

# Teacher Environmental Competence in Elementary School Environments

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## **Abstract**

*Teacher environmental competence, the ability to understand and effectively use physical instructional space for a pedagogical advantage, continues to receive limited attention in education. Exploring the perceptions of 20 teachers at five urban elementary schools, this study investigates teachers' understanding and effective use of the physical environment to meet instructional goals. It examines organizational factors that contribute to poor environmental competence in school environments. The action research approach employed in this study includes a set of interconnected training, research and action activities. Once teachers were introduced to a means of communicating their environmental experience through the training component, they were able to articulate specific environmental concerns, see their interrelationship, and make judgments of priority. The paper suggests avenues for raising the environmental competence of educators within the context of educational reforms advocating for collaborative, learner-centered environments.*

**Keywords:** school environment, learning environment, action research, environmental competence, teacher training, place experience

## Introduction

Environmental competence refers to the ability to effectively use the physical environment to meet desired goals (Steele 1980). The question of how, and to what degree, teachers understand and effectively use instructional space to their pedagogical advantage continues to receive only limited attention in education research (Taylor 2005; Horne-Martin 2002; OECD 1989; Taylor and Vlastos 1983; Richardson 1970). The main objective of the study reported here was to raise the environmental competence of teachers. A second objective was to determine, if possible, the degree to which those increased competencies influenced their classroom practice.

Understanding how to effectively organize instructional space is critical to successful classroom practice, both in terms of classroom design (Taylor 2005; Sanoff 2001; Nelson and Sundt 1993; Taylor and Vlastos 1983) and management (Weinstein 1996; Follows 2000). Educators admit the importance of the physical school environment as a contextual factor in the educational process (Weinstein 1981). For instance, they perceive school facilities as affecting their ability to function as professionals (Overbaugh 1990; Lewis and Smith 1990). However, the degree to which educators are able to manipulate the school environment for their purposes varies considerably (Taylor and Vlastos 1983). Regardless of improvements in classroom size, spatial configuration, physical features, furnishings or equipment, traditional patterns of direct instruction persist (Sanoff 2001). This paper will argue that these unchanging patterns of use exist because, first, educators as a whole lack the environmental competence to effectively use the school environment to support their teaching practice. Second, educators lack a common language for expressing their experience of the school and for articulating their environmental concerns with reference to the activities of teaching and learning.

Overall, educators have not been formally trained to use the physical environment in the learning process (Weinstein 1996). OECD (1989) suggests that the environmental competence of teachers could be greatly improved through in-service programs and professional development, although at present, this training is virtually non-existent. What is needed is a method of training designed to assist teachers to gain insights by effectively using the physical setting to better support their teaching practices, and thus lead to more engaged learning on the part of their students. Action research, specifically Kurt Lewin's triangle of action, research and training (1946, reprinted in Lewin 1997) offers an approach to raise environmental competence. This study makes the argument that training teachers to conduct assessments of their own school environments will lead to actions that support the teachers' practice and will further improve their environmental competence.

## Environmental Competence

Environmental competence, following Steele (1980), is defined as the *awareness* of one's physical environment and its impact on one's activities, as well as the ability to *use* or *change* that environment to suit one's goals and activities. Steele argues that most occupants underutilize the potential of their settings and tend to accept inappropriate settings. More specifically, Steele (1980) suggests that an individual's

environmental competence involves three types of learning: (a) personal style, attitudes, and awareness of physical setting; (b) knowledge of physical settings, including technical knowledge, how to obtain new information, knowledge about the social control of space, and knowledge of the relationship between environment and behavior; and (c) practical environmental skills such as scouting, matching, personalization, and creative custodianship.

Additionally, environmental competence is expressed at multiple scales. Table 1 synthesizes the work of Steele (1980; 1973) and Becker and Steele (1995) in summarizing a number of factors at the individual, social and organizational scales that contribute to a lack of environmental competence.

**Table 1. Factors contributing to a lack of environmental competence**

Scale	Factors
<b>Individual Factors</b>	LACK OF TRAINING: No professional training in using physical settings
	PASSIVE RESIGNATION: Passive acceptance of existing circumstances or perceived lack of resources; "making do"
	SPATIAL CAUSE: Difficulty recognizing spatial aspects of experiences
	LACK OF KNOWLEDGE: No technical knowledge regarding use of space
	INABILITY TO REFLECT: Inability to articulate what is needed spatially to accomplish an activity in a setting
	DISREGARD OF SPACE: Minimizing or disregarding the importance of the physical setting over the more immediate work task
	FEAR OF IRREVERIBILITY: Fear that once a change is made it cannot be reversed; unfamiliarity with the idea that settings change over time
<b>Social Factors</b>	NORMS OF ACCEPTABILITY: Norms of acceptable behavior (power relations) may inhibit initiation or suggestions for environmental change
	STATUS QUO: Disagreement over goals leads to inertia, inhibits change
	TURF ISSUES: Territoriality, status and turf issues
<b>Organizational Factors</b>	UNILATERAL DECISIONMAKING: Norm of unilateral, top-down facility decision-making reinforces resignation
	LIMITING RULES: Rules for management and use of space tied to positions such as facility managers and administrators
	OCCUPANT MOBILITY: Creating equity for next occupant limits choices
	IDENTITY: Need to maintain a corporate image limits personalization
	LACK OF AWARENESS: Blindness to the impact of settings and potential connections between settings and functioning of the organization
	FAMILIARITY: Tendency of organizational leaders to jump to familiar, but inappropriate solutions without adequate diagnosis or analysis of existing policies and norms governing use of space
	LACK OF RESOURCES: A lack of resources from conventional sources; no creative exploration of resources from non-traditional sources

A lack of environmental competence in educational environments is a consequence of many of the factors listed in Table 1. While these factors affect the level of teacher environmental competence, at the same time, teachers' awareness of and

ability to use their environment also has implications for the school at the individual, social and organizational scales.

At the individual scale, teachers and administrators tend to focus on pedagogical and interpersonal issues, ignoring the physical-spatial context in which the teaching-learning process occurs (Loughlin and Suina 1982; Weinstein 1981). The notion that the physical environment could help them meet their goals goes largely unrecognized by educators, who continue with traditional patterns of instruction despite innovations in school design. Teachers more often perceive the learning environment as a default and “make do” with rather than proactively change it to better suit their desired instructional goals and activities (Wolfe 1986). Any knowledge that teachers have about the role of the physical setting on teaching and learning was likely gained from direct experience and trial and error experimentation, rather than from formal education and training (Horne-Martin 2002).

The literature cites examples of the lack of environmental competence at the individual scale. For instance, teachers’ dominant focus on student behavior management in the classroom precludes their awareness of any spatial causes or the consideration of any possible spatial/environmental strategies that could aid in that management (Gehrke and associates 1982). Further, while teachers should expect to exert the greatest degree of control in their assigned classrooms, due to a lack of knowledge or inability to reflect on their environment, classroom teachers consistently report that they have little control over the quality of their workplace environment (Johnson 1990). Illustrating a lack of training, Lang (2002) found that in the occupancy of a new school, teachers’ freedom to change arrangements took precedence over issues of crowdedness and the need for privacy. Ironically, although teachers had the freedom to move furniture, layouts were relatively stable over time (Rivlin and Rothenberg 1970), possibly indicating a fear of irreversibility or even a passive resignation. Teachers’ focus on what they perceive as more pressing problems—such as a feeling of limited collegiality, difficulties implementing project-based learning due to restricted adaptability of the classroom, or problems of classroom management and overcrowding—are often implicitly linked to an unrecognized environmental concern. Rather than modify their physical environment to decrease unwanted visual and auditory distractions, teachers instead adjust their curricular activities (Ahrentzen and Evans 1984) providing evidence of a lack of understanding of spatial cause.

Table 2 outlines the levels of environmental competence at the individual scale—from high proficiency to a lack of proficiency—that teachers might expect to exhibit in a particular school environment, described by their degrees of awareness, knowledge and skill at manipulating environment-behavior relationships.

**Table 2. Levels of environmental competence at the individual scale**

Level	Description
<b>Highly Proficient</b>	<p><u>Awareness</u>: There is evidence of an explicit and immediate awareness of the impact of the physical setting on both one's instructional practice and student learning behaviors.</p> <p><u>Knowledge</u>: Teacher has a working knowledge of relationships between environment and behavior. When the teacher lacks technical knowledge, she is able to articulate the problem and seeks immediate assistance to resolve environmental concerns.</p> <p><u>Skills</u>: When necessary, teacher is highly effective in making immediate spatial adjustments that best support his or her purposes and activities.</p>
<b>Proficient</b>	<p><u>Awareness</u>: There is evidence of a general awareness of the impact of the physical setting on instructional practice and student learning behaviors.</p> <p><u>Knowledge</u>: Teacher has a general knowledge of relationships between environment and behavior. When the teacher lacks technical knowledge, she is able to articulate the problem, and will on occasion seek assistance to resolve her environmental concerns when they are perceived to be out of her control.</p> <p><u>Skills</u>: When necessary, teacher is moderately effective in making spatial adjustments that best support the purposes and activities.</p>
<b>Lack of Proficiency</b>	<p><u>Awareness</u>: There is very little evidence of an awareness of the impact of the physical setting on instructional practice and student learning behaviors.</p> <p><u>Knowledge</u>: The teacher lacks the ability to articulate the problem when asked, is passively resigned to existing circumstances of the physical setting in which she practices and rarely seeks assistance in improving circumstances.</p> <p><u>Skills</u>: When adjustments are needed to support purposes and activities in the classroom, the teacher is unclear how to proceed.</p>

At the social scale of environmental competence (see Table 1), teachers' informal communication among peers tends to reinforce the *status quo* and discourage innovation (Taylor and Vlastos 1983).

At the scale of the organization (see Table 1), environmental competence suffers when administrators feel the need to make unilateral decisions regarding space and facility issues based on political expediency or a lack of resources. Additionally, when new facilities are provided, they may be inefficiently designed due to a lack of awareness. Once new facilities are occupied they can also be haphazardly and

hastily staffed, creating additional, unexpected problems of use (e.g., limiting rules and lack of familiarity).

Steele (1973) suggests that the collective environmental competence of an organization can grow if it progresses through a process of diagnosing and solving problems, taking action and obtaining feedback about the consequences of action; a process that resembles both the traditions of collaborative action research (Paterson et al. 1993; Carr and Kemmis 1986) and reflective teaching (Zeichner and Liston 1996). However, for most schools this reflective process never begins since teachers and administrators continue to be unaware of problems, are unable to clearly define the problems, and/or are oblivious to spatial solutions that might improve their conditions.

Before a process of training for greater environmental competence can be initiated, a need for change must reach a critical mass within the organization. Recognizing the inertia in organizations, Shein (1992), following and expanding on Lewin (1946, reprinted in Lewin 1997) suggests that the client system must be “unfrozen,” a process in which assumptions are reexamined (i.e., disconfirming data). The disconfirming data should then be connected to important goals and ideals resulting in motivation for change. It is necessary to create a psychologically safe social atmosphere that will allow individuals to move through the process comfortably and solve problems without a loss of personal integrity. Unfreezing leads to a cognitive redefinition that broadens and enlarges one’s knowledge, creates alternative solutions and initiates change (Shein 1992). Unfreezing includes becoming aware of the impact of the physical environment in practice, thus clarifying and assessing teaching practices against the physical environment. In the context of educational planning, architectural programming provides a model for that could be used to unfreeze organizational assumptions.

### **Experiencing the School Environment**

The degree of an individual’s awareness, knowledge and skills associated with environmental competence is connected to the person’s direct experience in an environment. Weisman (2001) has demonstrated that a common set of attributes of place experience, such as comfort, crowdedness and adaptability, have emerged in the literature across a broad range of place types. In school environments these attributes can comprise the habitability of a place (Taylor and Preiser 1983) and have the potential of creating a common language that teachers can use to articulate their environmental concerns with explicit reference to the purposes and activities of teaching and learning. Within the context of the literature on school environments, attributes of place experience are summarized in Table 3.

**Table 3. Attributes of the school environment**

Attributes	Definition
Accessibility	The ease of access, movement, and use of the school environment (Ansley 2000).
Adaptability	The extent to which the school environment can be adapted to desired educational activities and functions (Schneider, 2002a; Horne-Martin 2002; Weinstein and Mignano 1997; Sanoff 1994; Gump 1987; Loughlin and Suina 1982; Richardson 1970).
Aesthetics and Appearance	The degree to which the school environment is attractive, clean and orderly (Schneider 2002; Sanoff 2001).
Crowdedness/ Spaciousness	The degree of perceived social density within school and classroom environments (Evans 2006; Lang 2002; King and Marans 1979).
Legibility and Wayfinding	The ease with which occupants can understand the spatial organization of the school and can effectively find their way without feeling disoriented (Carpman and Grant 2002).
Meaning	The extent to which the school environment holds individual or collective culturally symbolic and historic significance for people (Crumpacker 1995)
Personalization and Ownership	The extent to which the school provides opportunities for learners to personalize and take ownership and control over space (Johnson 1990; Overbaugh 1990).
Physical Comfort	The degree to which the physical micro-climate as well as furnishings and technology support developmental capacities and task performance (King and Marans 1979; Laeser et al. 1998).
Privacy	The extent to which there are spaces in the school that provide opportunities for an individual or a small group to be free from the intrusion of others when desired (Lang 2002; Wolff 2001; Ahrentzen and Evans 1982).
Safety and Security	The extent to which the school environment protects learners from harm, injury, or undue risk (Schneider Walker and Sprague 2000; Crowe 2000).
Sensory Stimulation	The extent to which the school environment provides the adequate quality and quantity of visual, auditory, and tactile stimulation (Evans 2006; Schneider 2002; Hescong et al. 2002; King and Marans 1979; Maxwell and Evans 1997; Olds 2001).
Social Interaction	The extent to which the school contains adequate space in close proximity to support social contact between individual learners (Moore 1986; Brody and Zimmerman 1975) and collegiality among teachers (Wolff 2001).

These 12 attributes of school environments are not intrinsic to physical settings, but are a consequence of individual and social interactions within physical settings. As a whole, these attributes describe the environment as it is experienced and establish an everyday language that educational practitioners can use to assess the suitability of their physical surroundings.

Teachers' ability to manipulate the physical/spatial environment to support teaching and learning requires a working knowledge of environment-behavior relationships in the classroom. Unfortunately, the knowledge teachers may have is based on a loose body of school environments literature that tends to focus on the unidirectional impact of facilities *on* teaching and learning, such as the influence of various conditions including light, noise, size, density and arrangement on behavior, attitudes and academic outcomes (for reviews see Evans 2006; Schneider 2002; Moore and Lackney 1994; Gump 1987; Weinstein 1979). One exception is school climate theory where the physical milieu is seen as one subsystem of an ecological interplay that includes the social environment, the orderliness of the classroom, and teacher expectations about student outcomes (Moos 1979; Anderson 1982; Creemers and Reezigt 1999). On the whole, the literature neglects the transactional nature of environment-behavior relationships in school environments that would be of interest to practitioners interested in managing environmental change.

### **Methodology**

This study investigated an attempt to raise the environmental competence of teachers and verify their understanding of their surrounding environment. A second objective was to determine, if possible, the degree to which their environmental understanding might have influenced their classroom practice. The study employed an action research approach that included a set of interconnected training, research and action activities (1946, reprinted in Lewin 1997). Action research, as originally conceptualized by Lewin, combines the generation of theory with the act of affecting social system change. Action research aims to contribute to the immediate concerns of people in problematic situations while simultaneously contributing to the goals of social science (Greenwood and Lewin 1998). This study of environmental competence was embedded in a larger project to investigate the impact of improved environmental quality on educational outcomes, described more fully below.

### **Study Context**

This study was initiated as a subset of a broader study conducted for a public-private partnership to assess environmental quality in a number of elementary schools as part of an on-going school reform effort in a large urban school district on the east coast of the U.S. This study examined teacher perceptions of their school environments at five elementary schools chosen from a total of 80 within the district. The case schools were chosen by the school district administration, not the researcher. The primary selection criteria included school sites that were willing to address environmental quality issues or expressed the need to do so. The district, experiencing low achievement in comparison to national averages, low attendance rates, and minimal parent involvement at the time of the study, had recently embraced site-based management School Improvement Teams (SIT) consisting of stakeholders from across the learning community for the purpose of monitoring needed improvements in school climate and outcomes. When possible, members from these teams were recruited for the study. The schools taught students from pre-kindergarten through fifth grade, and the age of the school buildings at the time of the study ranged from 13 to 22 years. All but one school had a combination



of self-contained and open plan classroom space, and all five schools were two-story structures (Table 4).

**Table 4. School site sample**

Case Number	1*	2	3	4*	5*
Building Age (years)	17	14	22	14	13
Building Configuration	SC/OS	SC/OS	SC	SC/OS	SC/OS
Student Population	348	577	232	420	582
Total Building Area (Gross Sq. Ft.)	35,887	79,642	47,828	44,805	40,223
GSF/Student (average)	103	138	206	107	69
Total Instructional Space (GSF)	17,981	36,470	18,104	24,080	18,743
Instructional GSF/Student (ave.)	52	63	78	57	32
Student/Teacher Ratio					
Pre-K/K	25	24	19	23	28
Grade 1-5	24	30	27	25	36

\* Schools participating in the school reform initiative

SC = Self-contained classrooms; OS = Open Space instructional areas

Once the case school candidates were identified by district administrators, their principals were solicited for their commitment and support of the goals of the broader environmental quality project that included both school reform and facility improvement components. Principals of each school recruited four teachers to participate in the study, using a criteria of providing participants with a variety of years of teaching experience, types of teaching, and lengths of residence in the building. A total of 20 teachers, 18 female and two male, were chosen to participate across the five schools. Teachers represented all grade levels and had teaching experience ranging from two to 28 years with a median of nine years of teaching. The teachers' residency at their schools ranged from one year to 20 years with an average of nine years.

### Process and Procedures

Environmental competence theory asserts that raising teacher competence will require strategies to "unfreeze" the client system by encouraging teachers to examine their assumptions regarding the school environment. This examination should lead to a cognitive redefinition that broadens their knowledge, creates alternatives and initiates the need for change. This should be accomplished in a psychologically safe environment that does not lead to a loss of integrity (Shein 1992).

Having teachers focus directly on their own classroom teaching practices can create defensiveness and evaluation anxiety. Instead, focusing their critique on the school environment gives teachers a less threatening way to examine their assumptions (Nelson and Sundt 1993). For this study, teachers were initially asked to conduct a self-assessment of their own school environment. Subsequently, the researcher used focused interviews, workshops and small group participation methods (Sanoff 1994; 2001), as well as modifications of methods used by professional designers

for architectural programming and post-occupancy evaluation, to serve as both training and research tools.

The research procedures followed three stages, described below: (a) interviews and observations, (b) workshops, and (c) implementation and action steps.

### ***Stage 1: Interviews and Observation***

The first stage consisted of an initial site visit to conduct reconnaissance on the school environment concerns of the school staff, as well as to gauge the level of environmental competence at the school for training purposes. The investigator conducted a series of semi-structured interviews with the principal and lead custodian, and carried out tours of the school buildings, a physical inventory of major building systems, and photographic documentation.

A second site visit involved semi-structured interviews with individual teachers, the purpose of which was to ascertain their perceptions of the school environment. A total of 20 tape-recorded semi-structured qualitative interviews were conducted by the investigator across five sites. The interviews started by asking teachers to reflect on their daily activities with students—a training strategy developed to get them to begin to define the attributes of the school environment. The investigator then asked several open-ended questions: How would you describe the qualities of a school environment? What are some attributes or features that you think make for an exceptional school environment? Once the participant completed their initial description of the school environment and its perceived impacts on teaching and learning, the investigator prompted the participant to reflect on other attributes of the school environment that they had not mentioned (Table 5). These question prompts were intended to act as an initial “intervention” aimed at advancing their environmental competence by getting them to more closely examine their assumptions.

**Table 5. Semi-structured interview questions**

<b>Attribute of School Environment</b>	<b>Interview Questions</b>
Accessibility	Has accessibility for the physically disabled been a concern at your school?
Adaptability	Have there been specific instances where you experienced problems using your classroom space effectively? Does the layout of the building fit the activities and programs in which you and your colleagues are engaged? Do you need to adjust your activities to fit the limitations of size and configuration of the school building?
Aesthetics and Appearance	What is your appraisal of the appearance of the building interior? The building exterior and grounds? What comments do you receive from visitors concerning the school's appearance?
Crowdedness/ Spaciousness	To what extent are classrooms crowded? If so, how do teachers and students cope with crowding?
Legibility and Wayfinding	How easy is it to find your way around the building? Can parents and community visitors find their way?

Meaning	Does the school have a recognizable history, a story, a collective memory of place?
Personalization and Ownership	How do you personalize your classroom? What opportunities do students have to personalize their spaces? Do you and other teachers have a sense of ownership in your school? Do students?
Physical Comfort	Are the school's furnishings, equipment and technology adequately sized to meet the developmental needs of students?
Privacy	Do private places exist for teachers and students when needed or desired? Have there been situations where privacy has been an issue for teachers or students?
Safety and security	How safe do teachers and students feel in school? What are some of the safety and security issues you have dealt with at your school?
Sensory Stimulation	To what extent is thermal and air quality a concern at your school? To what extent is noise and acoustics a concern? Do you experience any problems with lighting? Overall, how visually stimulating are classrooms in the school?
Social Interaction	Does the school offer places for informal social exchange between students, between students and teachers, and between teachers?

### **Stage 2: Workshops**

The second stage of the research consisted of semi-structured workshops attended by groups of teachers from each school who had previously been interviewed. These workshops were intended to provide psychological safety for teachers to collectively examine their assumptions regarding the school environment. The teacher participated in a variety of exercises during the workshops: clarifying the concerns about the school environment identified during the individual interviews, prioritizing these concerns, identifying the perceived impacts of these concerns on educational outcomes (e.g., student achievement and social development, teacher instructional performance) within their particular school (Table 6), and when possible, generating alternative solutions and planning actions to resolve the more critical concerns.

The workshops provided a second opportunity to raise the environmental competence of teachers, this time as a social working group. Workshop materials included individually identified environmental concerns, floor plans showing the location of issues throughout the building, and a presentation board containing photographs of areas of concern. Once the investigator re-presented the content of the interviews and participant observations using these materials, the participants were encouraged to comment, revise and challenge the results. Teachers often identified additional concerns that did not emerge from interviews or investigator observations, and in a few cases, teachers collectively dismissed some previously identified concerns.

Once there was agreement on a final list of environmental concerns, teacher participants rated the concerns by priority (high, moderate or low). The purpose of the prioritization exercise was to encourage teachers to consider how environmental concerns may be influencing their students' learning and social development as well as their teaching practice. Predictably, from the perspective of

environmental competence theory, an outcome of this exercise was raising the teachers' expectations that higher-prioritized concerns might at some point be addressed by the school administration.

The final exercise of each workshop was to identify what impacts each environmental concern was perceived to have on educational outcomes. The purpose of this exercise was to further enhance teacher environmental competence by helping them use their new language of school environment attributes to articulate specific instances in which their schools' environments may influence teaching and learning. A large blank matrix worksheet (Figure 1) was used for ranking issues by priority and the potential impact, if any, on one of three educational outcomes: student academic performance, student social development, and teacher instructional performance. *Student academic performance* was defined broadly to refer to students' achievement on standardized tests as well as their day-to-day performance on in-class work assignments. *Student social development* referred to social behavioral outcomes such as cooperative and competitive behaviors, incidents of disruptive behaviors, and students' expressions of self-esteem. *Teacher instructional performance* referred to the ability of a teacher to effectively provide instruction that meets the learning goals and needs of students. Teacher participants collectively discussed and debated the impact each environmental concern did or did not have on each of the three educational process outcomes.

**Figure 1. Workshop matrix worksheet**

Ranked Priority	Student Academic Performance	Student Social Development	Teacher Instructional Performance
High			
Medium		(Environmental concerns)	
Low			

**Phase 3: Implementation and Action Steps**

The first two steps of the study focused on describing the process, procedures and findings associated with enhancing the environmental competence of teachers. A third stage of the study involved the distribution of a final case study report to each school principal describing the results of the assessment process and offering an invitation to continue the process in order to develop strategies to address the environmental concerns voiced by teachers.

**Results and Findings**

Table 6 summarizes the aggregated results of the interviews and workshops conducted at all five schools. Given the limitation of a small sample of teachers available within each school, the study aimed for a more generalized understanding

of teacher environmental competence across all participating schools. The table displays school environment concerns according to attributes of the school environment, educational outcomes and priority.

A total of 84 school environment concerns were identified by teachers, ranging from 10 to 27 concerns per school, with a mean of 16.8 concerns per site. Some concerns were associated by teachers with only one attribute (e.g., "no elevator" was associated with accessibility), while other concerns were more complex in nature and were thus associated with more than one attribute (e.g., "classroom tables" were associated with adaptability, physical comfort and privacy).

During the workshops, the investigator encouraged teachers to use the language of environmental attributes (Table 3) first introduced in interviews. Some teachers began, for example, to discuss the broader issue of accessibility in the school or ways to organize their classroom to encourage more cooperative behaviors, while others continued to refer exclusively to the concrete concerns at hand. These observations indicate an expected unevenness in levels of environmental competence among teachers.

The goal of the prioritization exercise in the workshops was for teachers to focus and deepen their discussion of the most important concerns in the school with an eye toward future action, an important component of environmental competence. Teachers rated between five and 18 concerns as high priority at any one site. Some concerns that were relatively narrow in scope evolved into discussions of possible solutions (e.g., the problem of displaying paperwork on walls in humid rooms and the solution of providing a cork strip across the top of blackboards). Other concerns, such as overcrowded classrooms in one school, eventually evolved into a rudimentary space planning exercise that involved teachers reviewing, critiquing and choosing options.

The final workshop exercise was designed to have teachers first discuss and then come to a consensus on the influence each school environment concern might be having on educational outcomes. From the perspective of environmental competence, the objective was to encourage teachers to reflect on the ways in which the school environment may or may not be affecting their teaching and their students' learning (Table 6). Additionally, reflecting on the perceived impact of an environmental concern on educational outcomes was intended to highlight the importance of taking action in certain areas.

**Table 6. Environmental concerns categorized by attributes of the school environment and teacher perceptions of the impacts on educational outcomes**

Attributes of School Environment	Student Academic Achievement	Student Social Development	Teacher Instructional Performance	Totals
Accessibility	<ul style="list-style-type: none"> <li>No elevator (M)</li> </ul>	<ul style="list-style-type: none"> <li>No elevator (M)</li> </ul>	<ul style="list-style-type: none"> <li>No elevator (M)</li> </ul>	<b>3</b>
Adaptability	<ul style="list-style-type: none"> <li>Old, poor quality carpeting (H)</li> <li>Classroom tables (H)</li> <li>Overcrowded classrooms (H)</li> <li>Underutilized library/media center (H)</li> <li>Computer operation problems (H)</li> <li>Dissatisfaction with and inefficient use of open space for instruction (M/H)</li> <li>Non-use of computer nooks (M)</li> <li>Lack of electrical outlets (L)</li> <li>Cooperative learning in self-contained classrooms (L)</li> </ul>	<ul style="list-style-type: none"> <li>Dissatisfaction with and inefficient use of open space for instruction (M/H)</li> <li>Overcrowded classrooms (H)</li> <li>Classroom tables (H)</li> <li>Inadequate lobby design (H)</li> <li>Underutilized library/media center (H)</li> <li>Ideas for conducting landscaping projects (M)</li> <li>Interclass projects (L)</li> <li>Cooperative learning in self-contained classrooms (L)</li> <li>Lack of space for school-wide assemblies (L)</li> </ul>	<ul style="list-style-type: none"> <li>Dissatisfaction with and inefficient use of open space for instruction (M/H)</li> <li>Overcrowded classrooms (H)</li> <li>Inefficient self-contained classroom (H)</li> <li>Underutilized library/media center (H)</li> <li>Computer operation problems (H)</li> <li>Disorganized storage (H)</li> <li>Crowded administration area (H)</li> <li>Non-use of computer nooks (M)</li> <li>Lack of electrical outlets (L)</li> <li>Computer installation problem (L)</li> <li>Interclass projects (L)</li> <li>Cooperative learning in self-contained classrooms (L)</li> </ul>	<b>30</b>
Aesthetics and Appearance	<ul style="list-style-type: none"> <li>Old, poor quality carpeting (H)</li> <li>Unightly, Plexiglas windows (L)</li> </ul>	<ul style="list-style-type: none"> <li>Old, poor quality carpeting (H)</li> <li>Unightly playground with damaged equipment (H)</li> <li>Inadequate lobby design (H)</li> <li>Ideas for conducting landscaping projects (M)</li> <li>Student work displays (M)</li> </ul>	<ul style="list-style-type: none"> <li>Recurring insect problem (M)</li> <li>Developing relationship with custodian (M)</li> <li>No views out windows (M)</li> </ul>	<b>10</b>
Crowdedness/Spaciousness	<ul style="list-style-type: none"> <li>Overcrowded classrooms (H)</li> <li>Classroom tables (H)</li> </ul>	<ul style="list-style-type: none"> <li>Overcrowded classrooms (H)</li> <li>Classroom tables (H)</li> <li>Lack of personal space for students (H)</li> <li>Need to share lockers (M)</li> </ul>	<ul style="list-style-type: none"> <li>Crowded administration area (H)</li> </ul>	<b>7</b>
Legibility and Wayfinding			<ul style="list-style-type: none"> <li>Parents' inability to find way to classrooms (H)</li> </ul>	<b>1</b>
Meaning		<ul style="list-style-type: none"> <li>Signs of academic unity (M)</li> </ul>		<b>1</b>
Personalization and Ownership	<ul style="list-style-type: none"> <li>Overcrowded classrooms (H)</li> <li>Neighborhood quality (H)</li> <li>Classroom tables (H)</li> <li>Open-plan vs. self-contained (M)</li> </ul>	<ul style="list-style-type: none"> <li>Overcrowded classrooms (H)</li> <li>Neighborhood quality (H)</li> <li>Classroom tables (H)</li> <li>Unsafe playground (H)</li> <li>Lack of personal space for students (H)</li> <li>Ideas for conducting landscaping projects (M)</li> <li>Need to share lockers (M)</li> <li>Signs of academic unity (M)</li> </ul>	<ul style="list-style-type: none"> <li>Overcrowded classrooms (H)</li> <li>Neighborhood quality (H)</li> <li>Open-plan vs. self-contained (M)</li> <li>Locked storage for teacher belongings (M)</li> </ul>	<b>17</b>

		<ul style="list-style-type: none"> <li>• Student work displays (M)</li> </ul>		
Physical Comfort (Ergonomic)	<ul style="list-style-type: none"> <li>• Classroom tables (H)</li> </ul>			<b>1</b>
Privacy	<ul style="list-style-type: none"> <li>• Overcrowded classrooms (H)</li> <li>• Classroom tables (H)</li> <li>• Open-plan vs self-contained (M)</li> </ul>	<ul style="list-style-type: none"> <li>• Overcrowded classrooms (H)</li> <li>• Classroom tables (H)</li> <li>• Lack of personal space for students (H)</li> <li>• Need to share lockers (M)</li> </ul>	<ul style="list-style-type: none"> <li>• Overcrowded classrooms (H)</li> <li>• Open-plan vs. self-contained (M)</li> </ul>	<b>9</b>
Safety and Security	<ul style="list-style-type: none"> <li>• Psychological safety on building grounds (H)</li> <li>• Multiple points of entry (H)</li> </ul>	<ul style="list-style-type: none"> <li>• Psychological safety on building grounds (H)</li> <li>• Unsafe playground equipment (H)</li> <li>• Child safety and vehicular traffic (H)</li> <li>• Upkeep of grounds (M)</li> </ul>	<ul style="list-style-type: none"> <li>• Psychological safety on building grounds (parking lot) (H)</li> <li>• Ventilation for science projects (H)</li> <li>• Safety from intruders (H)</li> <li>• Locked storage for teacher belongings (M)</li> </ul>	<b>10</b>
Sensory Stimulation (Thermal and Ambient)	<ul style="list-style-type: none"> <li>• Poor air quality (H)</li> <li>• Too hot and/or too cold (H)</li> <li>• Old, poor quality carpeting (H)</li> <li>• Ventilation for science projects (H)</li> </ul>	<ul style="list-style-type: none"> <li>• Poor air quality (H)</li> <li>• Old, poor quality carpeting (H)</li> <li>• Too hot and/or too cold (H)</li> </ul>	<ul style="list-style-type: none"> <li>• Poor air quality (H)</li> <li>• Too hot and/or too cold (H)</li> <li>• Ventilation for science projects (H)</li> <li>• Developing relationship with custodian (M)</li> </ul>	<b>11</b>
Sensory Stimulation (Auditory)	<ul style="list-style-type: none"> <li>• Dissatisfaction with open-plan (H)</li> <li>• Noise in pods (M)</li> <li>• Street noise (L)</li> <li>• Bathroom and corridor noise (L)</li> </ul>	<ul style="list-style-type: none"> <li>• Street noise (L)</li> </ul>	<ul style="list-style-type: none"> <li>• Dissatisfaction with open-plan (H)</li> <li>• Noise in pods (M)</li> <li>• Street noise (L)</li> </ul>	<b>8</b>
Sensory Stimulation (Visual)	<ul style="list-style-type: none"> <li>• Unsightly, Plexiglas windows (L)</li> </ul>	<ul style="list-style-type: none"> <li>• Lighting in pods (M)</li> </ul>	<ul style="list-style-type: none"> <li>• No views out windows (M)</li> </ul>	<b>3</b>
Social Interaction	<ul style="list-style-type: none"> <li>• Classroom tables (H)</li> <li>• Underutilized library/media center (H)</li> </ul>	<ul style="list-style-type: none"> <li>• Classroom tables (H)</li> <li>• Old, poor quality carpeting (H)</li> <li>• Unsafe playground (H)</li> <li>• Inadequate lobby design (H)</li> <li>• Underutilized library/media center (H)</li> </ul>	<ul style="list-style-type: none"> <li>• Underutilized library/media center (H)</li> </ul>	<b>8</b>
<b>Totals</b>	<b>35</b>	<b>47</b>	<b>37</b>	<b>119</b>

Teacher awareness of the school environment appeared to be limited to their most immediate experience. Adaptability and sensory stimulation were the most often mentioned attributes of the school environment by teachers, while legibility and wayfinding were the least often mentioned. During individual interviews, when teachers were asked to describe their perceptions of their school environment, they tended to identify sensory stimulation concerns, specifically regarding thermal comfort and air quality of the school, followed by problems with noise. Attributes of sensory stimulation were a high priority concern to the majority of teachers interviewed and reflected the poor environmental quality of most of the schools in the study. Once the investigator asked questions that prompted teachers to think beyond their immediate concerns related to environmental quality, they began to discuss problems related to the adaptability of their own classroom environment. Concerns that surfaced included poor quality floor surfaces, poorly functioning and

outdated computers, a lack of electrical outlets, and dissatisfaction with open space and the acoustical distractions associated with it.

Once teachers exhausted their concerns over their classroom environment, further prompting was necessary to encourage them to discuss other aspects of the school environment they had not considered, such as evidence of personalization and ownership of the school, safety and security concerns, ways in which the school environment supported social interaction between students and teachers, and the aesthetics and appearance of the school. Few teachers expressed concerns over crowding, as all but one of the schools were experiencing either a steady or slightly declining population. Similarly, other than suggesting that some parents have problems finding their way through the building, teachers did not perceive legibility or wayfinding to be of concern. Finally, the idea that the building's character or history would convey some deeper symbolic meaning as an artifact of the surrounding community was almost completely absent among participants: for teachers, the school building is perceived solely in utilitarian terms.

When the investigator asked teachers to draw from their own experiences to identify to what degree they felt various environmental concerns impacted educational outcomes, teachers perceived that classroom adaptability had the most direct relationship with all educational outcomes. They were able to make the connection between the layout of a classroom, for instance, and their ability to teach effectively. Classrooms that lack space for storage, lack proper resources, contain poorly functioning computers, and are crowded and inefficiently laid out particularly overwhelm teachers; they are unable to do their work as effectively as they might like, and limits resources for students as well. For example, concerns for the lack of proper ventilation kept one teacher from conducting science projects altogether in his classroom, hindering potential curricular choices and impacting his students' learning. Adding to the problems of adaptability within the classroom was the frequent lack of support space outside the classroom, such as lack of teacher workspace, crowded administrative areas, and disorganized libraries. Teachers often felt that their concerns for adaptability were not being met and were out of their control.

Safety and security was another attribute of the school environment that teachers emphasized as a high priority and that has a perceived psychological influence on all school outcomes. The close relationship between safety and security and a lack of ownership became apparent to teachers as they discussed concerns related to the school grounds. Teachers commonly focused on the need for safety within the school building—an attribute they felt was partially under their control. However, teachers were much less comfortable with safety and security outside the building, whether on the playground, the parking lot, or the surrounding neighborhood streets.

Appearance to teachers focused almost exclusively on the cleanliness of the school and the orderliness of the classroom as a reflection of a caring and organized school image, rather than the aesthetic qualities of the school building itself. Although aesthetics and appearance were a concern for teachers, they were secondary to



safety. Teachers framed “appearance” in terms of a lack of ownership (e.g., unsightly playgrounds, uncaring neighborhood residents) and problems with adaptability (e.g., poor quality carpeting).

Issues of personalization and ownership of the school did not emerge until the investigator prompted the teachers. Teachers first discussed their students’ lack of personal space and crowdedness at shared classroom worktables, and then discussed other places in and around the school such as overcrowded lockers, cafeteria spaces, and unsafe playgrounds. Teachers often completed their thoughts by discussing broader concerns about the social relationships between the school and surrounding neighborhood community. As teachers became aware that personalization and ownership were attributes that lay at the heart of many of their environmental concerns, they begin to see their relationship to student social development.

Although the teachers regularly discussed social interactions between students, instructors did not immediately perceive the role space played in social relations. For instance, when attempting to get students to focus on-task as a cooperative group, teachers who participated in the workshops did not take full advantage of alternative arrangements that might have better supported this behavior and instead accepted the conclusion that not all students could work effectively in groups. These instructors persisted in the use of desk arrangements that suited the direct instruction style with which they were more comfortable, rather than attempt to explore more effective physical settings designed to support the cooperative learning they professed to practice. There were exceptions, however: a newly hired fourth-grade teacher in an open space instructional area was confronted with a class of students who were unable to focus on either the instructor or their cooperative learning tasks. With guidance from the assistant principal, the teacher observed his colleagues and other classes and after some deliberation, traded his desks for tables. Soon he found that his students began to work more productively as teams. He attributed part of his success to his observation of how kids worked in groups in other classrooms and the role tables played in supporting his goal of cooperative learning among his students. This example, although a rare epiphany in the study, illustrates the possibility that teachers can be trained to change the physical setting to suite their desired instructional strategy.

## **Discussion**

To what degree did the process and procedures followed in this training enhance the level of environmental competence across these five schools? In the initial interviews, most teachers exhibited very little evidence of an awareness of the impact of the physical setting on instructional practice or other student outcomes, and were passively resigned to existing circumstances. They did admit to seeking assistance in improving conditions such as indoor environmental quality, but were unclear how to proceed further. By the end of the workshop training, teachers exhibited some awareness of the impact of physical settings on their instructional practice and student learning outcomes. A few teachers were able to articulate problems and were able to begin thinking through alternative solutions. Although teachers generally recognized the importance of their findings, there was no

evidence in four of the five cases that the teachers were motivated and prepared to act to improve their conditions. In these four cases, environmental competence had moved slightly beyond a lack of proficiency into the proficiency (Table 2) expected of teachers who had experienced no prior training. Though teachers had gained some knowledge about the relationships that existed between the school environment and behavior, they had not yet been trained in the skills necessary to make spatial adjustments. Teachers at the fifth school exhibited far greater proficiency due solely to the presence of an assistant principal who was recently assigned from the central office to assist this failing school. This assistant principal not only exhibited a high level of environmental competence proficiency, but had the interest, willingness and leadership skills necessary to turn the momentum of the training into a reflective practice exercise for the four teachers assigned to work with the investigator. She lifted an organizational barrier that allowed the training process to take hold, if briefly. When this individual left the school to become a principal in another school that was not part of the study, she implemented, with some success, many of the environmental design and management ideas generated from this study, indicating a degree of transferability of these findings to another context (Lackney and Finston 1999).

### **Social Control of Space and Creative Custodianship**

During the study, two broad themes emerged: what Steele (1980) refers to as creative custodianship and social control of space. Teachers feel a general lack of control of the school environment, especially in terms of sensory stimulation. Custodial and maintenance staffs were perceived by educators to have primary responsibility over thermal comfort, air quality and ventilation issues. Added to this perceived lack of control, mechanisms for logging complaints were unreliable, informal and in some cases political. A few teachers discussed taking the matter into their own hands by attempting to modify control systems, opening windows that had been locked for energy management purposes, or currying favor with custodians—none of which solve the underlying problem. Single-minded concern over the lack of control of sensory stimulation precludes teachers' perceptions of other critical attributes of the school environment because all their attention is focused on the more immediate and tangible conditions of the ambient environment.

Teachers' lack of knowledge of the effective use and management of space is evident in the large number of classroom adaptability concerns expressed by teachers. Open classrooms and other arrangements, for example, are mismatched with their activities, namely, cooperative learning activities and individualized learning centers. The sense of control teachers have over classroom adaptability appears to be mixed. Though custodians may be responsible for ambient conditions, teachers indicated that many school environment concerns remained their own responsibility. This recognition indicates some awareness of the importance of, and desire to, maintain control over their immediate school environment even if they do not see a clear solution (Table 1).

Ownership, or the lack thereof, emerged as a second thematic thread connecting a wide variety of attributes. During the workshops, teachers moved beyond a general

disregard of space in their classrooms to articulating the importance of the relationship between the school site and the surrounding community. Neglected neighborhoods, unsafe playgrounds and parking lots, and the appearance of unsightly plastic windows symbolized for many teachers the lack of ownership the community had for their schools.

The researcher observed that students lacked any private places in the school to call their own, having to share their lockers and spend their instructional hours crowded around classroom tables. Similarly, teachers did not have places to store their belongings. With all of these concerns, one might conclude it would be difficult for any occupant to think of their school as their home; however, teachers shared that students would confide to them that they lacked a safe home life. For many students, the school clearly symbolized a safe place. Teachers noted that this was evident in the way many students took ownership of, and showed respect for, their school environment.

The workshop and its conclusions illustrated several of the common factors contributing to a lack of environmental competence (see Table 1). It was for many the first time they had ever been asked to respond to questions relating to the physical school environment. At first, only a few were able to articulate how they used their classroom space or to see any spatial causes of classroom experiences.

Teachers in the study typically exhibited a disregard for space beyond their immediate concerns for indoor environmental quality. The passive resignation to these immediate concerns overshadowed any regard for the social-spatial attributes of the school environment such as privacy and social interaction, or the need for places for reflection, collaboration and collegiality among themselves or their students. The workshop structure allowed them, for the first time, to consider these broader influences of the school environment.

During the workshops, teachers freely shared possible strategies and solutions to environmental concerns with their colleagues. The process of discussing school environment concerns created a unique, safe and appropriate setting for exploring alternative solutions to their more immediate problems.

Unfortunately, based on follow-up calls with administrators after the study was completed, there was little evidence that many of the ideas generated in the workshops were acted upon. This lack of action might be explained through a variety of organizational barriers: (a) unilateral decision making on the part of administrators, who chose not to act based on a perceived lack of resources from conventional sources (and chose not to explore non-traditional sources); (b) assumptions that only certain individuals, such as administrators and maintenance staff, are responsible for facility management, and; (c) a lack of awareness or disregard for the findings of the study that indicated that teachers felt that the existing school environment had a meaningful influence on school outcomes.

Possibly, as a result of these organizational factors, teachers did not on the whole act on strategies to resolve or take advantage of their knowledge. In effect,

teachers maintained their passive resignation despite the environmental concerns they uncovered during their self-assessment of the school environment. There was a general lack of leadership on the part of teachers and administrators necessary to take action on these concerns once the outside investigator left the setting, and the organization's limiting set of rules served as a powerful barrier to implementing needed environmental change even with school improvement processes in place.

Teachers, once prompted, were able to identify links between the school environment and outcomes. The process stretched their thinking and awareness, but did not in most cases take hold. In one case an action plan was created and partially acted upon, but it too suffered from the social obstacles of challenging the norms of acceptability and the status quo. In that case, the administrators had concerns about sharing negative results with the central office, fearing a poor reflection on the school, even though the assistant principal argued for the use of the same data as evidence for securing additional outside funding for school improvement.

### **Conclusions**

The procedures of this study were designed to go well beyond obtaining data from participants. The goal was to raise teachers' environmental awareness through a process of reexamining their assumptions about the role played by the school environment in teaching and learning. Once teachers were introduced to a means of communicating their environmental experience in terms of attributes, they were able to talk about specific environmental concerns, see relationships between these concerns, and prioritize them. Teachers were able to make meaningful distinctions and to formulate reasons and general hypotheses for why the various attributes of the school environment had the impacts they did. Sadly, little to no action was taken at the administrative level of the schools under study, thus highlighting the organizational factors that continue to contribute to poor environmental competence in many school environments. As Schein (1992) argues, a "critical mass" was not reached within the organization to precipitate any meaningful change. There was no pressing need for these schools to change what they were already doing and therefore a lack of awareness—a blindness to the potential connections between the physical settings and the effectiveness of the organization—reasserted itself.

### **Directions for Further Study**

This study was limited to teachers in an urban school setting with traditional teacher-centered curriculum in, for the most part, self-contained classroom buildings. Although open plans were available to teachers, those spaces were still laid out in predictable arrangements consistent with teacher-centered, self-contained classrooms. Thus, findings of this study cannot be extended to the growing number of hands-on, learner-centered, project-based learning environments advocated by school reformers (Costa and Liebmann 1997; Wolff 2001). Studying environmental competence in these environments, as well as investigation of the environment as a "silent curriculum" or "third teacher" (Strong-Wilson and Elis 2007) are avenues for further investigation suggested by this study.

This study illustrates and supports the presupposition that the problem of environmental competence concerns the entire organization, not just its individual members. The ability to organize and conduct a systematic and comprehensive process of identifying school environments is not a "collective competence" (Steele 1980) that many schools possess. However, evidence that the processes and procedures employed by this study may improve the organizational environmental competence of a school did emerge in one of the five cases. Over a succession of follow-up workshops with this one school, a dialogue developed around how to address these problems. There was some increase in competence in not only the four teachers, but also in several of the school improvement team members that were not a part of the original workshop. The involvement and leadership of the assistant principal who shared her knowledge and skills with her staff as the training progressed suggests that there is a need for some extant environmental competence within an organization to institutionalize meaningful environmental change.

Thus, a second implication of this study is a call for investigation of the impact of systematic training of school teaching staffs in environmental competence as an integral part of "educational commissioning," or the reorganization of existing schools and occupancy of new ones. In this process, educators are trained to optimize their school facility for teaching and learning (Lackney 2005).

A third implication of this study is the need for a common language between educators, school planners and designers that can be used by architects and educators together. To this effort, the author and his colleagues have developed a working design pattern language for schools (Lackney 2009; Nair and Fielding 2005).

Finally, the results of this study point to the value of investigating ways to expand teacher professional development to improve their understanding and use of the environment as a teaching tool, or a three-dimensional textbook (Taylor 2005).

The environmental concerns experienced by teachers in this study are typical of many older schools that have not been well-maintained due to budget cuts and are consistent with previously cited literature indicating the poor condition of existing facilities nationally (GAO 1995). As long as concerns over thermal and acoustic comfort dominate teachers' awareness, other attributes of the school environment such as social interaction, privacy, personalization and ownership will likely continue to be out of the range of awareness. As indoor environmental quality concerns are resolved in newly constructed buildings, however, the question remains whether environmental awareness will recede among teachers, or will the more comfortable surroundings allow teachers to focus on higher-order pedagogical goals such as creating collaborative, project-based arrangements; using outdoor spaces for learning; allowing students to personalize their space; and offering students opportunities to share in the ownership of the school. Teacher assessments of new school buildings using these environmental competence training procedures may begin to answer this question.

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