 2004). Having space leads teachers to increase the number of teaching methods they use. Hands-on experiments, collaboration, student performances, and increased student-teacher communication begin to happen when space is available.

After careful thought, spaces that match the teacher's style for teaching and learning need to be preserved. Teachers can delineate these areas for preservation by marking the floor with masking tape or chalk.

#### *Step #3: Plan pathways*

Classroom pathways create a pattern that reminds people of a roadmap. While meeting with a civil engineer, the author spoke about roadways in a classroom and how there must be a science behind patterns of highways. The civil engineer suggested that a parking lot was a better model for a classroom: after all teachers park students at a desk (Duncanson, 2003b).

If classrooms are treated like parking lots, then a main avenue should start at the classroom door and run across the room parallel to one wall. Secondary paths should lead to special areas of the room (Federal Sign and Signal Corporation, 1974). Pathways, wide enough to allow two students to pass without touching each other, can be outlined on the floor (Colbert, 1997). A reasonable goal is for one-half of the classroom to be open space: space already outlined on the floor. Tanner (2000) recommends that each student have 49 square feet of empty space. Thus a classroom of 850 square feet should hold 17 students.

#### *Step #4: Arrange the furniture.*

Furniture that will be used on a daily basis can now be moved into the room in space not reserved for teaching or pathways. Student seating will probably occupy one-fourth of

the classroom space. A maximum of 15 additional pieces of moveable furniture can occupy the remaining one-fourth of the classroom. The open space and furniture placement should address a variety of teaching situations: group instruction to teach skills, laboratory learning for exploration and discovery, project work, practice space, and individual and group work and study. “When teachers choose only furniture that contributes to educational success, more space is available for student use” (Duncanson & Achilles, 2005, p. 31).

Adding additional pieces of furniture takes space away from students. When the number of boxes, bins, and furniture totals 30 or more, rooms become overcrowded and safety is compromised (Clayton, 2001). A target of 15 pieces of furniture reserves space for the students while providing easy access to materials student’s use. If materials are not readily available students spend a lot of time waiting in line, waiting for help, waiting for materials so they can get to work (Shalaway, 2013). Care should be taken to not employ unused student desks as a place to pile paper – a clear example of Flat Surface Syndrome (FSS). FSS is the habit of laying ‘stuff’ on any flat surface until the pile earns the title of clutter (Funny the World, 2009). Extra student desks should be sent to storage.

Teachers who generally only use their desk before and after regular school hours, or as a place to stack papers, should consider getting rid of their desk and using a large table as their work area. When materials teachers use are the same ones students use, storing them in the center of a worktable serves everyone’s needs (Duncanson & Volpe, 2009). The presence of a teacher’s desk also creates a ‘teacher’s space’ that students do not enter. Removing the desk can open 80 square feet of space that benefits the students. If the teacher needs a desk, it should be positioned against a wall to minimize the teacher space. A teacher who got rid of his desk commented, “I don’t have a place to lay things down. I have to deal with everything immediately: toss it or put it away. There is no more clutter. It is wonderful” (J. Tobin, personal communication, November 6, 2008).

As a final task, teachers should sit in different parts of the room to see the arrangement as students will see it (Chan, et al, 2009; Design Council, 2005; Loughlin & Suina, 1982; Lushington, 2008). Otherwise students get stuck with the teacher’s environment. Be careful that students do not have a place to hide.

## RESEARCH QUESTION

How do teachers maintain classroom space while being asked to store an increasing amount of material?

## METHODOLOGY

### *Research Design*

A descriptive, cross-sectional, non-experimental research design was used (Johnson, 2001).

### *Research Participants*

Five teachers in two rural, elementary schools 70 miles north of New York City volunteered to participate in the following study. They had previously worked with the researcher in studies of classroom space. Studies in their classrooms resulted in the collection of student achievement data in Science and ELA, the identification of tessellation patterns when students self-selected their learning space, and the study of 20<sup>th</sup> century classrooms. Teachers received a final copy of all the studies in which they participated.

While the teachers received assistance with classroom management in years past (see Steps 1-4 above), they were involved in no professional development activities related to room arrangement in the preceding two years. Five teachers participated in the study. (Eleven teachers made up the original pool of possible participants. Six were not available for the study: two had retired, one was deceased, two moved out of the area, and one elected not to participate.)

### *Data Collection*

Data were collected through classroom visits, survey, interview, and a follow-up interview to review findings. The narrative is presented in a conversational manner.

## FINDINGS

It was clear in the interviews that open floor space was constantly on the teacher's minds: all five participants mentioned space as a primary concern. They recognized that the development of independent learners requires spaces of different sizes to meet the individual needs of students (Casson, 2013; Harlan, 2000).

Teachers identified four recent trends that have negatively impacted open space in classrooms.

- (1) New York State Education Department officials have mandated the use of curriculum plans and materials to support Common Core State Standards (CCSS). The materials are stored in each classroom and commonly fill two sets of horizontal shelves.

*Impact:* The sheer volume of paper to read has been overwhelming. A sample set of teacher directions (six pages in length) contained 31 bullets of instructions for the teacher to relay to the students, 120 bullets of suggestions for how the teacher could meet student needs, instructions for the creation of a T-chart to record student answers, and instructions for a student homework assignment to analyze five quotes from a reading passage. A four-page lesson plan outlined teacher/student behavior for a 55 minute class (NYE Dept. of Education, 2012). Teachers reported that a 55-minute lesson plan normally consumed five 55-minute blocks of time. Science, Social Studies, project based learning, extended presentations, and special events were eliminated to create additional time for Common Core based instruction. The loss of space and increased pressure on time reduced space/student and forced teachers to work in an M-time system.

- (2) The school district science supply center was dismantled. Staff at the science center previously delivered a single science kit to a teacher when it was requested and retrieved the kit upon completion of the unit. Four units of a new kit-based science program are now stored in each classroom.

*Impact:* While the science program is designed to promote inquiry, the volume of the stored materials has reduced the work space available to perform inquiry science experiments. Teachers have resorted to lecture and fewer hands-on activities (M-time): both products of less space and time.

- (3) The ability to remove unwanted material has been restricted by administrators. A convoluted process developed by the Board of Education (BOE) discouraged teachers from trying to rid themselves of outdated instructional

materials. Teachers avoided the extra paper work and stored old materials.

*Impact:* Teachers have shelves, boxes, and bins of unwanted material they cannot dispose of. The amount of material in four of the five classrooms has increased in the past two years: space has been reduced.

- (4) Four teachers saw their class count for 2011-2012 increase by one student and then reduced by one student in 2012-13. It was noted in classroom observations that the desk for the lost student remained in the classroom taking up space and enabling the teacher to display a manifestation of flat surface syndrome by covering the desk with papers.

*Impact:* Open space was lost.

### *Positive Steps*

Teachers have reacted to the loss of classroom space by changing aspects of the classroom that are within their control.

- Large tables have been removed.
- Buckets or bins have been substituted for large cabinet interest centers.
- Tall bookcases and cabinets have replaced horizontal models. High shelves are used for teacher materials and lower shelves for student supplies.
- The amount of materials readily available to students has been decreased.
- Desks are rearranged frequently to create specific spaces needed for an activity.
- Tessellation pattern spaces are planned to match the needs of the Daily Five.
- Hallways and the library are used by students to access privacy.
- Teachers created private nooks in the classroom for silent reading.
- An interest center cabinet is removed when an additional student and a desk are added to the class.
- Teachers continue to operate in P-time.

### *Implications for Planning*

- Administrators need to be aware that decisions they make impact classroom space and teaching pedagogy (Banicky, 2000).
- Administrators need to give teachers permission to throw things away and give space back to the students (Zike, 2005).
- The availability of storage space outside the classroom for bins of science materials needs to be explored (Clayton, 2001).
- Teachers should revisit annually and follow recommendations found in Steps #1-4 for how to create greater amounts of classroom space (Duncanson, Volpe & Achilles, 2009).
- Teachers need to plan the physical layout of classroom furniture carefully due to its influence on space and student preference when choosing a place to learn (Duncanson & Achilles, 2010).
- Teachers can consider replacing horizontal storage shelf units with vertical units to gain storage space without decreasing open floor space.
- Teachers need to be aware of the impact on students that Common Core Curriculum



instruction based on M-time alters the classroom dynamic that functioned in P-time (Hall, 1976).

- Students need to have a voice in the design of classroom space to reflect their needs (Design Council, 2005; Sommer, 1977).
- Model classrooms can be established with carefully designed arrangements to promote the benefits of ample space (Achilles, 1999).

### CLOSING THOUGHTS AND OBSERVATIONS

There is a need to plan the physical layout of classroom furniture due to its influence on space and time. Teachers understand classrooms with maximum open space, clear pathways, and a variety of teaching spaces provide students with ample opportunities to self-select learning spaces that meet their needs. They know planning space before placing the furniture is a crucial step needed to preserve space and requires careful consideration.

Only materials needed for the current school year should be in the classroom: in this study, that was not always the case. Equipping rooms with a minimum amount of furniture is required to meet the goal of not covering more than one-half the floor space: student's desks plus 15 other pieces of furniture should be a maximum. Organizing a classroom to promote P-time teaching strategies can be achieved with proper planning and at no cost.

Decisions about classroom organization made by individual teachers and their students in the context of pedagogy, task demands, and furniture, are being over-ridden by decisions that are outside their control. Using classrooms as store rooms for large amounts of CCSS curricula, science kits, extra furniture and unwanted materials decreases space per student, limits instructional strategies teachers may use, and limits work-spaces for students.

Teachers have tried to counteract the loss of space by: reducing the amount of furniture students use; only using interest center materials that occupy a small amount of space; reducing the amount of materials readily available to students; using non-traditional classroom spaces; and frequent rearrangement of student desks to create needed work spaces. The mandated addition of material to classrooms has outstripped teachers' ability to rid classrooms of an equal amount: the result is a net loss of empty space.

When teachers understand how to plan classrooms, the ideas stay with them even when faced with obstacles. Constructive steps that restructure classrooms and remove obstacles to learning can be implemented. These observations are consistent with identified needs of P-time classrooms and the theory for OTL. Educators can change what happens in school.

### POST SCRIPT

Armed with knowledge of the barriers classroom teachers faced in their effort to maintain recommended amounts of empty floor space, the researcher wrote a letter to the Superintendent of Schools requesting consideration for the plight of teachers. The importance of spacious classrooms was summarized and supported with statistical results using state tests. Recent trends that hindered teacher's efforts to maintain classroom space were then listed. It was noted that the course of action required to dispose of outdated texts, non-working electronic equipment, and broken furniture was cumbersome. The Superintendent was urged to simplify the required paperwork. She immediately shortened that process.

Staff members took advantage of the change in procedure. Teachers quickly earmarked unwanted materials for disposal: 15 year old sets of texts for language arts and

mathematics, computers and overhead projectors that did not work, and pieces of broken furniture. This action resulted in benefits for teaching and learning: there was an increase of space/student, organization of teacher materials improved, a greater number of books were exposed for student use, and an inviting classroom environment emerged. Custodians cleaned out storage closets creating space so science kits and unneeded furniture could be removed from classrooms.

Teachers have been energized and continue to downsize with custodial assistance. Bookcases that held old texts and extra student desks have been moved to storage. Instructional materials used in conjunction with disposed texts are being discarded. Teachers continue to cull files of outdated material. One teacher reduced her holdings by 50% enabling her to remove two book cases and a file cabinet from her classroom. The floor space was given back to the rug-rats.

Once again classrooms look open and inviting. The participants in this study were able to simplify: they eliminated the unnecessary so the necessary could speak. They understood that the center for school improvement resides in the classroom.

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