

DO WINDOWS MAKE A DIFFERENCE? A LONGITUDINAL STUDY OF EFFECTS OF INSTALLING OPENABLE WINDOWS

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#44.20

Following a decision by a large urban school board to install openable windows in a "sealed" school, an interview/questionnaire study was commissioned of teachers' and students' perceptions of the school environment before and after installation of the windows. Results show positive improvements immediately after installation with subsequent decline to previous levels of dissatisfaction with the quality of the building environment. Lack of congruence between physical measurements of air quality and satisfaction of building occupants suggests a need for a total building performance approach which addresses psychological factors as well as physical in dealing with environmental quality issues.

INTRODUCTION

Publication in the press of stories headlined "Parents Want Windows: Sealed School Makes 'Em Ill" (Toronto Sun, March 15, 1985) and "The Runaround: Sealed School Needs Airing" (Toronto Sun, March 25, 1985), as well as a parent-child demonstration (with gas masks and buttons reading, "Open a window. I need air"), highlighted a series of meetings between parents, teachers, and Board of Education personnel which led to a decision to install opening windows in a "sealed" school. The building design facilitated removal of an existing exterior wall unit (9.5 square meters) in each classroom, and replacement of the wall unit with a window unit containing openable portions, thus increasing the window area in the classrooms by approximately 525 percent.

The authors were commissioned to conduct an interview/questionnaire study of the teachers' and students' perceptions of the school environment both before and after the windows were installed. It was apparent that illness and numerous other problems had been attributed to the absence of openable windows and many people believed that the presence of such windows would ameliorate or eliminate these problems. The question of the effectiveness of having openable windows installed in the school was, therefore, to be the key focus of the study (before similar expensive renovations might be undertaken elsewhere).

Perceptual phenomena, perceived beliefs, are a significant factor in the study of air quality

might be predicted on the basis of current technical measurements. As one staff member said, "I don't care what your measurements say. I KNOW the air is bad." People's experience may belie the "facts", there may not be a "correct" solution, or there may not be agreement on which facts are the salient ones to address.

School staff members function in a context of social and cultural spaces which have vast implications for perceptions. If people perceive that their building has "bad air" (e.g. "It's dry"; "It's dusty"; "It smells"); they will tend to believe that the building has "bad air" and to make attributions based on that belief (e.g.: "It gives me a headache"; "It makes me feel tired"; "It makes me sick"). They will tend to act on that belief, and the actions may range from feeling ill and taking a sick day, to complaining to a colleague, to demanding windows which open. Because the perceptions are real, and the beliefs and actions are sincere, it may matter relatively little that the "facts" are different.

If school staff members believe that their school building is causing their illness or that of their students, they will, at some point, hold those seen as responsible for the building responsible for the illness; that is, the responsibility for their illnesses may be assigned to the architects, engineers, maintenance people, or administrators.

The context of this study included the belief that staff, students, and parents in the experimental school were more critical of their school environment before openable windows were installed than were the staff, students, and parents of the control school. After the windows were installed it was expected that there would be an improvement in the reported evaluation of the environment at the experimental school, and that there would be no significant change in evaluations of the control school. The rationale behind the expectation that the evaluation of the school environment would improve after the openable windows were installed was twofold: firstly, the strong positive evaluations of "natural light" and "fresh air"; and secondly, the effect of the public commitment, involvement, and publicity about the "bad air", and the campaign to obtain the windows, which was undertaken by persons in the community. Because so much had been invested in obtaining the windows, it was expected that there would be a very positive evaluation of the windows after they were installed. No study was made of attitudes before the commitment was made to install the openable windows and the evaluation obtained in this study (which occurred during and after installation) may or may not represent how people might have responded earlier.

METHODOLOGY

To look at the effects of the installation of the openable windows, ruling out chronologically-related effects which might account for changes, another school of the same age and similar architectural design, also a "sealed building", was chosen as a control school to provide a standard basis of comparison with the experimental school both in a pre-test (before the windows in the experimental school were installed) and in the post-tests (after the windows were installed) (1).

Data were collected on three occasions: firstly, in the pre-test, before the windows were installed; secondly, in the first post-test, six months after the windows were installed; and thirdly, in the second post-test, eighteen months after the windows were installed.

To study the effects, in terms of the perspectives of building occupants, of satisfying their demands for openable windows, the varied and complex issues underlying the apparently simple question, "Do windows make a difference?", were divided into units which could be investigated. These units were represented by research questions addressing air quality,

satisfaction with the physical building environment, perceived health, and absenteeism.

The research questions were addressed through the administration of pre- and post-test interviews and questionnaires tapping the perceptions and beliefs of staff members and students in the experimental and control schools on the dimensions selected for study. All full-time staff members were interviewed individually by one of three interviewers, with interviews requiring from 20 to 40 minutes to complete. Students in Grades, 4, 5, and 6 were given a questionnaire in their classrooms, a whole class at a time, following administration to a small sample of students to refine and validate the form. The questionnaire was administered by two researchers, one reading the questions aloud, while the other circulated throughout the classroom answering questions raised by individual students. The administration of the questionnaire usually took 20 to 25 minutes. The tone of the sessions was serious and attentive. The purpose of the study was read to the students before the questionnaire was distributed. Questions from students were invited and answered. To assure anonymity, no names or other means of identification were attached to the questionnaires or interviews.

In addition to the information collected through the questionnaires and interviews, air quality surveys were conducted at the two schools both before and after installation of the windows. The following parameters were measured: carbon dioxide, carbon monoxide, formaldehyde, airborne microorganisms, total suspended particulates, volatile organic chemical emissions, temperature, and relative humidity.

Monthly absenteeism data were also obtained for teachers and students at the two schools, teacher data covering a period of five years and student data covering a period of ten years, as well as data covering six month and twelve month periods following installation of the windows.

Staff and student interview/questionnaire data were processed through SAS univariate, frequency and chi square programs (2) to compute descriptive statistics (means and standard deviations), frequencies, and the statistical significances of discrepancies of frequencies between the schools, pre- and post-test, as well as comparisons of the experimental school pre- and post-test versus the control school pre- and post-test. It was the latter phase of the analysis which helped to elucidate the major research questions.

RESULTS AND DISCUSSION

Although some changes were in a positive direction, the results of the study showed fewer effects than were expected in terms of changed attitudes toward the building in which opening windows were added. Students' perceptions improved from pre-test to post-test. In Post-test Two (conducted 18 months after the installation of the windows), they remained constant, with approximately 68 percent giving a positive air quality rating, contrasted with more negative ratings at the control school. Teachers' perceptions also improved from the pre-test to Post-test One; however, their general rating of the school environment increased in negative or problematic directions between Post-test One and Post-test Two, despite more than half noting that the windows were among the features of the building that they liked best. In the control school, both staff and students remained less satisfied with the physical environment of their building and staff dissatisfaction increased in the second post-test.

Staff and students in both schools continued to report illness which they attributed to their buildings, but in the experimental school, the decline was greater in teachers' attributions of student illness to the school building after the windows were installed. Although

students' reports of illness increased sharply from pre-test to post-test, fewer than 20 percent attributed their illness to the building. In the control school where students consistently reported feeling more ill than in the experimental school, attributions to the building environment were higher but still below 20 percent. Teachers' reports about their own health remained relatively constant pre- and post-test in the experimental school, with an increase being reported in the control school between Post-test One and Post-test Two. In the experimental school, teachers' attributions of the cause of their own illnesses to the building declined after the windows were installed; however, results in the second post-test were equivalent to the pre-test level. In terms of attribution, staff attitudes in the experimental and control schools were nearer to each other in the second post-test.

The addition of openable windows had no physically measurable effect on indoor air quality in the experimental school. An analysis of air quality in both schools indicated that in many sample sites, temperature, relative humidity, and microorganism levels exceeded comfort levels. In terms of health, all of the parameters measured were well below levels considered to be hazardous.

No meaningful relationship was demonstrated in either school between measured air quality (as represented by carbon dioxide levels) and perceived air quality (as asked in the question, "Do you think the air quality in your working area is Very Good, Good, Okay, or Very Poor?").

Absenteeism rates among staff and students at both schools showed a continuing decline from the previous 10-year average, with little probability that installation of windows affected absenteeism, and with little relationship indicated between perceived air quality ratings and absenteeism. It is also noteworthy that teachers' perceptions of their own health and that of their students did not appear to relate to rates of recorded absenteeism.

CONCLUSIONS AND RECOMMENDATIONS

The installation of openable windows improved the political situation at the experimental school for the time being; however, it did not solve the problems perceived by the 40 to 50 percent of teachers who maintained that the building was responsible for staff and student illness. In short, it did not solve the problem of people's being disaffected with the building in which they work.

The results of the study indicate that the psychological aspects of the problem were not fully satisfied.

This study, like subsequent studies in other schools, provides a strong case for using a total building performance approach (3) when diagnosing building environment problems and in routine operation and maintenance of all school buildings. This means looking at a building with a broader perspective than air testing alone can offer and involves an analysis of the physical, structural, mechanical, social, cultural, and psychological elements within the school environment.

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