

TITLE: School Facility Conditions and Student Academic Achievement

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ABSTRACT: This paper shows that the condition of school facilities has an important impact on student performance and teacher effectiveness. In particular, research demonstrates that comfortable classroom temperature and noise level are very important to efficient student performance. The age of school buildings is a useful proxy in this regard, since older facilities often have problems with thermal environment and noise level. A number of studies have measured overall building condition and its connection to student performance; these have consistently shown that students attending schools in better condition outperform students in substandard buildings by several percentage points. School building conditions also influence teacher effectiveness. Teachers report that physical improvements greatly enhance the teaching environment. Finally, school overcrowding also makes it harder for students to learn; this effect is greater for students from families of low socioeconomic status. Analyses show that class size reduction leads to higher student achievement.

1. School facility conditions affect student academic achievement.
2. School building design features and components have been proven to have a measureable influence upon student learning.
3. Among the influential features and components are those impacting temperature, lighting, acoustics, and age.
4. Researchers have found a negative impact upon student performance in buildings where deficiencies in any of these features exist.
5. Overcrowded school buildings and classrooms have been found to be a negative influence upon student performance (especially for minority/poverty students).
6. In cases where students attend school in substandard buildings they are definitely handicapped in their academic achievement.
7. Correlation studies show a strong positive relationship between overall building conditions and student achievement.
8. Researchers have repeatedly found a difference of between 5 – 17 percentile points difference between achievement of students in poor buildings and those students in standard buildings (when the socioeconomic status of students is controlled).

9. Ethnographic and perception studies indicate that poor school facilities negatively impact teacher effectiveness and performance and therefore have a negative impact on student performance.
10. All of the studies cited in this report demonstrate a positive relationship between student performance and various factors or components of the built environment. The strength of that relationship varies according to the particular study completed; nevertheless, the weight of evidence supports the premise that a school building has a measurable influence on student achievement.

TITLE: Testimony of Kathleen J. Moore, Director of the School Facilities Planning Division, California Department of Education (to the Committee on Education and Labor United States House of Representatives)

DATE: February 13, 2008

1. There is a growing body of research on the importance of school facility condition, design, and maintenance on student performance and teacher workplace satisfaction.
2. U.S. Dept. of Education cites over 40 academic research papers ...Researchers have repeatedly found a difference of between 5-17 percentile points between achievement of students in poor buildings and those students in above-standard buildings.
3. Design Council of London review of 167 sources... Showed clear evidence that extremely poor environments have a negative effect on students and teachers and improving these have significant benefits.
4. Poor building conditions greatly increase likelihood that teachers will leave their school.
5. Numerous studies have confirmed the relationship between a school's physical conditions and improved attendance and test scores, particularly in the areas of indoor air quality, lighting, thermal comfort and acoustics.
6. There is a consensus in the research that newer and better school buildings contribute to higher student scores on standardized tests.
7. Student attitudes and behavior improve when the facility conditions improve.
8. Teachers report that adequate space and access to technology are important variables to deliver curriculum.
9. Facility directors report that new and renovated schools can provide better opportunities for small schools
10. Building design such as large group instruction areas, color schemes, outside learning areas, instructional neighborhoods, and building on the student scale had a statistically significant impact on performance.
11. School quality can affect the ability of an area to attract businesses and workers.
12. The physical condition of school facilities impact student achievement and experience as well as teacher retention and community vitality.

TITLE: Do K-12 School Facilities Affect Education Outcomes? (Staff information report for Tennessee Advisory Commission on Intergovernmental Relations)

DATE: January 2003

1. Almost all of the studies conducted over the past three decades have found statistically significant relationship between the condition of a school, or classroom, and student achievement.
2. In general, students attending school in newer, better facilities score five to 17 points higher on standardized tests than those attending in substandard buildings.
3. School facility factors such as building age and condition, quality of maintenance, temperature, lighting, noise, color, and air quality can affect student health, safety, sense of self, and psychological state.
4. Research has also shown that the quality of facilities influences citizen perceptions of schools and can serve as a point of community pride and increased support for public education.
5. Of special importance is the effect that facilities have on time in learning, which is universally acknowledged as the single most critical classroom variable. Every school year, many hours of precious and irreplaceable classroom time are lost due to lack of air conditioning, broken boilers, ventilation breakdowns, and other facilities related problems.
6. It is unreasonable to expect positive results from programs that have to operate in negative physical environments.
7. The quality of the learning environment is known to affect teacher behavior and attitudes toward continuing to teach.
8. Review of 141 published studies, 21 papers presented at professional conferences, 97 published studies published studies ... summary:
 - a. Age of Facility:
 - i. Students had higher achievement scores in newer facilities (Math, reading, composition)
 - ii. Fewer disciplinary incidents in newer facilities
 - iii. Attendance records were better in new facilities

- iv. Social climate factors perceived by students were considerably more favorable in a new school

b. Condition of Facility:

- i. As the condition of the facility improved, achievement scores improved
- ii. Stimulating environments promoted positive attitudes in students
- iii. Higher student achievement was associated with schools with better science labs

c. Thermal Factors:

- i. 8 or 9 studies found significant relationship between the thermal environment of a classroom and student achievement and behavior
- ii. Consistent pattern of higher achievement in air conditioned schools
- iii. Excessive temperatures caused stress in students

d. Visual / Lighting

- i. Light in the classroom seemed to have a positive effect on attendance rates
- ii. Light had a positive effect on achievement
- iii. Daylight in the classroom seemed to foster higher achievement

e. External Noise:

- i. Higher student achievement was associated with schools with less external noise
- ii. Outside noise caused students to be dissatisfied with their classrooms
- iii. Excessive noise caused stress in students

f. Air Quality:

- i. Poor air quality causes respiratory infections, aggravates allergies, and causes drowsiness and shorter attention spans
- ii. When students do not feel well when they are in school, or miss school due to air quality problems, learning is adversely affected

TITLE: Do School Facilities Affect Academic Outcomes? (National Clearinghouse for Educational Facilities)

AUTHOR: Mark Schneider, Professor of Political Science at the State University of New York, Stony Brook.

DATE: November 2002

1. How can we expect students to perform at high levels in school buildings that are substandard?
2. Clean, quiet, safe, comfortable, and healthy environments are an important component of successful teaching and learning
3. Synthesis of earlier studies correlated student achievement with better building quality, newer school buildings, better lighting, better thermal comfort and air quality, and more advanced laboratories and libraries. More recent reviews report similar links between building quality and higher test scores
4. Students in newer buildings outperformed students in older ones and posted better records for health, attendance, and discipline
5. Good facilities had a major impact on learning
6. Research does show that student achievement lags in shabby school buildings – those with no science labs, inadequate ventilation, and faulty heating systems
7. Other studies tie building quality to student behavior...Vandalism, leaving early, absenteeism, suspensions, expulsions, disciplinary incidents, violence, disruption in class, tardiness, racial incidents, and smoking all have been used as variables in these studies
8. Good teaching takes place in schools with a good physical environment
9. The general attitudes, behavior, and relationships amongst pupils and staff are more conducive to learning in those schools which have had significant capital investments

TITLE: Good Buildings, Better Schools, An Economic Stimulus Opportunity With Long Term Benefits (Economic Policy Institute Briefing Paper)

AUTHOR: Mary Filardo, founder of *21st Century School Fund*

DATE: April 29, 2008

1. Many of the key educational initiatives designed to give the nation's children the tools and knowledge they need for the future have facility related implications
2. Building deficiencies impair the quality of teaching and learning and contribute to health and safety problems of staff and students
3. Building design and facility conditions have also been associated with teacher motivation and student achievement
4. Classroom lighting and thermal comfort are commonly cited by teachers as determinants of their own morale and the engagement of their students
5. 53 studies linked design features to student achievement

SOURCE: National Clearinghouse of Educational Facilities (Author Jack Buckley and Mark Schneider)

DATE: February 2004

1. A myriad of factors clearly affect teacher retention, but most teaching takes place in a specific physical location (a school building) and the quality of that location can affect the ability of teachers to teach, teacher morale, and the very health and safety of teachers
2. Many schools suffer from “Sick Building Syndrome” which in turn increases student absenteeism and reduces student performance
3. Ability to control classroom temperature as central to the performance of both teachers and students
4. Teachers believe thermal comfort affects both teaching quality and student achievement
5. Classroom lighting plays a particularly critical role in student performance
6. The consensus of 17 studies is that appropriate lighting improves test scores, reduces off task behavior, and plays a significant role in the achievement of students
7. Good acoustics are fundamental to good academic performance
8. Higher student achievement is associated with schools that have less external noise
9. Outside noise causes increased student dissatisfaction with their classrooms and excessive noise causes stress in students
10. Teachers believe that noise impairs academic performance

TITLE: The Effects of the School Environment on Young People's Attitudes Towards Education and Learning (Summary report for England's National Foundation for Educational Research)

AUTHORS: Peter Rudd, Frances Reed, and Paula Smith

DATE: May 2008

1. There is a good deal of evidence to indicate that student attitudes had become more positive after the move into a new school building
2. Those students who "felt safe" most or all of the time increased from 57 to 87 percent
3. Those students who "felt proud" of their school increased from 43 to 77 percent
4. Those students who "enjoyed going to school" increased from 50 to 61 percent
5. Those students who perceived that bullying was a big problem decreased from 39 to 16 percent

TITLE: Acoustics in Schools (Ceilings & Interior Systems Construction Association white paper report)

DATE: November 2009

1. Children, especially those younger than 13 years of age, have an undeveloped sense of hearing, making the impact of background noise on hearing, comprehending, and learning more pronounced for children than adults.
2. Students with learning, attention, or reading deficits are more adversely affected by poor acoustic conditions than the average student
3. Loud or reverberant classrooms may cause teachers to raise their voices, leading to increased teacher stress and fatigue

TITLE: Relationship Between School Facility Conditions and the Delivery of Instruction; Evidence From a National Survey of Principals (Journal of Facility Management)

AUTHOR: Ibrahim Duyar

DATE: 2010

1. Six of ten facility conditions are statistically and positively associated with the delivery of instruction
2. Facility conditions accounted for 43% of the explained variation on the delivery of instruction with medium sized effect
3. The paper supported the notion that educational facilities do matter and they affect the delivery of instruction

TITLE: Teacher Attitudes About Classroom Conditions (Journal of Educational Administration)

AUTHORS: Glen I. Earthman and Linda K. Lemasters

DATE: 2009

1. Differences between the responses of teachers in satisfactory buildings are significantly different than those of teachers in unsatisfactory buildings (responses concerning attitudes and impressions)
2. Physical environment influences attitudes of teachers, which in turn affects their productivity and such effects could cause morale problems in the teaching staff
3. The conditions of the classroom can cause morale problems with teachers

TITLE: Having an Impact on Learning (School Planning & Management)

AUTHOR: Deb Moore

DATE: August 2009

1. Facilities DO impact learning
2. Research shows that facilities can be an asset or a detriment to the educational process and to student achievement
3. Researchers have repeatedly found a difference of between 5 – 17 percentile points between achievement of students in poor buildings and those students in above-standard buildings. (When controlled for socioeconomic status). The average is around 10 points
4. Building age, windows in the instructional area and overall building condition were positively related to student achievement
5. Results showed a direct correlation between better facility conditions and student outcome
6. (1,100 schools in Canada) ... shows substantial differences between schools with different facility conditions.
7. In all cases, schools in top-ranked facility condition have better learning environments than schools in bottom ranked condition. Students work with more enthusiasm. The moral of teachers is higher. There is less disruption of classes by students. Teacher expectations of students are higher
8. Facilities are one of the things we can change that will positively affect students and staff