

## Planning For A School Building Renovation

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### ABSTRACT

*Many school systems in the United States face the prospect of renovating existing buildings rather than constructing new facilities because of budgetary limitations and constraints. The least disruption to the educational process when a building is scheduled for renovation is to move the student body to a vacant building. This option is not available to the vast majority of school systems and the student body must remain in the building while the renovation takes place. Students are moved from space to space in the building as renovation takes place. Obviously the renovation process is a disruption to the educational process. Some research substantiates this assertion (Maxwell, 1996). She found that the student achievement scores dropped during the period of renovation in both the third and sixth grade mathematics and reading scores. The student scores increased when the students returned to newly renovated buildings. There is some recent research, however, that indicates student performance during the renovation process is not as disrupted as previously thought. Mayo (2010), Norman (2014), and Thompson (2014) investigated the influence a renovation had upon student achievement while enrolled in a building during a renovation. They compared student scores during three time periods – pre-renovation, during the renovation and post renovation. All of the researchers found there was no significant difference in student scores during all three phases of the renovation process. Additional research (Wheeler, 2014) suggests that teachers may be doing something to keep student performance at a high level during a disruption of the educational program. In Wheeler’s study of teacher reaction to such a disruption, teachers suggested that close collaboration, focusing upon the necessary elements of the curriculum, increased use of technology, and collaboration of faculty to provide resources for alternative activities in the classroom might help keep students on task and perform better. Such activities on the part of the faculty might ease the disruption of a renovation and maintain student progress.*

### INTRODUCTION

School systems throughout the United States face the need to renovate existing buildings that have reached the age when improvements to the building are needed. The National Center for Educational Statistics (NCES) estimated that 53% of all school buildings in the country need major repairs, renovation, or modernization (Alexander & Lewis, 2014). This includes the renovation of the major systems of the school building such as HVAC, Lighting, Electrical, and Plumbing systems. Improvements in all of these systems are normally included in a renovation or modernization project.

The NCES also stated that the average number of years since the construction of the main instructional building in the local school system is 44 years (Alexander & Lewis, 2014). This means that many of the school buildings are in that stage of life where major improvements are needed. During the lifetime of these buildings many have not had a major renovation, which makes these buildings more of a concern to educators.

Even as school buildings age, the buildings apparently serve a vibrant community containing a significant student population. Thus these schools are needed in the community to accommodate the student population. The alternative of constructing new facilities or finding different educational spaces is apparently not open to school authorities.

In addition, the condition of these school buildings is such that they need some sort of renovation or modernization. A school building that is of this age would most certainly be a prime example of a building in need of major improvement. Aging schools normally do not contain the building elements necessary for a proper learning physical environment to serve today’s students (Earthman, 2013). Or if they do have such elements they are in need of modernization to bring these elements up to current standards.

The financial burden of improving schools that are in need of renovation or modernization is estimated to be approximately \$197 billion dollars (Alexander & Lewis, 2014). This amount is calculated in 2013 dollars. By the time such improvements could be planned, designed, and constructed, the amount could be much larger than the original estimate.

Local and state budgetary constraints and debt limits have curtailed the construction of new facilities in many localities. These constraints and the aging of existing buildings create problems in housing students in adequate facilities. In response to these needs, local school systems have engaged in more renovation projects in the last few decades than in previous periods of time (Abrahamson, 2014).

The ideal situation during a renovation project for an existing building would be to move the student population to a different building that is vacant. Moving the students would provide for the least disruption of the learning process and the least exposure of students to the hazards of construction (Earthman & Draeger, 2001). Many

times, however, the renovation process must take place when students are still housed in the existing facilities because there is no vacant place to put students while the building is being renovated. Thus, students are subjected to the disturbances of not only movement, but of noise, dust and in some cases un-wanted interaction with construction workers. The renovation process thus creates a considerable disturbance to both the educational program and the learning process in which students engage.

In most situations students must still occupy the building while a major renovation of a school building proceeds. This means that student classes are moved, perhaps more than once to parts of the building that are not being renovated or where renovation has been completed. This necessitates the movement of students throughout the building to vacate spaces so that workers can proceed with the renovation. Such movement of large sections of students serves to disrupt the educational process. The constant shift of students creates a less than desirable learning environment (Earthman & Draeger, 2001).

## **RESEARCH ON RENOVATIONS**

The renovation process does have an influence upon the student body of the school, but in what manner does the renovation process influence students? The question then becomes whether or not the renovation process has an influence upon student performance. The research dealing with the process of renovating school buildings is very limited. What few studies that are known deal with the relationship between a renovated school building and student achievement. The most cited work to date was completed by Maxwell in the state of New York (1996). More recently three studies dealing with the possible influence a renovation process has upon student achievement were completed. The first of these studies was completed by Mayo in 2012 in middle schools of Virginia. This study was followed by two replications of his study. One was completed in the elementary schools (Norman, 2014) and the final study was on the high school level (Thompson, 2014). It is unusual to find studies that are closely related that expand the level of knowledge to the three nominal levels of education in this country. Therefore, it seems very appropriate to examine the findings of these studies, especially when the findings of the three studies are basically the same. This kind of replication adds considerably to the knowledge base concerning the possible influence school buildings have upon the users of the buildings.

A major concern of educators is how much disturbance the renovation process will have on the learning of students and what can be employed to minimize any interruption in learning. Research has been conducted to provide some insight to educators regarding the influence the renovation process will have upon student learning. There is some early research that suggests that the renovation disruption might diminish student learning during the renovation process (Maxwell, 1996).

Maxwell investigated the possible influence the renovation process might have upon student learning (1996). She completed a case study of three elementary schools in the Syracuse Public Schools to determine the influence a renovation project might have on student achievement scores while the students are in the building being renovated. During the period of the renovation, student scores in mathematics and reading dropped, but returned to previous levels upon completion of the renovation. The decrease in student scores was not statistically significant, but there was a clear trend in the direction of decreasing student scores. This led her to surmise that "Subjecting students and teachers to the noise and confusion of a building undergoing major renovation may result in decreased student academic performance."(p. 9)

### ***Recent Research***

Recent research seems to indicate that student learning may not diminish during the renovation process (Mayo, 2012 Norman, 2014; Thompson, 2014). These researchers investigated the possibility that an interrupted physical environment might have a negative influence upon student learning. In these studies student performance on standardized academic tests during the pre-renovation, the renovation, and post-renovation periods was used to determine influence. In all three studies, the researcher did not find a significant difference in student scores during the three periods of assessment when compared to the state average student scores.

Mayo (2010) investigated this relationship with students in the middle schools of Virginia. He identified 10 school buildings that had a complete renovation of the four major building systems – Thermal control, Lighting, Acoustical control, and Plumbing (p. 46). He used the student scores in reading and mathematics as dependent variables to represent achievement. Mayo had to use the student scores of different student populations over the years of the renovation process in order to have a measure during the three periods of the renovation. To control for the possibility of a different population for each of the phases of the renovation, he compared the percent of minority students and the percentage of low income students in each of the various student populations. In addition, he controlled for the quality of teaching staff in the school over the period of time by comparing the percentage of highly qualified teachers in each school (p. 70). He found that the three demographic variables did not significantly differ over the years of the

renovation. He then assumed that the various student populations occupying the school during the renovation were similar and felt confident in comparing the means of student scores over the period of the renovation (p.70).

Mayo (2010) used a 1 X 3 ANOVA to determine if a significant difference in student scores existed over the period of the renovation. He compared the student scores in reading and mathematics over the pre-renovation, the renovation, and post-renovation periods and could not find a significant difference in the scores at the .05 level of confidence (p. 70). He further compared the scores of the students in the 10 renovated school buildings to the state means of scores during the period of time of the renovation. This was done to determine if there was a variance between the relationship of the school student scores and the average of the state student scores. He found no significant difference between the school and state student scores indicating a constant relationship over the renovation period (p.73).

Mayo (2010) concluded that there was no significant difference between student achievement scores when compared over the three periods of a renovation process. However, he also stated that a statistical difference was found in the student scores in reading between the pre-renovation period and the post-renovation period indicating that students in the newly renovated school performed better than before the renovation.

### ***Elementary School Research***

Norman (2014) replicated the Mayo study with students on the elementary school level with 15 school buildings that had a complete renovation. She used the same three demographic variables that Mayo used to determine if the composition of the different classes was basically the same. She found no differences in the percentage of minority students, low-income students, or the quality of the teaching faculty. The assumption was made that while her student populations were different, they were demographically similar. She used the same statistical analysis that Mayo used to determine if there was a difference in student scores in reading and mathematics over the period of the renovation of the building (p. 57). An ANOVA was used to determine if there was any difference. She could not find any difference in student scores at the .05 level of confidence. These findings were similar to those that Mayo (2010) found and reported.

When Norman compared the student scores involved in the renovation to the mean scores of students on the statewide level, she did not find any statistical difference. The relationship between student scores and the state means of student scores did not vary over the period of the renovation indicating a comparative stability.

One interesting finding that Norman (2014) expressed had to do with the difference in pre-renovation and post-renovation scores in mathematics and reading. She observed that when comparing the pre and post renovation scores in mathematics there was a 5.17% increase in student scores, whereas there was a decrease of 5.73% in the reading scores (p.73). She stated that perhaps there were other variables involved that could account for this difference in student scores. She observed that, "...other variables dealing with the specific instruction of mathematics content were involved. Variables such as the use of research based instructional strategies, backwards planning, and quality lesson design, and the nurturing environment of school."(p. 73) She suggested that these practices might help to explain this difference.

### ***High School Research***

Thompson (2014) completed a replication of the Mayo study on the high school level. He used the 11<sup>th</sup> grade student scores in Algebra I and reading as measures of student achievement. He also used the same demographic variables of percentage of minorities, percentage of low-income students and the quality of the teaching faculty to compare the student population composition. In the case of the demographic variables, he found no significant difference in the composition of the various student populations during the renovation process indicating that the composition of the various student populations remained the same over the renovation process.

Thompson used an ANOVA to compare student Algebra I and reading scores during the three stages of a renovation. He found no statistical difference in student scores, indicating that student scores remained stable during the three renovation process. This would suggest that the disruption of a renovation process while students were in the building would not influence student achievement. He also compared the student scores to the statewide means of student scores to determine if there was any difference in the relationship between the two scores. He found that there was no significant difference in relationship over the period of the renovation. These findings confirmed what Mayo 1996) and Norman (2014) found in their analyses.

Thompson (2014) reported an increase in the student scores in the Algebra I assessment in the post-renovation phase compared to the student scores in the pre-renovation assessment. This increase amounted to 8.35 points. This is reflective of what Norman found in her comparison of mathematics student scores and lends credence to the suggestion that teachers might have employed improved teaching strategies in mathematics and Algebra I that resulted in improved student performance.

The findings of these three studies seem to indicate that the renovation process may not have as much of an influence upon student achievement as Maxwell (1996) had suggested in her findings. The disruption of the daily schedule in the school may not be as pervasive as previously thought. The findings of these studies conducted on all levels of education are compelling evidence that students and teachers are able to successfully survive the unpleasantness of a renovation process.

### ***Mediating A Renovation***

Such findings as reported in these studies help school authorities in planning for a renovation. The research informs authorities that the renovation process might not have the negative influence upon student learning that has been perceived. Further there is some research that indicates what teachers can do to minimize the influence a different and disturbing environment might have upon student learning (Wheeler, 2014).

Wheeler (2014) investigated the disruption of the learning environment when moving students from a modern school building into an antiquated school facility. A middle school student body was moved from a modern middle school building to an outdated high school building to accommodate a displaced high school student body. For three years, the middle school population was housed in a school building that had been vacated several years previously because it was deemed inadequate to support a modern high school program. During that time, students were taught in classrooms and laboratories that were over 50 years old and were designed for a high school program of that time rather than a modern middle school program.

It might be expected that the student achievement assessment outcomes should have decreased during that period of time that students were housed in inadequate learning spaces. Such was not the case. The students in the middle school performed just as well on standard assessments as they had performed before the move and also after they were returned to the modern middle school building. Acknowledging this student phenomenon of maintained performance in adverse building conditions, Wheeler investigated the possibility that perhaps the faculty might have employed different or new teaching strategies to produce the student outcome.

He developed a survey instrument designed to query the teaching faculty about their classroom activities during the three year period in the inadequate facilities. The instrument generated both quantitative and qualitative data to permit the teachers to express themselves about their activities. Wheeler asked the teachers to enumerate their activities relating to classroom instruction and any out of classroom activities in which they participated that were different from previous years while in a modern facility.

Although a disruption of this sort does not emulate a renovation process, it does resemble the type of displacement students experience in a renovation process. Student felt the same type of displacement in both situations. In all of the research studies included here there was a problem of adequate space, but in the renovations students and teachers have to contend with the constant noise of construction. Disrupting noise in the classroom is very detrimental to student learning. Nevertheless, the findings of the Wheeler (2014) study do give educators some remedies that can be used to modify the influence a renovation might have upon student learning. Wheeler found that the faculty can do some things that will help student go through a disruption in the educational program.

### ***Other Research Findings***

Wheeler (2014) found that teachers expressed themselves as being able to stress a cooperative spirit among faculty members, students, administrators, and community members. The spirit of cooperation was found throughout the faculty members and they felt that everyone wanted to cooperate with them and to help them. This seemed to unite the faculty in a willingness to overcome any difficulties they might face. A cooperative spirit also permeated the student body. The principal even reported a decline in disciplinary incidents over the three year period. This same spirit of cooperation and collaboration might well have been in place during the renovations investigated in previous studies.

The faculty reported that throughout the years they concentrated on the essential parts of the curriculum and provided for individualized instruction of students to insure student satisfactory progress. The teachers apparently realized that they would have to overcome some inadequate measures such as limited physical space, limited instructional space because of bussing students in and out of a different community, and out-of-date classroom amenities. They stated that by concentrating on the essential elements of the curriculum and giving individual instruction where needed, they would best serve the students' needs. Teachers also commented that more technology was available to them, and that they utilized that technology better while in adverse facilities.

Wheeler (2014) reported five major findings from the survey instrument that perhaps helped the students to succeed in their academic progress over the years. The first was that instructional content was condensed, focusing on the necessary content related to the Standards of Learning assessment of the state. Second, teachers were able to put technology to better use than before, and that seemed to assist students in their studies. Teachers reported a closer collaboration among the faculty during the time in the old building than in previous years. The teachers reported that the

more cooperative spirit among the faculty helped them greatly. Teachers seemed to feel that everyone was cooperating with them, especially the central administration personnel and the members of the community. This resulted in a greater sense of community among all segments of the school population.

The overall finding in Wheeler (2014) was that an increased effort on the part of the teachers to design lessons that concentrated on the necessary components of the curriculum and a modification of classroom activities as a result of limited space helped the students maintain a high level of performance. In addition, the availability and use of additional technology enabled the teachers to keep students on task and achieve better on statewide assessments (p. 69). These are most certainly sound prescriptions that teachers can put to use to perform more effectively and for students to improve their learning, especially under adverse building conditions such as the renovation of a school building.

## DISCUSSION

Although Mayo (2012), Norman (2014), and Thompson (2014) did not find that the renovation process impaired student test results, one should not assume that the renovation process does not have any influence upon students and teachers. The process of renovation of a school building does have an influence upon students and teachers in several different ways that these researchers did not attempt to take into consideration. The work of these researchers endeavored to examine how the process of a complete renovation influenced student achievement, and the only way that this could be done was by examining the test scores of several student bodies. In their studies these researchers controlled for possible changes in the student population to endeavor to seek a comparable student population. In each of these comparisons of student scores to state student scores, there was no significant difference for each student population. This indicated that the renovation process did not have as much influence as it was thought to have. In essence the renovation process and all that entails does not seem to have as much influence upon student scores as assumed. Perhaps examination of a student body that undergoes a renovation process for several years, which is not uncommon, might produce different results.

While teachers through extraordinary efforts might help ameliorate the difficulties of a renovation process, they are not capable of completely reversing the unsettling results of a major building change on student achievement. One might assume from Wheeler's work (2014) that teachers can make up the difference poor building conditions effect upon students, but this would be a wrong assumption. Moving a student body into an old building after being in a modern building is different than being housed in a school building during a renovation.

Repeated research has demonstrated that poor building conditions have a negative influence upon student achievement (Edwards, 1992; Cash, 1993; Earthman, Cash, & Van Berkum, 1995; Hines, 1996; Lanham, 1999; Crook, 2000; Bullock, 2007; O'Sullivan, 2006; Fuselier, 2008). A renovation process is different than a building in poor condition. Each of the researchers cited above explicitly state the difference between the two in their studies. A renovation is a process that can be observed, and perhaps its influence upon users of the building can be measured. A school building in poor condition is quite another matter, and the influence poor building conditions have upon student performance is well documented. The Mayo (2012), Norman (2014), and Thompson (2014) studies measured the influence the renovation process had upon successive student populations.

## CONCLUSION

Renovation of a school building while students occupy the structure presents problems for school authorities. Students are subject to the disruption of the educational program and the noise and confusion of the actual construction process. In addition, there is always the possibility of physical danger to students. School authorities must plan carefully for a renovation to reduce these possibilities as much as possible. There is also the disruption of moving students from one part of the building to another to accommodate construction work. This leads to a possible disruption of the learning process or at least compromises in how students learn.

Equipped with the knowledge that the renovation process might not have as much of an adverse influence upon students as previously thought, plus the knowledge that the faculty can do much to ease the stress and disruption of the renovation process, school authorities can plan a renovation of an existing building with confidence that potentially adverse effects on student learning can be ameliorated with effective planning and teacher performance.

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