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Measuring school facility conditions: an illustration of the importance of purpose

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Abstract

Purpose – The purpose of this paper is to argue that taking the educational purposes of schools into account is central to understanding the place and importance of facilities to learning outcomes. The paper begins by observing that the research literature connecting facility conditions to student outcomes is mixed. A closer examination of this literature suggests that when school facilities are measured from an engineering perspective, little connection to learning outcomes is evident. By contrast, when school facilities are rated in terms of educational functions, a connection to learning outcomes is apparent.

Design/methodology/approach – The paper provides an empirical test of the educational relevance of how school facilities are measured. Using the schools in a Canadian division, the condition of school facilities was measured in two ways, including both conventional, engineering tools and a survey capturing principals' assessments. School facility ratings using these alternate measurement methods were correlated with schools' quality of teaching and learning environments (QTLE).

Findings – Two central findings emerge. First, engineering assessments of facilities are unrelated to the QTLE in schools. Second, educators' assessments of school facilities are systematically related to the QTLE in schools.

Originality/value – The findings indicate that more research needs to be directed at developing sound tools for measuring school facilities in terms of their educational relevance. In addition, school administrators need to reconsider policies that devalue the contribution that facilities make to learning outcomes.

Keywords Schools, Facilities, Teaching, Learning, Educational policy, Canada

Paper type Research paper

There is little debate that the condition of school facilities in the USA and Canada are deficient. In the USA, the 1995 General Accounting Office report documented the extensiveness of deferred maintenance deficits and, since then, spending on maintenance and operations has decreased (Agron, 2006). In Canada, where engineering guidelines suggest budgeting between 2 and 4 percent of the replacement cost of school buildings for renewal, the actual percentage set aside ranges between 0.5 and 1.25 percent (Roberts *et al.*, 2008). The lack of adequate investment ensures that the inevitable process of continued facility deterioration will continue.

Multiple voices have called attention to school facility condition deficits, ranging from the American Federation of Teachers call for a "Marshall Plan" to US Department of Education's "No Child Left Behind" research (Mendell and Heath, 2004). All with little apparent effect, since school deferred maintenance backlogs continue to grow. There are undoubtedly many reasons for this inadequate action. This paper explores one possibility related to the way school facility conditions are measured.

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The basic argument is as follows: educational administrators and legislators who control school budgets are focused on school outcomes and, rightly, direct funding at those factors which they think will optimize these outcomes. The research evidence on the contribution of school facility conditions to learning outcomes is mixed, with findings ranging from no effects to substantial ones. The ambivalence of such evidence makes the case for investing in facility conditions harder to sustain against competing investment opportunities.

This paper forwards the idea that the ambivalent evidence about facility condition effects on learning outcomes is related to how facility conditions are measured. Conventional measurements of school facilities use an engineering "property management" perspective which takes no account of the purpose of schools. When such measures are used, little connection to learning outcomes is evident. Other, less institutionalized, measures do take the educational purposes of schools into account and tend to find a connection to learning outcomes.

The paper makes the case that it is essential to take the purpose of facilities into account when considering their connection to learning outcomes. As a demonstration, empirical evidence is presented that directly compares engineering assessments of school facilities with educators' assessments to determine what connection these different rating methods have to the quality of learning environments. The results are instructive and carry some important implications for measuring, monitoring, and managing school facilities.

An engineering perspective on school facilities

The institutionalized perspective used to measure the state of school facilities in North America is some version of the "facility condition index" (FCI) (OECD, 2000; Piper, 2004). The term FCI refers to a standardized approach to measuring the physical condition of facilities. An FCI score measures the state of facility conditions by applying a formula that divides the value of a building's deferred maintenance by its total replacement cost. The higher the proportion of the building's value that is in need of repair, the worse the building's condition. The value of the numerator in an FCI score is determined by examining and rating building components. The detail of the component assessment varies considerably from as few as a couple of dozen "critical system" components to over 700 components in a complete assessment. The research literature and current practices include several different versions of the "FCI" measure. Although all versions use the same concepts in the numerator (i.e. deferred maintenance cost) and denominator (i.e. total replacement cost), they vary in which building systems and components are included and how they are priced.

Contrary to the statements about "independence" and "objectivity" that commonly surround the reporting of FCI measures, this assessment of facility condition contains plenty of imperfections. Engineers, architects, or technicians who do the assessments use their "professional judgment" to assess the condition of building components and this variation leads to issues of inter-rater reliability. In addition, differences in what items are included in the numerator can also generate very different assessments of the same building stock.

The most important flaw, however, of FCI-based measures for assessing school facilities relates to the issue of "purpose". The fundamental principle underlying assessments of anything involves the specification of intended purposes.

Without identifying what any "thing" is for, it is impossible to assess "how good it is". This general principle of evaluation applies to "school facilities", as it does to everything else.

FCI-based measures of facilities use a "property-management" perspective. In other words, they focus on the life-cycle considerations of a building's components[1], with the goal of managing capital planning and maintenance budgets. Since their original development, the application of FCI-based measures has spread to a wide range of facilities, including apartment blocks, stores, hospitals, hotels, social housing and, of course, schools.

Users of FCI measures of school facility condition employ ranges to interpret the empirical results. For example, it is common for schools with FCI scores under 6 percent to have their facilities rated as "good; those with scores between 6 and 15 percent to be rated "fair", etc. Two points are worth emphasizing about such commonly employed measurement schemes of school facilities. First, as far as the literature reports, the ranges for interpreting the results have never been calibrated for the K-12 sector and, consequently, are to a considerable extent arbitrary. Second, these measures of facility condition do not take account of the educational purposes of schools. They simply view schools as properties to be managed.

Given this understanding of the purposes of FCI-based measures of school facilities, it is not surprising that effort to relate these measures of facility condition to educational outcomes yields weak results. A good example is the recent work of Picus *et al.* (2005) on the Wyoming school system, whose research claims there is "essentially no relationship between the quality of school facilities and student performance". In this paper, the authors point out that Wyoming was "the first state with a measure of school facility quality that is reasonably consistent across school sites and districts" (Picus *et al.*, 2005, p. 72). For current purposes, it is instructive to note that these Wyoming school facility assessments were conducted by a national consulting firm. Their facility condition measures contained two components including a "single building score" and a "suitability tool". The following descriptions of each component illustrate their contents.

Regarding the "single building score":

> [The consulting firm] calculated a single building condition score for each building based on an instrument it created and was [sic] designed to be objective. The building condition scores were determined by collectively assessing up to 22 separate building subsystems such as foundations, ceilings, floors, and so forth. The individual rating tools consisted of 1 to approximately 20 questions (depending on the particular building), the answers to which were agreed on by a school representative and an assessor ([...] usually an architect, contractor, or building supervisor). [The consulting firm] weighted the subsystem assessments relative to the cost of bringing the affected components up to an "as new" condition [...] The published overall condition score was the average of the weighted values of all the applicable subsystems (Picus *et al.*, 2005, pp. 80-1).

Regarding the "suitability tool" measure:

> The suitability tool possessed a higher degree of subjectivity than the building condition instrument because it was 95 per cent self-reported by district superintendents or their designees. The suitability tool purported to measure the degree to which each building was suitable for its current use (Picus *et al.*, 2005, p. 81).

The "single building score" description appears to be a measure similar to the FCI. A Wyoming Department of Education Report (1998) confirms this view and includes the cut-off points on a 100-point scale used to determine buildings in "good", "fair", "poor" or "unsatisfactory" condition. It is also reported that this overall assessment measure can also be decomposed into "structural, mechanical, and safety/building code" subsystems. The Wyoming Department of Education's description of the "educational suitability" contains no elaboration beyond a "technological readiness" component and a set of cut-off interpretation points.

In summary, the "single building" school facility assessment scores used by Picus *et al.* (2005) are similar to the engineering convention[2]. Such a measurement choice appears unproblematic for property management purposes, but it is much less clear why such facility measures should bear a relationship to educational outcomes. Why, for example, should a global measure that includes the condition of boilers, roofs, ducts, and foundations have any systematic relationship to educational outcomes? Using the findings of Picus *et al.* (2005), such an unreasonable prediction is not supported by the data.

An educational perspective on school facilities

An educational perspective on school facilities would view these assets in terms of their educational consequences. Some simple examples illustrate how such an educational perspective contrasts with an engineering one. Take the case of windows in schools. The research literature suggests that lighting is an important contributor to educational outcomes (e.g. Schneider, 2002; Uline and Tschannen-Moran, 2008). When an engineer assesses school lighting, the rating centers on items such as the state of deterioration of window sills, level of leakage between and around window panes, and the life expectancy of the electrical fixtures in the classroom. Such items are clearly relevant to property management, but their connection to effective teaching and learning is tenuous. The relevance of light to teaching and learning is less about the condition of windows and electrical fixtures and more about the amount of natural light and its functional equivalent in instructional spaces. These educational concerns are not property management concerns and, subsequently, are ignored in conventional school facility assessments.

Or take the case of indoor air quality and temperature control, which is demonstrably relevant to student performance (Wargocki and Wyon, 2006). The conventional engineering perspective, for example, examines these air-related issues by determining the life expectancy of the school's boiler (or other heat source), and assessing whether the air distribution fans are functional. Again, these kinds of determinations are fine for property management outcomes but tangential to educational ones. The educationally relevant questions concern whether the air distribution system provides sufficient fresh-air exchange or whether classroom temperatures can be regulated within target ranges. Conventional school facility assessments do not speak to such educational concerns.

A long standing axiom in social science is that "meaning" (and therefore "relevance") is not inherent in any object. Meaning and relevance are matters of decision and declaration[3]. Fortunately, schools are social institutions whose primary purposes are reasonably well-established. Consequently, the teaching and learning objectives of schools makes declaring the relevance of their components straightforward.

The primary consideration in assessing the relevance of school facilities is the same as it is for assessing, for example, teachers or curricular materials – what aspects of these components are relevant to optimal learning. Teachers would never be judged on irrelevant characteristics like height or eyesight; just as curricular materials would never be judged by their colour or weight. This is not to say that teachers' height and eyesight or the colour or weight of curricular materials is never relevant. They are probably relevant for some objectives; but they are not relevant for judging their adequacy for the educational mission of schools. In a parallel way, the mission-relevant aspects of school facilities are the conditions that should be given primary consideration when examining the importance of school facilities to educational outcomes.

Existing evidence supports the relevance of utilizing an educator's perspective on school facilities when exploring for relationships to learning outcomes. In practice, obtaining an educator's perspective distills to obtaining the perspective of principals or teachers, since these are the role players who experience and interpret school facilities through an educator's lens. The literature contains illustrations of each approach.

Using the principal's perspective is illustrated in the research programme of Glen Earthman and his students (e.g. Earthman *et al.*, 1995; Al-Enezi, 2002; Bullock, 2007). When measuring school facilities, studies in this research programme utilize an instrument called the Commonwealth Assessment of Physical Facilities (CAPE). The standard version of this questionnaire includes 28 questions probing a wide number of aspects of school facilities. For present purposes, two aspects of this approach deserve highlighting. First, the aspects of school facilities probed in the survey are those which the research literature has demonstrated have relevance to teaching and learning. Included in this roster are issues such as lighting, thermal comfort, building maintenance, indoor air quality, acoustics, programmatic supports, and aesthetics. Second, in probing these aspects of school facilities the survey asks descriptive (vs evaluative) questions. In other words, rather than ask about the adequacy of lighting, indoor air quality, etc. (which is evaluative), the CAPE survey asks descriptive questions such as what proportion of instructional spaces have windows (re: lighting), or how frequently are the walls painted (re: aesthetics). The scoring protocol for the CAPE survey provides a method for creating school building index scores from the principals' survey responses.

The recent work of Uline and Tschannen-Moran (2008) takes an alternate approach to obtaining an educator's perspective on school facilities. Their work gathers the views of teachers, rather than those of principals. Also in contrast to Earthman's approach, the items collected by Uline and Tschannen-Moran are more evaluative than descriptive. For example, they ask teachers to assess the "adequacy" of various aspects of facility condition. Using this approach, Uline and Tschannen-Moran are able to generate a scale measuring the quality of school facilities with high reliability.

For purposes of the current argument, one other point about the educational perspective on school facilities deserves mention. This point concerns the relationship between this measurement approach to school facilities and educational outcomes. In contrast to studies that rely on the engineering approach to school facilities, research such as Earthman's and Uline and Tschannen-Moran's do find meaningful connections between facility conditions and educational outcomes. In this regard, the research of Buckley *et al.* (2004) provides an interesting illustration. They found that overall health and safety compliance ratings of schools in the Los Angeles Unified School District had

a substantial, independent relationship to academic performance. Such health and safety measures are part of "participant wellness" – one of four dimensions that Roberts *et al.* (2008) posit should be part of an educational conceptualization of school facilities.

An empirical demonstration

The argument so far has suggested that how we conceptualize and measure school facilities does have important implications for determining the connection between facilities and educational outcomes. Both reasoning and empirical evidence suggests that if school facilities are assessed in engineering terms, then little connection to educational outcomes is evident. By contrast, both reasoning and empirical evidence suggests that when school facilities are examined in either descriptive or evaluative terms by educators then meaningful connections to educational outcomes emerge. In short, it appears as if taking purpose into account does matter when making school facility assessments. The existing literature, however, contains no direct tests of how much difference using an engineering versus an educational assessment of school facilities makes to understanding educational outcomes. A description of one such test follows.

In the summer of 2007, a school division in western Canada undertook a thorough facilities assessment. The division included 38 schools covering the complete K-12 spectrum. The facilities assessment utilized the "full form" assessment which included site visits by engineering staff and ratings of over 700 facility system components for each school. It is worth noting that the FCI assessment methodology used in this case was extraordinarily complete, since some assessment protocols include as few as two dozen "critical system" measures. By contrast, the engineering evidence from this sample of schools was exceptionally thorough. Using the facility audit information, an independent engineering firm calculated FCI scores for all schools in the division. These assessments provided measures of each school's facility condition from an engineering or property management perspective.

While the engineering assessments were being conducted, all principals in the school division completed a survey about their assigned schools. This survey centered on gathering three types of information. Two of these focused on principals' assessments of their facility condition. One other measure of school facility condition was the CAPE measure developed by Earthman (2007). As noted earlier, this measure provided a "descriptive" measure of facility conditions from the principal's perspective. The second measure of facility condition was "evaluative" in that it asked principals to assess the extent to which their "school's capacity to provide effective instruction was hindered by a shortage or inadequacy of the following aspects of facility condition":

(1) general condition of buildings;
(2) heating and/or cooling systems;
(3) lighting systems;
(4) acoustic systems;
(5) indoor air quality; and
(6) instructional space.

The six facility condition components included in the evaluative assessment were those whose relevance to educational outcomes is well-established in the literature.

To explore the difference between engineering and educational assessments of school facilities, the survey also included a measure of educational outcomes. Unlike the USA, Canadian school divisions do not routinely gather school-wide educational achievement data; so this type of measure was not a possible dependent variable. However, as recent research confirmed (Uline and Tschannen-Moran, 2008), the effects of school facilities on student achievement are mediated by "school climate". Using this rationale, the principals' survey included a measure of each school's "learning environment".

The overall measure of "learning environment" included 24 items covering three component themes. The themes included "student morale and commitment", "teacher morale and commitment", and "student and teacher-related factors affecting achievement". Specific items related to each theme included:

(1) *Student morale and commitment:*
- Students enjoy being in school.
- Students work with enthusiasm.
- Students take pride in this school.
- Students value academic achievement.
- Students are cooperative and respectful.
- Students value the education they can receive in this school.
- Students do their best to learn as much as possible.

(2) *Teacher morale and commitment:*
- The morale of teachers in this school is high.
- Teachers work with enthusiasm.
- Teachers take pride in this school.
- Teachers value academic achievement.

(3) *Student and teacher-related factors affecting achievement:*
- Student absenteeism.
- Disruptions of classes by students.
- Students skipping classes.
- Students lacking respect for teachers.
- Student use of alcohol or illegal drugs.
- Students intimidating or bullying other students.
- Teachers' low expectations of students.
- Poor student-teacher relations.
- Teachers not meeting individual students' needs.
- Teacher absenteeism.
- Staff resisting change.
- Teachers being too strict with students.
- Students not being encouraged to achieve full potential.

For the student and teacher morale/commitment items, principals reported their level of agreement with each statement using a conventional Likert scale. For the student and teacher-related factors affecting achievement, principals reported the level to which effective teaching and learning in their school was hindered by each item. The scale used for these items included the response categories "not at all", "very little", "to some extent", and "a lot". These 24 "learning environment" measures mirror those collected in the recent Programme for International Student Assessment studies. The rationale for using these measures was to provide a national norm again which the local situation could be compared.

Analysis

The analysis to illustrate the connection between school learning environment and alternate assessments of school facilities proceeds as follows:

- Descriptions are reported of how indexes for each measure were constructed.
- The correlations between the three measures of school facilities are examined.
- The relationships between the alternate approaches to school facility measurement and school learning environment are reported.

Facility condition index

As noted earlier, the FCI is a widely used engineering based, property management measure of facility conditions. The FCI for a school is calculated by dividing the "deferred maintenance cost" of a facility by the "total replacement cost" of the building. The higher the proportion a building's replacement cost that is in need of repair, the worse a school's facility conditions.

The standard reporting of FCI scores is in percentages, although engineers, architects, and others interested in property management do not have a shared, professional standard for interpreting FCI scores. However, one common classification (Piper, 2004) is to translate FCI scores into descriptions of building condition as follows: 0-5 percent (good); 6-15 percent (fair); 16-29 percent (poor); 30+ percent (critical). The FCI scores for schools in the sample ranged from 5.5 to 58.7, with a mean of 25.6 ($s = 14.8$).

CAPE index

This measure uses principals' assessments to generate a "descriptive" measure of school facility condition. The CAPE scoring protocol (Earthman, 2007) creates a facility index score ranging from 25 to 75, with higher scores indicating better facility condition. The conventional interpretation of CAPE scores utilizes three categories. Schools with scores below 41 are labeled "substandard"; those with scores over 60 are labeled "standard"; leaving schools with scores between 41 and 60 in an ambivalent category. On the CAPE scale the schools in the sample ranged from 42 to 61, with a mean of 53.2 ($s = 4.6$).

Evaluative assessment index

Like the CAPE scores, this index asked principals to assess their school's facility conditions. However, instead of asking questions that inquire about the state of school facilities (descriptive), the measure asked principals to assess the adequacy (hindrance

level) of various facility components (evaluative). The theoretical range for this index is between 6 and 24, with lower scores indicating better facility conditions (i.e. less hindrance). The schools in the sample ranged between 6 and 18 on this index, with a mean of 10.2 ($s = 3.7$).

Learning environment index

Each school's learning environment was measured on three dimensions, including student morale and commitment, teacher morale and commitment, and student and teacher-related factors affecting achievement. The items in each of these dimensions were aggregated into an index[4], with scores ranging from 59 to 96. The α reliability coefficient for the index was 0.93, with a mean of 78.1 ($s = 9.4$).

Alternative school facility assessments

The study included three measures of school facility conditions. The FCI measure which employs an engineering, property-management perspective, and two measures of facilities from an educator's (principal's) perspective – one "descriptive" (CAPE), and one "evaluative." Earlier we suggested that there is good reason to think that the engineer's and educator's views of school facilities will not coincide. Table I reports the correlations among these three measures.

These results support the idea that an educator's and engineer's viewpoints on the facility conditions in schools, as measured by the instruments described earlier, are uncorrelated. Both the educator's "descriptive" (CAPE) and evaluative assessments of school facilities have small, insignificant correlations to the engineer's FCI ratings. By contrast, the alternate educator's perspectives on school facility conditions are significantly correlated[5].

Connections to learning environments

Earlier it was argued that taking the purposes of schools into account when assessing the facilities is important to observing connections to educational outcomes. In this study, the educational outcomes of interest are schools' learning environments which are the conditions that mediate the physical facility – student achievement connection. If this reasoning is correct, we should expect that different measures of school facilities should have different kinds of connections to school learning environments. Table II presents the relevant correlations.

The correlations in Table II confirm the idea that educator's viewpoints on school facilities have more relevance to school learning environments than engineering or property-management perspective do. In fact, the FCI has an insignificant connection to learning environment, while both principal's perspectives (as measured by the

	Educator's descriptive (CAPE)	Educator's evaluative	Engineer's property mgt (FCI)
Educator's descriptive	1.00	−0.511*	−0.122
Educator's evaluative		1.00	0.302
Engineer's property mgt			1.00

Note: Significant at: *0.01

Table I.
Correlation coefficients among school facility condition measures

survey instruments) have substantial, significant correlations. The CAPE measure, which has an extended history of development and use, has a stronger connection to learning environments than the recently constructed "evaluative" measure.

Since the evidence in Table II speaks to the core message of this report, perhaps it is worth illustrating the evidence in another way. From an administrator's perspective, a measure of school facilities should be able to meaningfully distinguish between schools in some educationally relevant way. For instance, if schools with higher facility assessments have better learning outcomes, then the case for directing more management capital to school facilities is stronger.

In the CAPE scoring protocol, Earthman (2007) suggests that school facility scores can meaningfully be sorted into quartiles. These quartiles organize the schools in a sample into four rank-ordered groups, each including 25 percent of the sample. Table III presents the percentage of schools from the lowest and highest CAPE quartiles that fall into the top learning environment quartiles. Table IV presents the same segmentation for the lower and upper quartiles of the "evaluative" educational assessments of facility conditions.

Tables III and IV both show that an educator's assessment of school facilities gathered through a principals' survey does sort schools into relevant learning environment categories. In either the descriptive (CAPE) or evaluative assessment of school facilities, only about 20 percent of schools in the bottom quartile were rated in the top half of learning environments. By contrast, among the top quartile of CAPE-rated school facilities, 70 percent were above the median; while the equivalent number was 60 percent using the evaluative facility assessments.

Table II.
Correlation coefficients of school facility conditions to learning environments

	Facility condition measures		
	Educator's descriptive (CAPE)	Educator's evaluative	Engineer's property mgt (FCI)
Global learning environment scores	0.41*	−0.36*	−0.13

Note: Significant at: *0.01

Table III.
Top and bottom CAPE quartiles by upper learning environment quartiles (percentages)

	CAPE scores	
Learning environment ranking	Schools in bottom quartile	Schools in top quartile
Upper quartile	11.1	30.0
Third quartile	11.1	40.0

Table IV.

	Evaluative facility assessments	
Learning environment ranking	Schools in bottom quartile	Schools in top quartile
Upper quartile	0.0	30.0
Third quartile	20.0	30.0

Note: Top and bottom evaluative facility assessment quartiles by upper learning environment quartiles (percentages)

Discussion and conclusion

The intention of this paper is to illustrate a simple but important point; namely, that how we measure school facilities has important consequences for what is observed. Almost all of the school renewal industry, a large portion of policy researchers, and a significant number of academic researchers in this area use institutionalized, engineering based, property-management measures of school facility condition. For example, in Canada, all provinces between Alberta and Quebec have mandated FCI assessments of K-12 schools, and all engineering firms working in this sector rely on these assessments. The ideas and evidence in this report are meant to suggest that, although these entrenched measurement methods are backed by powerful vested interests, they may not be particularly relevant for managing schools toward an educational mission[6].

The evidence illustrated in this report suggests that property-management measures of school facilities provide few clues to the learning environments in schools. It follows that if school facilities are managed against such FCI measures, parents, principals, teachers, and students should expect unpredictable returns to the quality of a school's learning environment. Given that learning environments provide the mediating conditions in which teaching and learning takes place, it is reasonable to expect that managing school facilities by such metrics will not systematically support student achievement. On the other hand, it appears that measures that use an educator's perspective on school facilities do have reliable relationships to learning environments. It follows that such measures hold greater promise for measuring, monitoring, and managing school facilities toward achievement of their educational mission.

The evidence in this report is suggestive, not definitive. It is based on a small school division and used measures of "evaluative" facility assessment and "learning environment" whose psychometric properties are not standardized or institutionalized. There is clearly much room for more systematic conceptualization and measurement of how school facilities should be measured from an educator's perspective.

However, the evidence in this report is persuasive enough that its implications should be taken seriously. Currently, less than 10 percent of funds allocated to schools are directed toward facilities; the other 90 + percent goes to salaries, textbooks, etc. While this allocation may seem justified by "educational" priorities in the short term, continually shirking the smaller investment in school facilities puts the efficiency and effectiveness of the larger investment at risk. Monies not spent on school facilities are not "saved"; they represent a lost investment in the core educational mission.

School boards and administrators have zero-tolerance policies about all kinds of issues related to effective education: no illegal drugs; no violence; no sexual harassment (American Bar Association, 2008; Casella, 2003). Given the apparent importance of facility conditions to learning environments and educational outcomes, perhaps boards should have zero-tolerance policies about school facilities that hinder educational effectiveness. Unlike many contributors to educational effectiveness (e.g. class, race, and gender), the knowledge and technology to create improved school facility conditions is available – and administrators should consider their fiduciary obligations to utilize them.

Notes

1. It is worth noting that FCI measures were first used in the 1960s by the Naval Facilities Engineering Command, US Navy Atlantic Fleet. At that time they managed about 20,000 facilities spread over 100 sites. Their goal in developing the FCI was to establish a reliable priority listing for managing their capital planning and maintenance budget for these shore facilities.
2. Determining "how similar" is problematic when examining studies using engineer's FCI measures of facility condition. Experience shows that while social researchers examining facility condition are quite willing to share their measurement tools and documentation, proponents of the engineering perspective are more reluctant. Examination of available FCI based measures shows considerable variation in conceptualization, measurement, and interpretation.
3. A famous formulation being the "Thomas Theorem": If people define situations as real, they are real in their consequences (Turner, 2006).
4. Given the comparatively small sample size, factor analysis procedures were not used in the index construction process for this study. However, these same items were included in a national assessment of the quality of school learning environments, which included 1,087 schools. A thorough analysis of the national sample revealed that, although the quality of learning environment included the three dimensions identified earlier, the empirical results of a global, one factor solution revealed the plausibility of a single "learning environment" conceptualization. For reasons of parsimony, we report the results using an aggregated, "learning environment" scale. Additional tests using the separate learning environment dimensions shows the same pattern as the global results.
5. The negative sign of the correlation results from the "evaluative" assessment probing "hindrance", with lower scores indicating better facility conditions.
6. This is not to suggest that FCI measures of school facility condition are irrelevant. Schools are, in some ways, like other "properties" and so their property-management condition deserves attention. But it deserves attention for the general concerns of "occupants", not the specific concerns of teachers and students trying to optimize learning.

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