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UNIVERSITY OF NORTHERN COLORADO

Greeley, Colorado

The Graduate School

THE RELATIONSHIP BETWEEN THE CONDITION OF COLORADO ELEMENTARY SCHOOL FACILITIES AND STUDENT ACHIEVEMENT

A Dissertation Submitted in Partial Fulfillment
Of the Requirements for the Degree of
Doctor of Education

Edward Bernard Brooks

College of Education and Behavioral Sciences
Department of Leadership, Policy and Development:
Higher Education and P-12 Education
Educational Leadership and Policy Studies

August 2015

This Dissertation by: Edward Bernard Brooks

Entitled: *The Relationship Between the Condition of Colorado Elementary School Facilities and Student Achievement*

has been approved as meeting the requirements for the Degree of Doctor of Education in College of Education and Behavioral Sciences in Department of Leadership, Policy and Development: Higher Education and P-12 Education, Program of Educational Leadership and Policy Studies

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ABSTRACT

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Research has shown conflicting results in the study of the relationship between student achievement and school facility condition. Much of the research has focused on specific aspects of the school facility or included the completion of surveys by school personnel. This study included a focus on the overall condition of school facilities according to the Facilities Conditions Index (FCI) as indicated in the Colorado Statewide Financial Assistance Priority Assessment conducted under the direction of the Colorado Department of Education (CDE) in fiscal year 2009-2010. The FCI was used as the independent variable while student achievement on the Colorado Student Assessment Program (CSAP) was used as the dependent variable. Hierarchical multiple regression (HMR) analyses were conducted to investigate the relationship between student achievement on the CSAP in reading, writing, and math and school facility conditions according to the FCI while controlling for English Language Learner (ELL), Special Education (SPED), and Free and Reduced Lunch (FRL) populations. Due to suggestions of multicollinearity between the control variables of ELL and FRL as well as minimal R^2 change values following the addition of the FCI into the models in the original analyses; 21 additional analyses were conducted which included control variable variations as well as simple bivariate or zero-order correlations. Consequently, 24 analyses were ran.

The results of the three Hierarchical multiple regression (HMR) analyses in reading, writing, and math which addressed the original research questions indicated that one would fail to reject the null hypotheses and indicated that there is no relationship between student achievement on the Colorado Student Assessment Program (CSAP) and the Facilities Conditions Index (FCI) when controlling for English Language Learner (ELL), Special Education (SPED), and Free and Reduced Lunch (FRL) populations. These analyses found ELL, SPED, and FRL to be significant in explaining the variance in CSAP scores while the FCI was found not to be significant. The correlations between student achievement and ELL and FRL populations were strong while the correlations with SPED and the FCI were weak. Although weak, correlations revealed that greater percentages of students scoring proficient or advanced on the CSAP were associated with lower FCI indices or better facility conditions. Better student performance on the CSAP was also associated with lower percentages of ELL, SPED, and FRL populations. The correlations also revealed that the FCI is positively correlated with ELL, SPED, and FRL populations or that poorer facility conditions are associated with greater percentages of ELL, SPED, and FRL populations. The variable of Free and Reduced Lunch (FRL) population was found to be the greatest predictor of student achievement. The multiple analyses conducted indicated that student achievement on the CSAP in traditional Colorado public elementary schools and the Facilities Conditions Index (FCI), as an indicator of school facility condition, have a weak negative relationship and exhibit little shared variance. In other words, there is little to no relationship between school facility condition and student achievement.

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INTRODUCTION

The last national study of America's school facilities occurred in1995 and reports issued since that study by the United States General Accounting Office (GAO), *Condition of America's Schools*, indicate that America's school facilities continue to deteriorate and that a comprehensive assessment of the current conditions is needed (Center for Green Schools, 2013, p. 4). In a letter to congress dated January 14, 2013, the Center for Green Schools at the United States Green Building Council (USGBC) called for an updated survey on the condition of America's school facilities (Center for Green Schools, 2013, p. 4). Although, the condition of the school facility is important, buildings should also be safe, healthy, educationally appropriate, and environmentally sustainable (Center for Green Schools, 2013, p. 8). Earthman and Lemasters (1996) conducted a review of research pertaining to the relationship between school facilities, student achievement, and student behavior. Much of the research that has been conducted relating to aspects of school facility condition and student achievement and student behavior included the completion of surveys by school personnel to evaluate school facility conditions (Earthman and Lemasters, 1996, p. 11). Other research has focused particular aspects of the school facility such as: open-space schools, school building age, thermal factors, visual factors, color and interior painting, hearing factors, underground facilities, site size, building maintenance, and numerous other factors (Earthman and Lemasters, 1996, p. 1).

This study included a focus on the overall condition of school facilities and the relationship between student achievement as opposed to directing attention to one particular aspect of the school facility and the relationship to student achievement. The Facilities Conditions Index (FCI) as obtained through the Colorado Statewide Financial Assistance Priority Assessment in fiscal year 2009-2010 provides an indicator of overall facilities condition. The school fiscal year (FY) is defined as the 12 month school year beginning July 1 and ending June 30. The Colorado Statewide Financial Assistance Priority Assessment FY 2009-2010 did not include a study of the relationship between school facility and student achievement, but resulted in a FCI pertaining to the condition of each school facility in Colorado.

The FCI pertains only to Tier I facilities as depicted in the assessment (Colorado Department of Education [CDE], 2010, p.15). Tier I facilities include aspects of each academic facility such as school grounds, classrooms, libraries, and other teaching/learning spaces (CDE, 2010, p. 15). The FCI is a ratio of the cost of the overall facilities conditions needs over the cost to replace the entire facility (CDE, 2010, p. 5). Storage, temporary modular classrooms, and other support facilities are incorporated into Tier II (CDE, 2010, p.15). Administrative, maintenance, and transportation offices and facilities are included in Tier III (CDE, 2010, p.15). The Facilities Conditions Index (FCI) pertains only to Tier I facilities or the teaching/learning spaces evaluation and this index was used as an independent variable in this study to investigate the relationship to student achievement.

School Facility Conditions in the United States

In 2013, it was estimated that the cost to bring the nation's school facilities up to working order and in compliance with laws was approximately $271 billion (Center for Green Schools, 2013, p. 2). When considering modernization costs to meet current education, health, and safety standards, the estimate increases to approximately $542 billion (Center for Green Schools, 2013, p. 2). Although some states maintain information on school facilities, there is no national or comparable state-by-state database to provide even basic information on school facilities (Center for Green Schools, 2013, p. 2). Consequently, much of the information currently available in regard to the conditions of America's school facilities lacks extensive detail and the studies also vary in date of completion.

In the fall of 2012, nearly 50 million students attended approximately 100,000 public primary and secondary schools with an average date of construction of 1959 (Center for Green Schools, 2013, p. 6). According to the Center for Green Schools (2013), the latest report pertaining to the condition of the nation's school facilities, there is a need for more precise, detailed, and accurate information in order to direct efforts to restore, repair, and revive America's schools (p. 4). The United States General Accounting Office (GAO) last performed a comprehensive evaluation of the physical condition of the nation's school facilities in 1995 (GAO, 1995a, p. 1). The less comprehensive reports issued since the 1995 GAO report have suggested that the nation's schools are continuing to deteriorate and that a comprehensive understanding of the current conditions of America's educational facilities is needed (Center for Green Schools, 2013, p. 4).

In 2010, the National Center for Educational Statistics (NCES) reported that the 50 states and District of Columbia reported that $597.5 billion was collected for public elementary and secondary education with the states providing 87.3 percent of all revenues (NCES, 2007a, p. 3). In 2008, the 21st Century School Fund compared what school districts had spent since the 1995 study by the United States General Accounting Office (GAO) and what should have been spent to maintain school facilities in good repair (Center for Green Schools, 2013, p. 7). According to American School and University's Annual Maintenance and Operations Cost Studies for Schools and project start data obtained by McGraw-Hill Construction, estimates amounted to $211 billion for maintenance, repair, and capital renewals from 1995 to 2008, but school districts should have spent approximately $482 billion to keep existing school buildings and grounds in good repair (Center for Green Schools, 2013, p. 7). Analysis of these data from 1995 to 2004 revealed that 41% of the total project spending was for new building construction, 24% was spent on existing buildings alone, and 35% included additions and renovations to existing buildings (Center for Green Schools, 2013, p. 6).

In 1999, the National Center for Educational Statistics (NCES) surveyed a representative sample of school districts and estimated deferred maintenance needs to be $127 billion (NCES, 1999, p. iv). According to the United States General Accounting Office (GAO), in 1999, three-fourths of the nation's schools reported a need to repair, renovate, or modernize facilities in order to put them in overall good condition (NCES, 1999, p. iii.). This survey included information pertaining to the condition of different building features which included: roofs, framing, floors, foundations, exterior walls, finishes, windows, doors, interior finishes and trim, plumbing, heating, ventilation, air conditioning, electric power, electric lighting, and life safety features (NCES, 1999, p. iv.). The funding needed to restore the nation's schools in need of repair in 1999 was approximately $127 billion with an average of $2.2 million needed per school or $3,800.00 needed per student (NCES, 1999, p. iv.). Fifty percent of schools reported at least one building feature in less than adequate condition while 75% reported more than one feature in less than adequate condition (NCES, 1999, p. iv.). Urban schools were more likely to report at least one building feature in less than adequate condition (NCES, 1999, p. iv.). Those schools with the highest concentration of poverty, or with 70% or more students eligible for free or reduced lunch (FRL), were more likely to report at least one building feature in less than adequate condition (NCES, 1999, p. iv.).

The average age of school buildings in America in 1998 was 42 years (NCES, 1999, p. 1). Approximately 28% of all public schools were built before 1950, 45% were built between 1950 and 1969, 17% were built between 1970 and 1984, and 10% were built after 1985 (NCES, 1999, p. 1). Almost half of the existing school buildings in the United States were completed before 1959 (NCES, 2000, p. 6). On average, a school facility begins to deteriorate rapidly at age 40 and most schools are abandoned after 60 years (NCES, 1999, p. 1). The average age of schools in the Northeast and Central regions of the United States were older than those in the Southeast and the West as the mean age of school facilities ranged from 46 years in the Northeast and Central states to 37 years in the Southeast and West (NCES, 1999, p. 1).

According to the United States General Accounting Office (GAO), in 1995, every state in America was identified as having school buildings in substandard condition

(GAO, 1995a, p. 3). The National Center for Educational Statistics affirmed that students in America attend school in buildings that threaten their health, safety, and learning opportunities, particularly in urban and high-poverty areas (NCES, 1999, p. 1). It was estimated that over half of the nation's schools needed at least one or more major building components or features extensively repaired (GAO, 1995a, p. 2). The United States General Accounting Office (GAO) determined that approximately two-thirds of America's school buildings were in at least overall adequate condition and, at most, were in need of only some preventive maintenance or corrective repair (GAO, 1995a, p. 2). Conversely, the 14 million students in the remaining one-third attended schools in need of extensive maintenance or replacement of one or more buildings (GAO 1995a, p. 2). The United States General Accounting Office (GAO) report in 1995 indicated that $112 billion was needed to bring the nation's schools into good repair and eliminate deferred maintenance (GAO, 1995a, p. 2). However, the GAO study in 1995 did not include the cost of any new construction due to enrollment growth or modernization for educational purposes (Center for Green Schools, 2013, p. 7). School facility designs and mechanisms may have an effect on student learning and academic outcomes (Earthman, 2002, p. 1). Educational leaders are concerned about school facilities as research has shown the possible correlation between the condition of school facilities and student achievement (Buckley, Schneider, & Shang, 2004, p. 3).

School Facility Conditions in Colorado

In 2004, the Donnell-Kay Foundation, launched an assessment of Colorado's school conditions. Estimates depicting the state-wide facilities needs at the time were between $5.7 to $10 billion (Colorado's Crumbling Classrooms, n.d., p. 1). Estimates since the 2004 report, depict an increasing need to improve the condition of Colorado's schools. According to the Statewide Financial Assistance Priority Assessment, completed in FY 2009-2010, Colorado's 178 school districts, 149 charter schools, 21 Boards of Cooperative Education Services, and the Colorado School for the Deaf and Blind are coping with aging facilities and initiatives that envision the revolving relationship between school facilities and student performance (Colorado Department of Education [CDE], 2010, p. 15). Results pertaining to the age of Colorado's facilities are displayed in Figure 1.

Figure 1

Colorado Tier I Facilities in Comparison to NCES Statistics

School Characteristics	Colorado Tier 1	NCES
Average Age in years	40	42
Median Date Built	1971	NA
Built before 1950	15.59%	28.00%
Built between 1950 and 1969	32.66%	45.00%
Built between 1970 and 1984	20.51%	17.00%
Built after 1985	31.24%	10.00%
Potential historic significance (50 years or older)	575	NA

Retrieved from: Statewide Financial Assistance Priority Assessment FY 2009-2010 (CDE, 2010, p. 16)

The average age of Colorado's school facilities was 40 years. As stated by the National Center for Educational Statistics (NCES), a school facility begins to deteriorate rapidly at age 40 and most schools are abandoned after 60 years (NCES, 1999, p. 1). The figure also shows that at least 15.59% of Colorado's schools were built before 1950. Additionally, the 575 schools with potential historical significance will be 60 years old in approximately 6 years as this study was completed in December of 2009.

Figure 2

Colorado Tier I Estimated Maintenance Needs for Current Period (2010-2013)

	Estimate
Tier 1 Current Period Needs (2010–2013)	
Tier 1 Condition Deferred Maintenance Needs	$9,352,051,375
Tier 1 Facility Condition Index (FCI)%:	30.10%
Tier 1 Suitability Needs	$4,537,669,700
Tier 1 Energy Audit Needs	$19,143,749
Total Tier 1 Current Period Needs	**$13,908,864,824**
Tier 1 Current Replacement Value (CRV):	$31,076,797,387
Tier 1 Colorado Facility Index (CFI)%	44.80%

Notes:

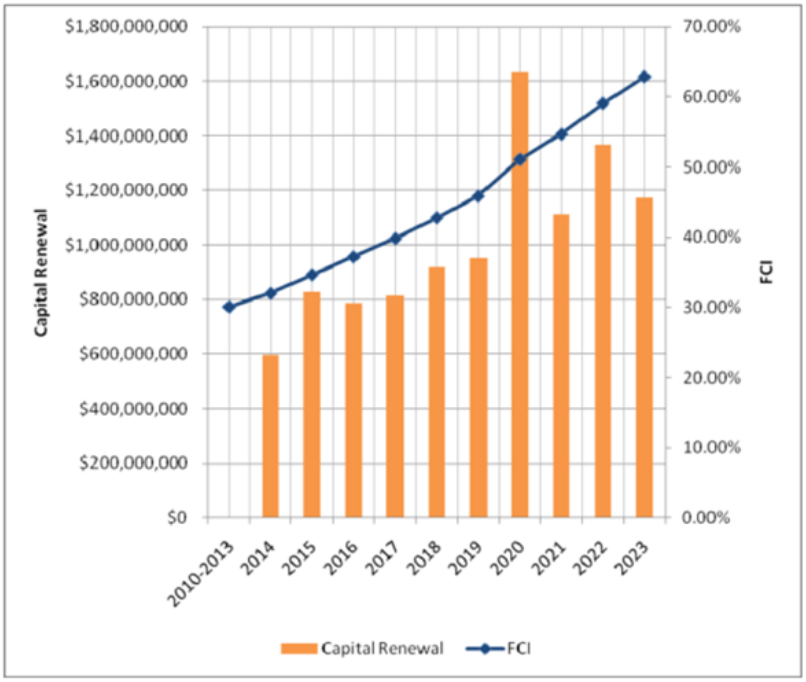
1. Condition needs reflect order-of-magnitude estimates as of FY 2010 for condition deferred maintenance needs, plus predicted condition capital renewal for Current Period (2010–2013).
2. Suitability needs represent order-of-magnitude estimates for needs associated with the suitability of a school's spaces for its academic program—elementary, middle, high school—based on the Guidelines.
3. Energy Audit needs represent order-of-magnitude estimates for detailed energy audits for schools that used more than the average Energy Utilization Index (EUI) of 87 KBtu per square foot per year[15].

Retrieved from: Statewide Financial Assistance Priority Assessment FY 2009-2010 (CDE, 2010, p. 17)

Displayed in Figure 2 is a summary of Tier I estimates for Current Period (2010-2013) facility condition deferred maintenance, suitability, and energy audit needs (excluding condition capital renewal needs beyond 2013. Substantial current period (2010-2013) estimated school facilities needs in Colorado are also displayed. Colorado needs to immediately invest almost $14 billion in order to bring the state's school facilities up to standard according to Figure 2.

Figure 3

Colorado Conditions Capitol Renewal Needs Forecast



Retrieved from: Statewide Financial Assistance Priority Assessment FY 2009-2010 (CDE, 2010, p. 20)

The Conditions Capitol Renewal Needs Forecast are displayed in Figure 3. The forecast period (2014 to 2018) depicts future facility and site improvement depreciation (CDE, 2010, p. 26). The blue line shows an increase in the Facilities Conditions Index (FCI) of 30.10% during the current period (2010-2013) to an FCI of 62.87% by 2023, should the capital renewal needs and the current $9.35 billion not be funded (CDE, 2010, p. 26).

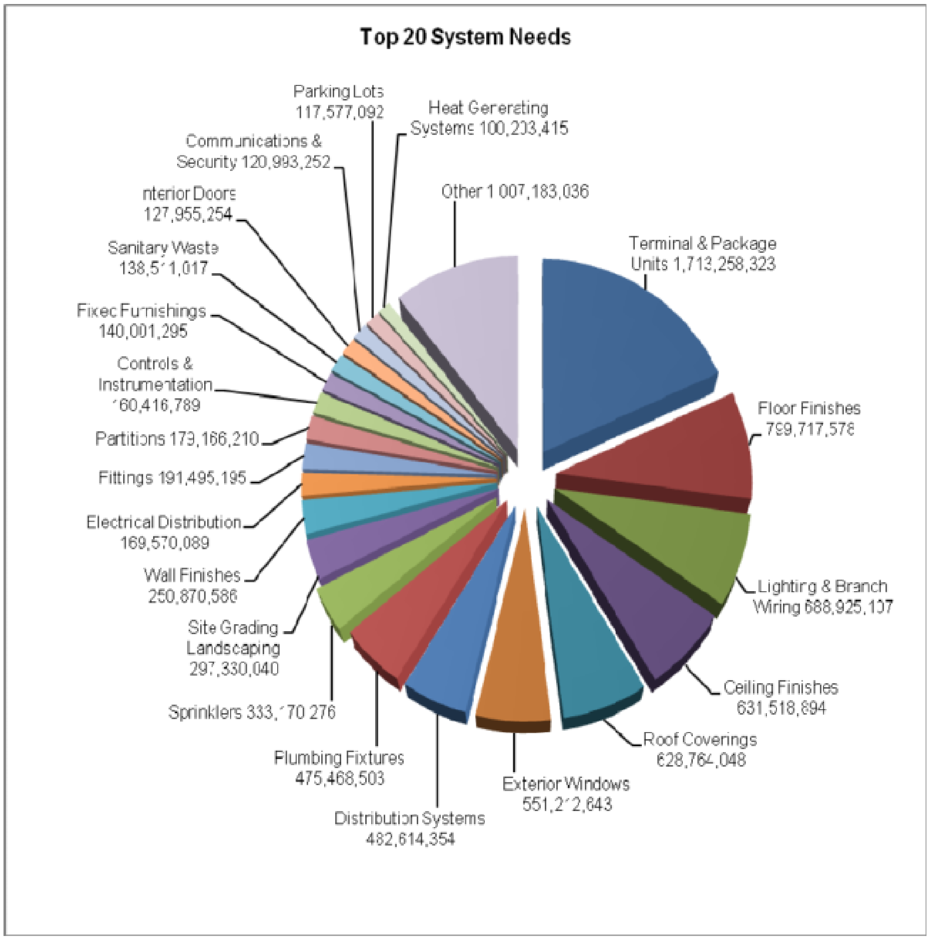
In 2009, Colorado was ranked 35th in educational funding, received a "D" rating and was noted as regressive in education funding distribution (Baker, Sciarra, & Farrie, 2012, p. 12). The state also received an "F" rating in educational funding effort based on the state's gross domestic product (Baker et al., 2012, p. 14). The Building Excellent

Schools Today (BEST) Act of 2008 in Colorado resulted in the creation of the Public School Capital Construction Assistance Board (CCAB) and the Division of Public School Capital Construction Assistance to address concerns pertaining to school facilities in Colorado. The CCAB was formed to address health and safety concerns in public school facilities and to maximize student achievement with a primary goal of ensuring sufficiency in condition and capacity in order to provide a safe environment favorable to learning (CDE, 2010, p. 6). The CCAB strives to provide the most equitable, efficient, and effective use of state revenues through appraisals for repair and construction and by providing expert recommendations based on objective criteria to the State Board (CDE, 2010, p. 6). The Division of Public School Capital Construction Assistance offers support to the CCAB, as the CCAB exercises its powers and duties specified in the BEST Act (CDE, 2010, p. 6). Addressing school facility condition is critical in meeting the Colorado Department of Education's *Forward Thinking* strategic plan (CDE, 2010, p. 15). The urgency and need to address school facility condition needs in Colorado is evident and, given research associating school facility needs to student performance, it would be wise to address these concerns.

The criteria and estimated costs associated with the evaluation of Colorado's school facilities (excluding suitability and energy audit needs) by facility system are shown in Figure 4. The pie chart shown in Figure 4 depicts estimates for the top 20 Tier 1 conditions needs in Colorado by facility system for the current period (2010-2013) to be $9,352,051,375 (CDE, 2010, p. 20). These costs represent the needs at the time of this study.

Figure 4

Top 20 Tier I Condition Needs by Facility System for the Current Period (2010-2013).



Retrieved from: Statewide Financial Assistance Priority Assessment FY 2009-2010 (CDE, 2010, p. 20)

Factors That May be Associated with Student Achievement

Factors that define social class inevitably influence the ability for a child to learn and may include financial assets, child rearing practices, health needs, English language acquisition, and student mobility (Rothstein, 2004, p. 40). However, these factors are out of the school's control once the student exits the educational facility at the end of the day. Teachers are the key to student achievement through instructional strategies, classroom management, and curriculum design (Bafumo, 2005, p. 8). Administrators may influence student achievement through the facilitation of data-driven instruction and the influence they may have on the morale of staff and the culture of the school (MacNeil, Prater, & Busch 2009, p. 82). When principals assist in creating a school climate that increases a focus on goals and creates structures that support adaptation, the environment will more effectively enhance student learning (MacNeil, Prater, & Busch, 2009, p. 82).

According to Rothstein (1993), where funding has not been equalized, students continue to attend dilapidated schools without adequately paid teachers or necessary equipment (p. 31). This supports the notion that, all too often, school districts with more-costly-to-educate students have lower property tax bases (Ladd, Chalk, & Hansen, 1999, p. 1). The research in this study was conducted in order to investigate the relationship between student achievement and facilities condition using the Facilities Conditions Index (FCI), an indicator of overall facilities condition, as the independent predictor variable.

Lack of Consensus regarding School Facilities and the Affect on Student Achievement

Conventional wisdom would suggest that the condition of school facilities has an effect on student learning, but researchers have had trouble demonstrating a statistically significant correlation (Odden & Picus, 2008, p. 174). There are no conclusive findings as to whether school buildings affect student achievement despite the several hundred that have been performed (Odden & Picus, 2008, p. 174). A great number of the studies were based on the open schools movement in the 1970s and no longer apply to today's schools while others have major methodological flaws and have produced conflicting and ambiguous results (Odden & Picus, 2008, p. 174). Studies that have been completed thus far have only controlled for a small fraction of all of the great many factors that could influence student achievement in addition to the age of the school facilities (Odden & Picus, 2008, p. 175). These factors may include: building renovations, teacher credentials, students on free-and-reduced lunch, single-parent families, school size, length of school day, and host of other factors (Odden & Picus, 2008, p. 175).

In a review of over 230 studies pertaining to the relationship between school facilities and student achievement, Earthman and Lemasters (1996) concluded that it was difficult to determine any definite line of consistent findings (p. 3). Some of the researchers stated that the building has such an insignificant influence upon the user that whatever effect is evident is simply due to chance, but others contended that the built environment does have a marked influence upon the process of teaching and learning (Earthman & Lemasters, 1996, p. 1). The research affirmed that building occupants are influenced both positively and negatively by how the built environment either allows them to function or inhibits the process of teaching and learning (Earthman & Lemasters, 1996, p.1). Systematic analysis of whether building condition has an effect on student achievement on a large enough scale to generalize or predict has not been undertaken (Earthman & Lemasters, 1996, p. 1).

Purpose: School Facility Conditions and Student Achievement

The United States is increasingly characterized as falling behind in education and losing its competitive edge when compared to other nations (Baker et al., 2012, p. 1). Educators, school board members, civil rights organizations, parent groups, state and federal elected officials, business leaders, and concerned citizens deliberate, adopt, and implement various policies, strategies, and "reforms" in an effort to boost outcomes for students, particularly those in areas of low socioeconomic status (Baker et al., 2012, p. 1). Educational reform initiatives have focused on raising standards, student assessment with a goal of closing the achievement gap, preparing students for workforce and college readiness, engaged citizenship, and participation in the economy (Baker et al., 2012, p. 1).

Research has repeatedly shown a difference ranging from 5 to 17 percentile points in the achievement of students that attend schools of varying building condition in when controlling for socioeconomic status (Earthman, 2002, p. 3). Additionally, ethnographic and perception studies indicate that poor school facilities negatively influence teacher effectiveness and performance, and therefore negatively influence student performance (Earthman, 2002, p. 3). Although research, as of yet, has failed to measure the exact link between student achievement and funding, there has been a consistent belief that schools must not be underfunded to avoid destructive economic and social consequences (Thompson, Wood, & Crampton, 2008, p. 53). Some reformers argued that schools distribute economic and social opportunity and that equal opportunity is dependent upon the quality of schools (Thompson et al., 2008, p. 53).

One of the most recent school reform initiatives in Colorado is *The Educator Effectiveness Act*, signed into law in 2010. There are many aspects of the act, but the most compelling component is that the law requires that at least 50 percent of all teachers and principals be evaluated on the academic growth of students (CDE, 2010, n.d.[h], p. 7). Much emphasis has been placed upon student achievement. Considering that research has shown a correlation between school facilities and academic achievement, it is clearly evident that additional study is warranted in this area

(Earthman, 2002, p. 4). Numerous studies have demonstrated a positive relationship between student performance and various factors of the school facility (Earthman, 2002, p. 4). The strength of that relationship varies according to the particular study completed, but the evidence supports the premise that a school building has a measurable influence on student achievement (Earthman, 2002, p. 4).

Odden and Picus (2008) identified a lack of data pertaining to the condition of school facilities as a serious issue (p. 152). Those supporting the green school initiative are calling for more research into the effect of education facilities on student health and performance (American School & University, 2012, p. 10). According to the United States General Accounting Office (GAO), numerous and widely quoted studies conducted in recent years report that school facilities are in poor condition (GAO, 1995a, p. 3). These studies documented problems and provided much anecdotal information (GAO, 1995a, p. 3). However, they had different methodological problems limiting their usefulness (GAO, 1995a, p. 3). Further, the Department of Education has not assessed the condition of all of the nation’s school facilities since 1965 (GAO, 1995a, p. 3). Many of Colorado’s school districts are coping with aging facilities, changing educational programs, and growth in all or some of their schools (CDE, 2010, p. 15). The evolving relationship between school facilities and student performance and behavior are greatly impacting school facilities and curriculums (CDE, 2010, p. 15). Addressing school facility condition is critical in meeting the Colorado Department of Education's *Forward Thinking* strategic plan (CDE, 2010, p. 15). As the research points to the various conditions existing in America's schools and the effect upon student achievement, I believe the overall condition of the school facility to be paramount. As one who advocates for educational equity, the linking of the overall condition of Tier I facilities or learning spaces to student achievement may aid in the argument toward an acquisition of more equitable school facility conditions for all students. Given the possible link between student achievement and school facility condition, the purpose of this study was to investigate the relationship between the condition of school facilities and student achievement in Colorado.

Significance of Study

Considering that the condition of school facilities may be linked to student achievement, it is critical that school facility conditions in the nation and in Colorado are improved so that all children may have access to a quality education and learning environment. The findings obtained in this study added to abundance of research pertaining to the relationship between school facility condition and student achievement.

The Colorado Statewide Financial Assistance Priority Assessment

Parsons Commercial Technology Group was selected by Capital Construction Assistance Board (CCAB) to conduct the assessment of school facilities throughout Colorado (CDE, 2010, p. 5). Parsons is a national company specializing in school facility assessment, design, and construction management (CDE, 2010, p. 5). The assessments were completed in December 2009 resulting in the Colorado Statewide Financial Assistance Priority Assessment FY 2009-2010 report (CDE, 2010, p. 5). This study used the Facilities Conditions Index (FCI) as an independent variable. This index was calculated as a ratio of the cost to repair any building deficiencies over the Current Replacement Value (CRV) resulting in a percentage (CDE, 2010, p. 5). The CRV represents the cost to rebuild or replace the entire building in current dollars to its optimal condition under current codes and construction methods (CDE, 2010, p. 5). The greater the percentage, the greater the facilities needs or the poorer the condition of the building.

**School Facility Condition,
Student Achievement, and
Educational Funding**

Some states, such as Colorado and Wisconsin, provide resources for school facilities within the basic school support funding program (Odden & Picus, 2008, p. 169). Funding is typically provided on a per pupil basis as part of the distribution of state money to schools. Most school districts depend on general obligation bonds to pay for new facilities (Earthman, 2009, p. 26). However, not all school districts are able to obtain voter approval (Bunch & Smith, 2002, p. 1050). A result of the local responsibility and control of school funding in America is that the quality of school facility varies by the income of the communities responsible for supporting the public schools (Center for Green Schools, 2013, p. 9). The results of an analysis of school construction from 1995 to 2004 revealed the tremendous disparity in the capital investment of schools located in low income versus those in more affluent communities as the per pupil expenditure varied in high income areas versus low income from $11,500 to $4,140 (Building Educational Success Together, 2006, p. 21).

Due to disparities in property values and the ability of varying school districts to raise revenues for school facilities based on location, school facility condition varies from district to district. As a quality education is viewed as a vital element in creating jobs and restoring economic prosperity, it is important that the nation's children attend school in quality facilities. However, often left out of the debate of educational reform in the United States is the fact that having a predictable, stable, and equitable system of educational finance is of critical importance to the success of any school improvement initiative (Baker et al., 2012, p. 1). Sufficient school funding that is fairly distributed regardless of concentrated poverty is an essential foundation to an equitable school system and without it, educational reforms, cannot be achieved or sustained (Baker et al., 2012, p.1).

Research Questions

The relationship between the condition of school facilities and student achievement was the focus of this study. The specific focus was the relationship between the Facilities Conditions Index (FCI) as depicted in the Colorado Statewide Financial Priority Assessment in FY 2009-2010 for each of Colorado's traditional public elementary schools with grade 5 as the highest grade level and student achievement on the Colorado Student Assessment Program (CSAP) tests in reading, writing, and math in grades 3, 4, and 5 while controlling for total special education population (SPED), English Language Learner (ELL) population, and socioeconomic status through Free and Reduced Lunch (FRL) data during the 2009-2010 fiscal school year. Traditional elementary schools with grade five as the highest grade level were used in order to maximize the study population and maintain consistency as the number of elementary schools is far greater than the number of both middle and high schools combined. In order to promote consistency and eliminate variability with regard to student demographics and curricular programs within the study population, this study did not include charter schools. Three specific questions pertaining to the possible relationship between school facility conditions and student achievement were answered through this study:

Q1 Is there a relationship between school facility condition as indicated by the Facilities Conditions Index (FCI) in traditional Colorado public elementary schools during the 2009-2010 school year and student achievement on the Colorado Student Assessment Program (CSAP) in *reading* while controlling for Free and Reduced Lunch (FRL), English Language Learner (ELL), and Special Education (SPED) populations?

Q2 Is there a relationship between school facility condition as indicated by the Facilities Conditions Index (FCI) in traditional Colorado public elementary schools during the 2009-2010 school year and student achievement on the Colorado Student Assessment Program (CSAP) in *writing* while controlling for Free and Reduced Lunch (FRL), English Language Learner (ELL), and Special Education (SPED) populations?

Q3 Is there a relationship between school facility condition as indicated by the Facilities Conditions Index (FCI) in traditional Colorado public elementary schools during the 2009-2010 school year and student achievement on the Colorado Student Assessment Program (CSAP) in *math* while controlling for Free and Reduced Lunch (FRL), English Language Learner (ELL), and Special Education (SPED) populations?

Definition of Terms

The definitions of school facility and student achievement as they apply to this study are provided. It was necessary to provide a description of these terms as they are specific to the state of Colorado and this study.

School facility: School facility in this study was defined as all traditional public elementary school facilities with grade 5 as the highest grade level in the state of Colorado as indicated in the Statewide Financial Assistance Priority Assessment in FY 2009-2010 (CDE, 2010, p. 104).

Tier I Facilities: The Statewide Financial Assistance Priority Assessment in FY 2009-2010 categorized the school facilities into three distinct tiers: Tier I facilities include academic facilities such as school grounds, classrooms, libraries, and other teaching/learning spaces (CDE, 2010, p. 15). Storage, temporary modular classrooms, and other support facilities are incorporated into Tier II (CDE, 2010, p. 15). Administrative, maintenance, and transportation offices and facilities are included in Tier III (CDE, 2010, p. 15). The Facilities Conditions Index (FCI) pertains only to Tier I facilities or the teaching/learning spaces evaluation and this index was used as an independent variable in this study.

Student Achievement: Student Achievement was defined through the CSAP. This assessment began in 1997 with assessments in 4th grade reading and writing. The tests were originally designed to provide an indication of how well Colorado students were achieving the content standards in reading, writing, math and science, which were adopted in 1995. This study included public elementary school assessment data in grades 3, 4, and 5 in reading, writing, and math for the 2009-2010 school year. The CSAP test was replaced by the Colorado Transitional Student Assessment Program (TCAP) in 2011 as Colorado continues to develop new content standards. This was one year after the Statewide Financial Priority Assessment was conducted in FY 2009-2010 resulting in the Colorado FCI data.

Conclusion

The goal of social justice is the full and equal participation of all groups in a society that is mutually shaped to meet their needs (Bell, 2007, p. 1). This includes a vision where individuals are self-determining and interdependent and in which the distribution of resources is equitable and all members are physically and psychologically safe and secure (Bell, p. 1). As one who advocates for social justice and educational equity, I took an interest in the relationship between the overall condition of school facilities and student achievement in order to provide research in support of more equitable school facilities for all students. Lanham (1999) expressed that the expectation of all schools, regardless of socioeconomic status, to achieve at the same level on the same time schedule is not supported (p. 130).

Given the possible link between school facility condition and student achievement, it is critical that all children be able to learn in an adequate school facility. Given the disparities in facility conditions throughout Colorado, the definition of adequate seems to differ among areas of varying socioeconomic status.

Acronyms

Colorado Student Assessment Program (CSAP)

English Language Learner (ELL)

Facilities Conditions Index (FCI)

Free and Reduced Lunch (FRL)

Hierarchical Multiple Regression (HMR)

Special Education (SPED)

Statistical Program for Social Sciences (SPSS)

CHAPTER II

REVIEW OF LITERATURE

Included in Chapter II is a discussion of the role of education in America and a history of school facilities in the United States. Through an examination of the research pertaining to school facilities and achievement and the complications with outdated and deteriorating school facilities, a context for the study was developed. A brief overview of the Facilities Conditions Index (FCI) was presented in addition to a review of the *Giardino v. State Board of Education* case and the Building Excellent Schools Today (BEST) grant program. The chapter ends with the conclusions and implications, the problem, and the purpose of the study.

The History of School Facilities in the United States

Horace Mann had an interest in politics, education, and social reform and became the nation's first secretary of education in 1837, and later served in both the House of Representatives and Senate (Mann, 2013, para. 3). He insisted that the advancement of the human race could benefit through education, philanthropy, and republicanism (Mann, 2013, para. 3). His principles regarding public education were greatly influential and included the following: citizens will not be able to maintain both ignorance and freedom; education should be paid for, controlled, and maintained by the public; education should be provided in schools that embrace diversity; education must be nonsectarian; education must be taught using the tenets of a free society; and education must be provided by well-trained, professional teachers (Mann, 2013, para. 5). Mann insisted that free, universal public education in association with well-educated teachers was the best way to ensure that the nation's children became upstanding citizens (Mann, 2013, para. 5). Most states adopted some form of the educational system that Mann had helped to establish in Massachusetts (Mann, 2013, para. 5).

As the nation became interested in creating a common culture through formal education, local governments began to form public schools (Odden & Picus, 2008, p. 277). Three periods of time depict the evolution of educational facilities throughout the country's history. Through the colonial period, industrial revolution, and information age educational facilities have evolved to meet the demands of societal, economic, and political influences (Tanner & Lackney, 2006, p. 2). Architecture, aesthetics, symbolism, and school building design have been influenced by the progression of educational philosophy and goals, curricular objectives, instructional methods, culture, and the value systems of various school governing boards (Tanner & Lackney, 2006, p. 2).

The Colonial Period

The one-room schoolhouse exemplified the educational facility of the Colonial period (1650-1849) and was characterized by an agricultural society in which formal education was not valued by many (Tanner & Lackney, 2006, p. 4). Education generally occurred in homes or churches and other informal settings as the main focus was to teach a trade or skill (Tanner & Lackney, 2006, p. 3). Schooling and learning from books was only a small fraction of education and children acquired values and skills from family members and neighbors of all ages and conditions (Tanner & Lackney, 2006, p. 3). The major curriculum work occurred on the farm, in a workshop, or in the corner store and civic and moral instruction occurred mostly in church, home, or in the village (Tyack, 1974, p. 15). As cities became more populated, there was a need to educate larger groups of students (Tyack, 1974, p. 15). In response, the Lancasterian Monitorial System, which utilized older students to serve as monitors to teach younger children, had allowed one educator to provide instruction for hundreds of students (Tanner & Lackney, 2006, p. 5).

Educational reformers in the early 1900s resented community control of schools as these schools often included non-graded primary education, the instruction of younger children by those who were older, flexible scheduling, and a lack of bureaucratic buffers between teachers and patrons (Tyack, 1974, p. 14). At the turn of the century, some leading scholars argued that a community-controlled education could no longer ready youth to cope with the changing demands of agriculture or with the complex nature of citizenship in a technological, urban society (Tyack, 1974, p. 14). Children often endured schooling in deplorable conditions during this time (Tyack, 1974, p. 14). The meagerness of formal schooling in rural areas seriously handicapped those who migrated to the complex urban industrial society (Tyack, 1974, p. 14).

The Industrial Revolution

The Industrial Revolution (1850-1949) commenced as factories flourished throughout the United States in order to produce such products as firearms, textiles, and sewing machines (Tanner & Lackney, 2006, p. 5). The need to educate larger groups of immigrants in urban areas became a necessity as the social problems related to the Industrial Revolution grew in the mid to later part of the 19th century (Tanner & Lackney, 2006, p. 5). During this time, schools and communities were generally tightly knit groups where individuals knew one another’s affairs (Tyack, 1974, p. 16). The teacher was often a subordinate to the community (Tyack, 1974, p. 16). As the population grew, school location, the selection of the teacher, the condition of the school facility, discipline, governance, religion instruction, and curriculum often became areas of contention (Tyack, 1974, p. 16). Despite the efforts of educational reformers, most urban educational systems in the early nineteenth century began as loosely-structured village schools. This frustrated those who wished to standardize and adapt schools to the demographic, economic, and organizational transformations in the cities (Tyack, 1974, p. 28).

Eventually, a more bureaucratic system prevailed as the organization of education began to establish a pattern for public education throughout the country (Tyack, 1974, p. 15). Compulsory education was needed to play a major part in the total education of the children in the country just as it did for those in the cities (Tyack, 1974, p. 14). Reformers wished to create the one best system modeled after that which was slowly developing in the cities (Tyack, 1974, p. 14). As educators justified their proposed programs as public service, they also sought to gain greater power and status (Tyack, 1974, p. 14).

Schools typically consisted of classrooms and corridors in the mid-19th century, but by the end of the century spaces such as auditoriums and administrative offices became more integrated (Tanner & Lackney, 2006, p. 22). Educational reformers in the 1890s and early 1900s saw the curriculum, selection and supervision of teachers, sporadic attendance, lack of discipline, diversity, and condition of one-room school buildings as issues (Tyack, 1974, p. 22). The reformers believed that the rural folk did not know what was good for them in a complex new society and argued that industrialization, demographic shifts, and urbanism were altering country life (Tyack, 1974, p. 22).

Beginning with the National Education Association Committee of Twelve on Rural Schools in the 1890s, the remedies were mostly agreed upon and included the following: consolidation of schools and transportation of pupils, expert supervision by county superintendents, removal of politics, professionally trained teachers, and curriculum content in which children were taught sound values and vocational skills (Tyack, 1974, p. 23). School reform by administrative progressives from 1900 to 1950 has never been shaped more powerfully by any other group before or since (Tyack, 1995, p. 17).

The Information Age

The Information Age (1950 to present) is recognized as a time in which people appreciate travel, celebrate diversity, and seek to integrate work and family lives (Tanner & Lackney, 2006, p. 22). The number of one-room school houses diminished from 200,000 to 20,000 from 1910 to 1960 (Tyack, 1974, p. 25). The end of World War II in 1945 commanded the need for the construction of schools as never seen before due to changes in societal conditions and increases in population as a result of the baby boom (Tanner & Lackney, 2006, p. 22). Although new construction demanded novel methods of school building fabrication that fostered further experimentation in flexible and adaptable spaces many new schools were built as quickly and as cheaply as possible which resulted in low-quality facilities (Tanner & Lackney, 2006, p. 22). The trend toward the consolidation of schools resulted from the convergence of industrialization and urbanization during the middle part of the nineteenth century (Tyack, 1974, p. 29).

The consolidation of high schools became a major source of controversy at this time as they became the new focus of community life and ritual (Tyack, 1974, p. 25). Reformers believed that children and teachers would benefit from better school buildings, a broader and more contemporary course of studies, and better qualified teachers and administrators (Tyack, 1974, p. 25).

The Progressive Movement of the late 19th century, principally led by John Dewey, focused on child-centered education and flexible spaces (Tanner & Lackney, 2006, p. 9). The open classroom became popular during the 1950s through the early 1970s in order to encourage group work and team teaching (Tanner & Lackney, 2006, p. 22). However, changes in teaching styles often did not accompany the changes in classroom design and many teachers complained of distractions (Tanner & Lackney, 2006, p. 22). In the 1960s, public schools were under criticism that they were not adequately addressing the needs of minority and low-income students (Tanner & Lackney, 2006, p. 22). This gave rise to alternative schools such as Freedom Schools (Tanner & Lackney, 2006, p. 22). Freedom Schools were initiated in 1964 through the collaborative efforts of several Civil Rights organizations and provided an opportunity to understand how students can drive the curriculum to meet individual and collective needs within a community (Agosto, 2008, p. 168). The concept of community schools re-emerged as city and county agencies sought to leverage tax dollars to create joint-use facilities that involved the local community in education (Tanner & Lackney, 2006, p. 23). Community schools connect schools with community resources to work toward the goal of improving academic performance (Garrett, 2012, p. 15). In recent years, educators, civic leaders, and businesses are recognizing the potential of community schools to address numerous concerns (Garrett, 2012, p. 15). The pooling of resources to combat crime, delivery of social services, and the production of an educated workforce are noteworthy (Garrett, 2012, p. 15).

The number of school districts declined from 127,531 in 1932 to 16,960 in 1973 and in 1980 there were less than 1,000 one-room school houses (Tyack, 1995, p. 20). Regulations skyrocketed as state governments were lobbied to require schools to meet minimum requirements in order to receive state aid (Tyack, 1995, p. 20). However, many students were being left behind despite the apparent progress in the mid-century given the major disparities in educational opportunity. The inequalities in educational opportunity derive from places of residence, family occupation and income, race, gender, and physical and mental handicaps (Tyack, 1995, p. 22). Due to economic and social inequalities, schools became a diverse and unequal set of educational institutions and some educational leaders became concerned with unequal educational funding, but efforts to equalize school finance fell short (Tyack, 1995, p. 22). Young people that generally needed the most schooling received the least as the communities in which these people lived typically lacked the funds to build school facilities or pay teachers (Tyack, 1995, p. 22).

In October 1979, Congress passed the Unites States Department of Education (DOE) Organization Act (Public Law 96-88) (DOE, 2010, p. 1). The United States Department of Education (DOE) is the federal agency that establishes policy, administers, and coordinates the majority of federal assistance to education (DOE, 2010, p. 1). The DOE’s mission is to serve the nation’s students in order to promote student achievement and prepare them for global competitiveness by fostering educational excellence and ensuring equal access (DOE, 2010, p. 1). Throughout the history of education in the United States, educational reformers and advocates have frequently been faced with strong opposition to theories regarding how children should be taught and what they need to know in order to succeed in society (Tanner & Lackney, 2006, p. 23). It often takes many years for the physical school setting to respond to changes in pedagogy (Tanner & Lackney, 2006, p. 23).

Future Trends in School Facilities

The nation's one-room school houses have long since been replaced by large multi-faceted school facilities often consisting of multiple buildings and structures (United States General Accounting Office [GAO], 1995a, p. 3). A school district may have an original building, any number of additions to the original, and a variety of temporary and permanent structures, all of which may have been constructed at different times (GAO, 1995a, p. 3). These facilities are comprised of classrooms, administrative offices, and additional areas such as gymnasiums and auditoriums (GAO, 1995a, p. 3). Some buildings may have been well maintained or renovated and may be on par with the equivalent of a newer building (GAO, 1995a, p. 3).

According to the United States General Accounting Office (GAO) (1995a), every state in America was identified as having school buildings in substandard condition (p. 3). The Unites States GAO (1995a) estimated that over half of the 42 million students in American schools attended school in a building that needed at least one or more major building components or features extensively repaired (p. 2). The National Center for Educational Statistics (NCES) found that the average age of school buildings in America in 1998 was 42 years old (NCES, 1999, p. 1). Approximately 28% of all public schools were built before 1950, 45% were built between 1950 and 1969, 17% were built between 1970 and 1984, and 10% were built after 1985 (NCES, 1999, p. 1). Approximately half of the existing school buildings in the United States were completed before 1959 (NCES, 1999, p. 6). America's oldest schools also have a higher proportion of children in poverty (NCES, 1999, p. 2). Twenty-nine percent of schools with 20-49% of children eligible for free or reduced lunch (FRL) were built before 1950 while 34% of schools with over 50% of students eligible for FRL were built before 1950 (NCES, 1999, p. 2). The age of a school and its size are also related as 40% of schools with enrollments of less than 300 were built before 1950 while only 23% of schools with enrollments of 1,000 or more were built before 1950 (NCES, 1999, p. 2). Twenty-nine percent of all public schools fell into the category of "oldest condition" and these were schools built before 1970 and either were never renovated or were renovated prior to 1980 (NCES, 1999, p. 2).

The National Center for Educational Statistics (NCES), reported that there were 98,817 operating public elementary/secondary schools in the United States in the 2010-2011 school year (National Clearinghouse for Educational Facilities [NCEF], 2013). Many students in America attend school in buildings that threaten their health, safety, and learning opportunities, particularly in urban and high-poverty areas (NCES, 2007b, p. 1). In a study by the NCES in 2005, 56% of school principals reported that various environmental factors had no interference upon the delivery of instruction in permanent buildings (NCES, 2007b, p. v). However, 33% reported minor interference, nine percent reported moderate interference, and one percent reported major interference (NCES, 2007b, p. v). The United States General Accounting Office (GAO) (1995a) determined that approximately two-thirds of America's school buildings were in at least overall adequate condition and, at most, were in need of only some preventive maintenance or corrective repair (p.2). However, the 14 million students in the remaining one-third attended schools in need of extensive repair or replacement of one or more buildings (GAO 1995a, p. 2). It is well past the time for us to start the work that it will take to change these inequities (Kozol, 2005, p. 54). According to the United States General Accounting Office (GAO), district officials mentioned that a major factor in the declining physical condition of the nation's schools were decisions to defer maintenance and repair expenditures from year to year due to lack of funds (GAO 1995a, p. 2). On any given school day, approximately 20% of Americans spend time in a school building (Schneider, 2002, p. 1). Studies by the United States GAO have determined widespread physical deficiencies in many school facilities with an average building age of roughly 50 years (Schneider, 2002, p.1). School district officials are working to build, renovate, and modernize K–12 facilities as they are challenged with aging buildings and shifting student enrollments (Schneider, 2002, p. 1).

In a study conducted by the United States General Accounting Office (GAO), *Americas Schools not Equipped or Designed for the 21st Century* (GAO, 1995b), school officials in a national sample reported that although most schools met key facilities requirements and environmental conditions for education reform and improvement, most were unprepared for the twenty-first century in essential areas (p. 4). Many of those invested in public education believe that it is unfair to hold students to nationwide standards if they do not have an equal opportunity to learn (GAO, 1995b, p. 20). If schools cannot provide students with sufficient technological support or facilities for instruction and services, they may not be providing even a roughly equal opportunity for all students to learn (GAO, 1995b, p. 20). This is particularly concerning in central cities and in schools that serve high percentages of minority and poor students (GAO, 1995b, p. 20). There is a tremendous need for more money to build and modernize school buildings (Odden & Picus, 2008, p. 155).

In 1983, *A Nation at Risk* asserted that poor schooling was responsible for lapses in the economy and that the solution to both educational and economic decline was improved academic achievement or test scores (Tyack, 1995, p. 34). The higher standards and expectations are repeatedly demanded of urban schools, but far lower standards in ethical respects appear to be expected of the dominant society that isolates these children in unequal institutions (Kozol, 2005, p. 44). In their article *Mismatch: Historical Perspectives on Schools and Students Who Don't Fit Them (2001),* Deschenes, Cuban, and Tyack (2001), stated that *A Nation At Risk* ignored the fact that America's schools as they are organized pay little attention to the fact that they better serve privileged groups than those placed on the margin (p. 527). The denial of “the means of competition” is perhaps the single most consistent outcome of the education offered to poor children in the schools of our large cities (Kozol, 1991, p. 101). Market-oriented solutions are evident in all of the current proposals advocating for educational choice, charters, and vouchers (Cuban & Shipps, 2000, p. 119). However, making public education entirely subject to the demands of individual consumers requires no one to look out for the public interest in public education (Cuban & Shipps, 2000, p. 121).

The United States has invested hundreds of billions of dollars in school infrastructures so that children can be properly educated and prepared for the future at stated by the United States General Accounting Office (GAO, 1995a, p. 3). However, it is almost exclusively a state and local responsibility to maintain school facilities (GAO, 1995a, p. 3). Public concern is growing that some school buildings may be unsafe or even harmful to the health of our children as well as those working in educational facilities (GAO, 1995a, p. 3). As stated by the United States General Accounting Office (GAO), although many hazardous situations in various school facilities have been well publicized, little information exists documenting the extent to which the nation's schools may lack appropriate facilities (GAO, 1995a, p. 3). Perhaps the greatest issue pertaining to school facilities is a lack of clear data on what is exactly needed (Odden & Picus, 2008, p. 152). The last comprehensive evaluation of the physical condition of the nation's school facilities was performed by the GAO in 1995 (Center for Green Schools, 2013, p. 4). According to the Center for Green Schools, there is no national or comparable state-by-state data base to provide even basic information on school facilities (Center for Green Schools, 2013, p. 2). A great many old buildings do not have the features such as: climate controls that maintain a comfortable thermal environment, adequate lighting, up-to-date roofs, and the adequate space necessary for a quality learning environment (Earthman, 2002, p. 2). If the older buildings do have such components, they often do not function well due to poor maintenance practices (Earthman, 2002, p. 2). The relationship of a well designed physical environment to effective student learning is quite important and as a result, research exploring the relationship between school facilities and student performance is critical (Earthman, 2002, p. 2).

Educational Funding

There has been a consistent belief that schools must not be underfunded so that destructive economic and social consequences can be prevented (Thompson, Wood, & Crampton, 2008, p. 53). Some reformers argue that schools distribute economic and social opportunity and that equal opportunity is dependent upon the quality of schools (Thompson et al., 2008, p. 53). Policies pertaining to educational programs and funding have evolved into a balance of local, state, and federal laws and regulations (Baker, Green, & Richards, 2008, p. 94). However, states have become increasingly more responsible for the governing of educational programs and revenues (Baker et al., 2008, p. 94). Whatever the systems designed to fund school facilities, the funding formulas must give consideration to vertical equity as well as horizontal equity. Horizontal equity holds that similar students should be treated the same (Odden & Picus, 2008, p. 66). Vertical equity recognizes the differences among children and takes into the consideration that some students deserve or need more services than others who may be better off (Odden & Picus, 2008, p. 72).

How are Schools Funded?

Public schools are funded through federal, state, and local funding. The following paragraphs include an explanation of how America's schools are funded and information pertaining to the funding of school facilities is provided in greater detail.

Federal Funding

The principle support for K-12 education from the federal government began in 1965 with the enactment of the Elementary and Secondary Education Act (ESEA) (DOE, 2005, p. 1). In 2010, the United States Department of Education (DOE) administered a budget of approximately $68.1 billion dollars in discretionary funding (DOE, 2010, p. 3). The DOE operates programs pertaining to every area and level of education (DOE, 2010, p. 3). Elementary and secondary programs annually serve nearly 16,000 school districts and approximately 49 million students that attend more than 98,000 public schools and 28,000 private schools (DOE, 2010, p. 3).

Federal funds for education are distributed using either a set formula, through competition, or by financial need determination (Thompson et al., 2008, p. 115). Examples of federal revenue sources include unrestricted grants-in-aid that are received either directly from the federal government or as restricted grants-in-aid from the federal level that are allocated by the state (Thompson et al., 2008, p. 115). The federal government has no direct responsibility for providing an education for America’s children and, therefore, no liability for the funding of the operation of the local school system (Earthman, 2009, p. 135). It is important to point out that education in America is primarily a state and local responsibility, and the Department of Education’s budget is only a small part of both the total national education spending and the overall Federal budget (DOE, 2010, p.5). The appropriations for the DOE totaled $65.7 billion in fiscal year 2013 which equates to 5.5% of the $1.2 trillion in total appropriations funding (New American Foundation, 2013b, para. 4).

State Funding

Most states use some form of a foundation program to fund schools as the goal was to set a level of expenditure per pupil that would provide at least a minimum quality of education (Odden & Picus, 2008, p. 283). A foundation plan is a type of equalization plan in which state aid formulas seek to grant aid inversely to the local ability to pay for schools and balance expenditure levels in rich and poor communities (Thompson et al., 2008, p. 86). State aid under these plans is based on the concept of increasing state aid to local school districts with the least fiscal capacity (Thompson et al., 2008, p. 86). Intermediate sources of revenue include funds from governmental units that stand between the local school district and the state such as cities and counties (Thompson et al., 2008, p. 115). Intermediate and state funding may include unrestricted grants-in-aid and revenues in addition to taxes under tax exemptions or abatements granted by other taxing units (Thompson et al., 2008, p. 115).

The states play the most significant role in financing K-12 public education (DOE, 2005, p. 2). In the school year of 2004-05, approximately 83 cents per dollar spent on education came from the state and local levels, 45.6% from state funding, 37.1% from local government, and 8.3% from the federal government (DOE, 2005, p. 2). Approximately nine percent came from private sources which mostly funded private schools (DOE, 2005, p. 2). This allocation remains consistent with the country's historic reliance on local control of schools (DOE, 2005, p. 2).

Local Funding

Local revenues may include sources such as: property tax, tuition, student transportation fees, investment earnings, student organization fees, or money from textbook rentals (Thompson et al., 2008, p. 115). The majority of the responsibility is placed on local school districts to raise revenue for schools and the property tax is the primary source of that local revenue (Ladd, Chalk, & Hansen, 1999, p. 1). As property wealth varies significantly between the school districts within a state, districts with a small property tax base may find it more difficult than those with large property tax bases to generate local revenue for schools (Ladd et al., 1999, p. 1).

Additionally, districts with more-costly-to-educate youngsters most often do not have large property tax bases (Ladd et al., 1999, p. 1). The main issue with local financing is the variation in the ability to raise education funds which is usually dependent upon property values (Odden & Picus, 2008, p. 264). It is obvious that those who have money and spend it lavishly on their own children do it for good reason (Kozol, 2005, p. 46). In the words of Robert Slavin from John's Hopkins University (Bracy, 2004), "To my knowledge the United States is the only nation to fund elementary and secondary education based on local wealth" (p. 188).

The Funding of Educational Facilities

The overwhelming need to improve the existing condition of school facilities in lieu of limited resources make it critical that any funding for school facilities be spent wisely (Earthman, 2009, p. 249). A variety of lawsuits challenging funding for school facilities have drawn attention to the substandard conditions that many students encounter at school (National Center for Educational Statistics [NCES], 2000, p. 4). According to Kozol (1991), when looking at the solutions that countless commissions have proposed pertaining to educational funding, they do not mean equity but something close enough to equity to silence criticism by approximating justice (p. 211).

Funding for maintenance and capital expenditures for building improvement are often put off in times of budgetary strain and policy makers need to recognize the effect on students (Berner, 1993, p. 23). Many school districts throughout the United States are faced with the need to finance the construction, renovation, or repair of public school facilities (Bunch & Smith, 2002, p. 1065). The United States Department of Education (DOE) estimated elementary and secondary public and private school enrollment to increase by approximately one million students during the period from 1999-2009 (Bunch & Smith, 2002, p. 1065). Obtaining a balance between the need for new school facilities or renovations and the resistance to higher taxes is an ongoing challenge for school district officials (Bunch & Smith, 2002, p. 1065). The latest school finance litigation has turned from an equity argument to one of adequacy as recent court rulings have required adequate school facilities as part of an adequate educational program (Odden & Picus, 2008, p. 151). Equality seems beyond the realm of possibility for those in inner-city public schools, and today they look to a sufficiency of means or "adequacy" (Kozol, 2005, p. 44).

Education in America is primarily a state and local responsibility, as the federal budget for education is only a fraction of the total national education spending (DOE, 2010, p. 2). Therefore, it is mostly a state and local responsibility to maintain school facilities (GAO, 1995a, p. 3). Great disparities in the condition of school facilities among school districts in the United States have been created due to the many equity issues associated with the use of local bond measures and the ability of varying districts to raise funds through property taxes to repay the bonds (Odden & Picus, 2008, p. 155). States, such as Colorado and Wisconsin, provide resources for school facilities within the basic school support funding program and funding is provided on a per pupil basis as part of the distribution of state money to schools (Odden & Picus, 2008, p. 169). Hawaii is a state operated school system that provides full funding for school facilities (Odden & Picus, 2008, p. 169).

Additional approaches to facility funding include the following: lease purchase agreements, leases, renting of school space, local options sales taxes, developer fees, and sinking funds (Odden & Picus, 2008, p. 169). Sinking funds are similar to savings accounts as school districts are permitted to levy general or special taxes to be placed in a fund for a specific project or undesignated purposes (Thompson et al., 2008, p. 281). A significant section of the planning of school facilities requires the creation of a financial plan that addresses the operational and capital funding of the long-range plan (Earthman, 2009, p. 26). This is very important in order to determine how funding sources will be obtained and to anticipate financial need. Most school districts depend on general obligation bonds to pay for new facilities (Earthman, 2009, p. 26).

Bonding

General obligation bonds issued by local school districts are the most commonly used instrument in the financing of school facilities (Odden & Picus, 2008, p. 155). When voter approval is achieved, a school district is authorized to borrow a given sum of money through the sale of general obligation bonds (Odden & Picus, 2008, p. 155). The loan is then repaid through a property tax assessment in excess of the school district's property taxes for general operations (Odden & Picus, 2008, p. 155). School districts acquire lower interest rates because as a government entity, interest from the bonds is non-taxable to the purchaser and the repayment of the bonds is guaranteed by the local district's property tax base and the legal commitment to raise property taxes to pay for the principal and interest (Odden & Picus, 2008, p. 155). The duration of most bond issues is 20 years which makes sense as the life span of a new school facility is generally 30 or more years (Odden & Picus, 2008, p. 155). General obligation bonds are secured by the taxing authority of the school district and require local voter approval in most states, but many school districts are often unable to obtain voter approval (Bunch & Smith, 2002, p. 1050).

As there are many equity issues associated with the use of local bond measures and the ability of varying districts to raise funds through property taxes to repay the bonds, many states have created programs to minimize inequities (Odden & Picus, 2008, p. 155). Many states limit the amount of debt a school district can acquire most typically based on a percentage of a district's assessed valuation (Odden & Picus, 2008, p. 160). Therefore, a school district with a low assessed value per pupil cannot raise as much money through bond issuance as a wealthier school district even if those voters are willing to tax themselves at a high rate (Odden & Picus, 2008, p. 160). In some states, jurisdictions, as opposed to local school districts, issue the bonds and, therefore, the inequities of the property tax-based system are reduced (Odden & Picus, 2008, p. 161). As there is a greater assessed value throughout a county or municipality, the pooling of resources allows for the equalization of tax rates across school districts (Odden & Picus, 2008, p. 161). A number of states offer assistance in relation to school facilities based on un-housed student need or the number of students exceeding the schools intended capacity, standards of assessment for school facilities, or through the equalization of property tax levies (Odden & Picus, 2008, p. 161). However, in the case of the equalization of property tax levies problems arise in the inverse relationship to district property wealth and the commitment of the state to fund the given amount of funding to the recipient districts every year for the life of the bonds (Odden & Picus, 2008, p. 161). School districts seeking to obtain funds for construction, renovation, or land acquisition may obtain bonds that offer a tax-credit, pool together millions of dollars, and require an investor who is not interested in a return which makes them a viable option for school districts (Herbert, 2010, p. 12). Forty percent of the bonds are given to the top 100 local education agencies based on the number of children below poverty level while 60% are given to states to be allocated to school districts (Herbert, 2010, p. 12).

Lease Purchases

A lease purchase agreement is an option to fund school facilities in which a school district makes lease payments over a period of time until the facility has been purchased, similar to an installment purchase (Bunch & Smith, 2002, p. 1064). Lease purchases legally are not classified as debt in most states and, therefore, typically do not require voter approval (Bunch & Smith, 2002, p. 1064). School districts most likely to enter into lease purchase agreements are characterized by higher enrollment and lower property wealth and those that perceive insufficient support from voters in the approval of bonds (Bunch & Smith, 2002, p. 1064).

Some things to consider with lease purchases are the possibility of higher issuance costs and higher interest rates which makes the selection of a good financial advisor critical (Bunch & Smith, 2002, p. 1064). Some form of state oversight or legal review of lease purchases or the possibility of combining lease purchases from a number of school districts into one larger bond issue could prove beneficial (Bunch & Smith, 2002, p. 1064).

Grant Programs

A matching grant is a type of grant that links the level of state general-aid assistance to the level of funding made by the local school district as well as to its fiscal capacity (Odden & Picus, 2008, p. 269). The most common type of general matching grant is the guaranteed tax base (GTB) program (Odden & Picus, 2008, p. 269). These grants are designed to equalize the ability to raise revenue among each school district and to associate the level of aid to spending at the local level (Odden & Picus, 2008, p. 269). Property-poor districts may be able to provide the same level of services while lowering their tax rates through these types of grants (Odden & Picus, 2008, p. 269). Categorical grants provide assistance to school districts, but often come with strict guidelines and have specific purposes (Odden & Picus, 2008, p. 270). These grants ensure that school districts provide services that are considered important by the state or federal government, but are not designed to equalize fiscal capacity (Odden & Picus, 2008, p. 270). Unrestricted general aid or block grants are a form of equalization grants that do not place restrictions on the use of the revenue (Odden & Picus, 2008, p. 282). Flat grants were early attempts to address the local differences in the ability to support public schools (Odden & Picus, 2008, p. 282). However, flat grants are not used as a means to provide general-purpose operating funds today (Odden & Picus, 2008, p. 282). Although easy to understand, they provide equal amounts of funding regardless of local fiscal capacity which in turn tends to worsen fiscal capacity (Odden & Picus, 2008, p. 282). Flat grants are utilized in nine states to support school facilities (Odden & Picus, 2008, p. 162).

An example of a grant program in Colorado is the Building Excellent Schools Today (BEST) Grant Program. The program was created in 2008 with the signing of C.R.S.22-43.7 and provides an annual amount of funding in the form of competitive grants to school districts, charter schools, institute charter schools, boards of cooperative educational services, and the Colorado School for the Deaf and the Blind (CDE), n.d.[a]). The funds may be used for the construction of new school facilities as well as general construction and renovation of existing school building systems and structures (CDE, n.d.[a]). The Building Excellent Schools Today (BEST) grant program plan leverages $30-40 million of funding annually from School Trust Lands and Colorado State Lottery revenues and raises up to $500 million in capital (Colorado Department of Education [CDE], n.d.[a]). The combined state and local revenues may be enough to repair hundreds of schools as well as build many new ones (CDE, n.d.[a]). There are three types of BEST grants: cash grants that can be used to fund smaller projects, lease purchase grants that may be used to fund larger projects like new schools or renovations in which the financing is paid back with future assistance fund revenues, and emergency grants that are utilized for unanticipated events that make all or a significant portion of the building unsuitable for educational purposes or threatens health and safety (CDE, n.d.[a]).

School Facility Condition and Student Achievement

Depending upon the condition of a school building, the overall effect it has on students can be either positive or negative (Earthman, 2002, p. 3). Some correlation studies have shown a strong positive relationship between building conditions and academic achievement (Earthman, 2002, p. 3). Students may be handicapped in their academic achievement if they attend school in a substandard building (Earthman, 2002, p. 3).

Increased accountability for public education has become a central theme in both educational and political arenas (Lanham, 1999, p. 1). The initiation of standards, NCLB, high-stakes testing, Race to the Top, and greater degrees of accountability for both teachers and administrators in relation to student performance have changed the educational landscape over the last several years (Lanham, 1999, p. 1). The consequences of high-stakes testing are far more harmful in schools in which the resources available in helping the children learn the skills that will be measured by the tests are fewest (Kozol, 2006, p. 110). As there may be a correlation between the condition of educational facilities and student achievement, political leaders and educational advocates have placed a greater focus on the state and condition of our nation’s schools (Lanham, 1999, p. 1).

Educational leaders are concerned about school facilities given the possible correlation between the condition of school facilities and student achievement (Buckley et al., 2004, p. 3). In *The Impact of Buildings on Student Health and Performance: A Call for Research,* the Center for Green Schools and the McGraw-Hill Research Foundation mention that education stakeholders can play a critical part to "advance, identify and require research into the connection between school buildings and student health and learning" (American School & University, 2012, p. 10). Considering the condition of school facilities may be linked to student achievement, it is critical that we improve the condition of the nation’s schools so that all children can have access to a quality learning environment and have the opportunity to improve their academic achievement. Educational funding is linked to the condition of school facilities, so if researchers were able to demonstrate that a certain percent increase in funding for education would result in a percent increase in student performance, then it would be fairly easy to determine the optimal funding level for every school in America (Smith, 2004, p. 7).

Research Pertaining to School Facilities and Achievement

In 1999, the average age of a public school facility in the United States was 42 years with rapid deterioration beginning at approximately 40 years (NCES, 1999, p. 1). The mean age of school facilities ranged from 46 years in the Northeast and Central states to 37 years in the Southeast (NCES, 1999, p. 1). However, the age of a school building is usually not an important factor in influencing student performance if the building is in good condition (Earthman, 2002, p. 8). An increasing number of studies are confirming the relationship between a school's physical condition, especially indoor lighting and indoor air quality (IAQ), to student performance (Environmental Protection Agency (EPA), n.d., para. 4).

High quality design may not just enhance student health, comfort, and performance, but also may have an influence on average daily attendance, teacher retention, operating costs, liability exposure, and environmental impact (EPA, n.d., para. 11). Often, the building components that are necessary for good student learning are absent in older buildings (Earthman, 2002, p. 8). Factors, such as lighting levels, air quality, and temperature and acoustics, have an effect on student behavior and outcomes (Fisher, 2001, p. 1). The condition of a school facility may also have an effect on teacher retention which surely has an influence on student academic achievement (Buckley et al., 2004, p. 3). The condition of a school building not only influences student achievement, but can also affect the work and effectiveness of a teacher (Earthman, 2002, p. 9).

Classrooms with air conditioning, thermal controls, ample daylight, quality roofing that prevents leaks, controlled noise, clean and non-crowded environments, inviting colors, and educational and scientific equipment that works may go a long way to improve student learning (Earthman, 2009, p. 249). Hines (1996) found that a direct influence on student achievement and behavior may derive from illumination, climate control, student population density, acoustics, color, and availability of resources (p. 7). Cash (1993) found that when socioeconomic factors were constant, facility condition had a significant correlation with student achievement (p. 77). As Kozol (1991) notes, if per-pupil spending grows at the same rate in the suburbs as in urban districts when there are already disparities, the result will be a prevention of any catching-up in achievement by the urban schools (p. 161).

In a synthesis of studies conducted by John Bailey (2009) at the Virginia Polytechnic Institute and State University, it was determined that the school building does in fact have an influence upon the health and productivity of students and teachers (p. 191). This synthesis supported and indicated that building condition was directly related to student achievement, student behavior, and student attitude (Bailey, 2009, p. 238). Berner (1993) compared the condition of elementary schools in Washington, DC to student standardized achievement scores and found a difference of five percentile points in the scores of students in poor buildings compared with scores of students in excellent buildings (p. 21). Additionally, she stated that based upon the parameter estimate, if a school were to improve its conditions from poor to excellent, the achievement scores would increase by an average of 10.9 points (Berner, 1993, p. 21).

Chan (1980) found that building age was statistically significant in the achievement scores of eighth grade students in the 1975/1976 school year in Georgia on the Iowa test of Basic Skills using multiple regression analysis and analysis of covariance (p. 13). Uline and Tschannen-Moran (2008) confirmed a link between the quality of school facilities and student achievement (p. 55). Bivariate correlational analysis was used to examine the relationship between the quality of school facilities, resource support, school climate, student socioeconomic status, and student achievement (Uline & Tschannen-Moran, 2008, p. 55). Al-Enezi (2002) used Pearson r to determine if there was a relationship between school building conditions and student achievement for twelfth grade boys in Kuwait (p. 2). This analysis revealed a positive significant relationship between student achievement and building conditions. According to Lyons (2001), research strongly suggests that there is a direct relation between the condition and utility of the school facility and learning (p. 6). Duran-Narucki (2008) concluded that students attended less days on average in run-down schools and had lower grades on standardized tests (p. 278). Greenwald, Hedges, and Laine (1996) used meta-analytic methods in a review of 60 studies to measure the relationship between multiple school inputs and student achievement and concluded that effect sizes were significant enough to suggest that moderate increases in spending could significantly increase student achievement (Greenwald et al. p. 361).

Approximately 25% of the U.S. population goes to school every day in nearly 140,000 P-12 schools, colleges, and universities (United States Green Building Council [USGBC], n.d.). Several conclusions have been determined: fresh and clean air can improve the health of occupants, daylight boosts concentration, comfortable temperatures increase focus, and improved acoustics enhance communication (USGBC, n.d.). Through the transformation of the physical environment of a learning institution, we have the ability to influence how students, teachers and communities engage in their world (USGBC, n.d.). Some more important factors found to influence learning are those relating to control of the thermal environment, proper illumination, adequate space, and availability of equipment and furnishings (Earthman & Lemasters, 1996, p. 1). Recent trends in school building planning and design have taken into account the affect on student outcomes and behavior (Fisher, 2001, p. 2). Good infrastructure is truly at the base of quality education, and, as society searches for ways to address educational needs in the future, the facility is a good place to start (Berner, 1993, p. 23).

The Facilities Conditions Index Addresses Multiple Facility Characteristics

As more and more pressure to improve student achievement is placed upon the nation's public schools, the need for research which ties the condition of school facilities to student achievement has never been more important. An important aspect to consider should be the great disparities in the condition of educational facilities among school districts, particularly the poor condition of numerous facilities in areas of low socioeconomic status. Much of the research pertaining to school facilities and student achievement has focused on one particular aspect or aspects of the school facility such as: open-space schools, school building age, thermal factors, visual factors, color and interior painting, hearing factors, underground facilities, site size, building maintenance, and numerous other factors (Earthman and Lemasters, 1996, p. 1). Thermal environment, IAQ, classroom lighting, moveable spaces, color schemes, technology, and other aspects of the facility may all affect student achievement. Although each aspect alone is worth empirical investigation, they are all aspects of the overall facility.

This study used the Facilities Conditions Index (FCI) as obtained through the Statewide Financial Assistance Priority Assessment in FY 2009-2010. This assessment did not study the relationship between school facility and student achievement, but an overall FCI pertaining to the condition of each school facility in Colorado was obtained. The FCI was used as the independent variable to investigate the relationship between the overall condition of school facilities and student achievement while controlling for SPED, ELL, and FRL populations.

The FCI pertains only to Tier I facilities as depicted in the Statewide Financial Assistance Priority Assessment. Tier I facilities include academic facilities such as school grounds, classrooms, libraries, and other teaching/learning spaces (CDE, 2010, p. 15). The FCI was derived as a ratio of the cost of the overall facilities conditions needs over the cost to replace the entire facility (CDE, 2010, p. 5). The Statewide Financial Assistance Priority Assessment FY 2009-2010 and associated FCI included an extensive evaluation of Tier I facilities or teaching/learning spaces condition needs. The FCI encompasses a multitude of criteria and may or may not include each and every one of the building attributes listed in Figure 5. However, items such as terminal and package units (air conditioning and heating units) and distributions systems (ventilation systems) are directly associated with indoor air quality as well as temperature and humidity. Items such as wall coverings and finishes may include aspects related to acoustics, paint, or color schemes. The extensive list of Tier I conditions needs by facility system is shown in Figure 5. The study methodology is detailed in Chapter III.

Figure 5

Tier I Condition Needs by Facility System

System	Estimate
Terminal & Package Units	$1,713,258,323
Floor Finishes	799,717,578
Lighting and Branch Wiring	688,925,107
Ceiling Finishes	631,518,894
Roof Coverings	628,764,048
Exterior Windows	551,212,643
Distribution Systems	482,614,354
Plumbing Fixtures	475,468,503
Sprinklers	333,170,276
Site Grading & Landscaping	297,330,040
Wall Finishes	250,870,586
Electrical Distribution	169,570,089
Fittings	191,495,195
Partitions	179,166,210
Controls & Instrumentation	160,417,088
Fixed Furnishings	140,001,295
Sanitary Waste	138,511,017
Interior Doors	127,955,254
Communications & Security	120,993,252
Parking Lots	117,577,092
Heat Generating Systems	100,203,415
Other Systems	
Site Lighting	89,596,105
Cooling Generating Systems	70,862,199
Other Equipment	69,764,703
Exterior Doors	58,823,578
Site Development	56,627,974
Roadways	55,541,458
Sanitary Sewer	49,155,323
Domestic Water Distribution	44,018,234
Site Communication & Security	41,365,272
Systems Testing & Balance	36,318,359
Exterior Walls	35,062,760

Figure 5 (Continued)

System	Estimate
Other Electrical Systems	33,380,067
Elevators and Lifts	33,018,523
Pedestrian Paving	29,659,315
Special Construction Systems	57,837,343
Other Plumbing Systems	28,071,388
Special Facilities	27,273,983
Other Fire Protection Systems	26,944,697
Storm Sewer	25,481,077
Rain Water Drainage	22,257,204
Water Supply	17,750,350
Roof Openings	16,947,892
Institutional Equipment	16,073,968
Stair Construction	14,979,134
Standpipes	10,054,500
Fuel Distribution	8,601,131
Fire Protection Specialties	5,495,598
Other HVAC Systems & Equip.	3,739,547
Standard Foundations	3,659,797
Roof Construction	3,187,115
Vehicular Equipment	2,724,013
Special Structures	2,693,707
Slab on Grade	2,251,392
Energy Supply	1,841,216
Floor Construction	1,322,160
Heating Distribution	904,086
Basement Walls	888,501
Other Site Electrical Utilities	662,447
Site Earthwork	645,979
Welding Exhaust Scrubber Systems	346,766
Hazardous Waste Remediation	288,381
Lighting	234,787
Branch Wiring	220,447

Figure 5 (Continued)

System	Estimate
Fittings & Specialties	144,911
Other Conveying Systems	137,258
Special Foundations	105,439
Vehicular Equipment & Loading Dock	67,802
Basement Excavation	44,716
Distribution Systems & Exhaust Systems	40,974
Gas Service Piping	26,372
Systems Testing & Balancing	22,005
Site Demolition & Relocations	19,697
Other Site Mechanical Utilities	1,383
Total	**$9,352,051,375**

Retrieved from: Statewide Financial Assistance Priority Assessment FY 2009-2010 (CDE, 2010, pp. 20-22)

Indoor Air Quality (IAQ)

According to the Occupational Safety and Health Administration (OSHA) (OSHA, n.d.), IAQ may affect the health, performance and comfort of school staff and students and has become a concern in school facilities due to the age and poor condition of a great many school buildings (para. 1). Some of the common problems that contribute to poor IAQ include: radon, classroom pets, excess moisture and mold, dry-erase markers, dust from chalk, cleaning materials, personal care products, odors and volatile organic compounds from paint, caulk, and adhesives, insects, odors from trash, and communicable diseases, (Environmental Protection Agency [EPA], n.d. para. 3). There is a growing body of work connecting educational achievement and student performance to the quality of the air they breathe (Schneider, 2002, p. 1). In a critical review of the literature, Mendall and Heath (2005) concluded that evidence suggests that poor IAQ in school facilities adversely influences the performance and attendance of students (p. 27).

Facilities with poor IAQ are often referred to as having “sick building syndrome” (Schneider, 2002, p 1). Physical symptoms include: irritated eyes, nose and throat, upper respiratory infections, nausea, dizziness, headaches and fatigue, and sleepiness which may affect attendance and student achievement (Schneider, 2002, p 1). The National Institute of Occupational Safety and Health (NIOSH) as well as OSHA call for between fifteen and twenty cubic feet of air per minute per person in order to deliver a more adequate supply of fresh air and assist in the dilution or removal of contaminants, especially chemical and biological impurities such as mold or bacteria that have highly negative health effects (Schneider, 2002, p 1).

Temperature and Humidity

A common consensus among researchers is the importance of a controlled thermal environment as a necessary condition for satisfactory student performance (Earthman, 2002, p. 3). Studies have revealed that the thermal environment in the classroom will affect the ability of students to grasp instruction (American School & University, 2012, p. 10). Lanham (1999) reported that, following the socioeconomic status of the students, the most influential building condition influencing student achievement was air conditioning (p. 129). Cash (1993) found that higher achievement was associated with air conditioning in instructional spaces (p. 78). In a study conducted by Mayo (1955), 79% of the men who worked under a higher temperature condition in a U.S. Navy electronics course with a mean temperature of 82º F responded that their learning had been affected adversely (p. 245).

A study conducted by the New York Commission on ventilation in 1931 reported that, when classrooms are not maintained within temperature and humidity tolerances of 67° - 73° F and 50% relative humidity, more reported cases of student illness occur than in a properly controlled thermal environment (Earthman, 2002, p 6). Temperatures exceeding 77º F in combination with poor ventilation and humidification can result in increased respiration, more demanding physical effort, decreased attention spans, and greater discomfort, and can have detrimental effects on performance (Fisher, 2001, p. 4). Absenteeism increases and conditions favorable to disease and infection can spread amongst students under these conditions (Fisher, 2001, p. 4). According to the National Institute for Occupational Safety and Health (NIOSH), humidity levels should be maintained between 30% to 60% relative humidity (Centers for Disease Control and Prevention, 2003).

Findings support that students will perform mental tasks best in classrooms that are kept at moderate humidity levels, approximately 40-70%, and moderate temperatures in the range of 68-74ºF (Schneider, 2002, p. 2). Schools need particularly good ventilation because children breathe a greater volume of air in proportion to their body weight than adults and schools have much less floor space per person than found in most office buildings (Schneider, 2002, p. 2). The No Child Left Behind (NCLB) Act of 2001 called for the United States Department of Education (DOE) to make recommendations to Congress on how to bring schools into compliance with environmental health standards and determine the cost of such efforts (Schneider, 2002, p. 4). However, it has been difficult for policy makers to create definitive IAQ standards due to the current lack of specific knowledge pertaining to IAQ (Schneider, 2002, p. 4). School districts are allocating more effort and resources to ensure that fresh air in schools is plentiful and readily available to students and teachers as the link between IAQ and student performance becomes more quantifiable (Schneider, 2002, p. 4).

Natural Lighting

Research has shown that appropriate lighting improves test scores, reduces off-task behavior, and plays a significant role in student achievement (Schneider, 2002, p. 6). Good lighting, either natural or artificial, can contribute to the aesthetic and psychological character of a learning environment (Fisher, 2001, p. 3). Studies have confirmed that appropriately designed and well-maintained lighting can improve achievement scores and medical studies have shown that natural light is vital to the regulation of the circadian rhythm of the body in adjusting to night and daytime conditions (Fisher, 2001, p. 3).

Natural light was the predominant means of illuminating most school spaces until the 1950s, but as the cost of electricity declined, so did the amount of day lighting used in schools (Buckley et al., 2004, p. 4). Lighting may affect neuron functions, hyperactivity, overall health and on-task behavior (Fisher, 2001, p. 3). Ultra-violet enhanced broad-spectrum fluorescent lighting may be linked to growth and development and therefore, attendance (Fisher, 2001, p. 3). Fluorescent lighting may reduce glare and provide a more diffused spectrum, but may increase hyper-activity as opposed to full spectrum or incandescent lighting (Fisher, 2001, p. 3). There has been renewed interest in increasing natural daylight in school buildings, as older structures generally do not have proper illumination (Earthman, 2002, p. 8).

Adjustable Learning Spaces

A range of building factors may have an influence on student behavior and academic performance including: amount of space allocated per student, the openness of space, the use of underground or windowless facilities, site size, building utilization and room occupancy, the existence and scope of support facilities, storage spaces, and facilities for instructional specialists (Fisher, 2001, p. 4). Accommodating for occupancy is a fundamental educational necessity and classes should commence in classrooms meant for instruction as opposed to closets, hallways, or other makeshift spaces (Burnett, 1996, p. 6). If schools are to fulfill their educational mission, adequate space for learning must be provided and this is particularly important in urban areas where students may not have access to a safe and orderly environment outside of school walls (Burnett, 1996, p. 6).

The Institute for Urban and Minority Education (IUME) conducted an analysis of New York City school profile data that revealed a strong correlation between overcrowding, achievement, and socioeconomic status. In this analysis, students in overcrowded schools scored between four to nine percentage points lower in reading, and two to six points lower on math exams (Burnett, 1996, p. 5). Forty percent of students in New York City Schools mentioned that they had trouble concentrating in their classes when learning something new and 41.9% of students said that they did not want to remain in their current school (Burnett, 1996, p. 5). In instances when the capacity of the building is exceeded pressure is exerted upon the total educational program as well as the course offerings available (Earthman, 2002, p. 10). Hines (1996) found that a direct affect on student achievement and behavior may derive from student population density

(p. 7). Findings have indicated that students in overcrowded schools and classrooms do not score as high on achievement tests (Earthman, 2002, p. 10).

Color Schemes

Color is believed to influence student attitudes, behaviors, and learning, particularly student attention span and sense of time (Fisher, 2001, p. 4). Color schemes can affect absenteeism, promote positive feelings about school, and can also influence muscular tension and motor control if students prefer the colors (Fisher, 2001, p. 4). Color has been determined to influence student performance, achievement, and behavior (Hines, 1996, p. 33). Color is important in the physical learning environment and is a key component of interior design that affects student achievement, as well as teacher effectiveness and staff efficiency (International Center for Leadership in Education, 2008, p. 1).

Elementary children are attracted to primary colors that are bright and warm, but as children mature and enter middle school they tend to prefer bright medium-cool colors such as greens and blues or a combination of the two (International Center for Leadership in Education, 2008, p. 1). High school students have a preference for darker colors such as burgundy, gray, navy, dark green, deep turquoise, and violet (International Center for Leadership in Education, 2008, p. 1). Cash (1993) noted that higher achievement was found in schools with pastel painted walls rather than white walls in instructional areas (p. 79). Color has been repeatedly noted as factor in influencing student achievement (Cash & Twiford, n.d., para. 23). McGowen (2007) noted that interior color also may influence student attitudes and behavior as well (p. 30).

Acoustics

Evidence for the cumulative effect of poor acoustics on scholastic achievement suggests that good acoustics be made a high priority, particularly for students in lower grades (Lubman & Sutherland, L. 2001, para. 1). When speech communication is important to the learning process, good acoustics are absolutely necessary in classrooms and learning spaces (Lubman & Sutherland, L. 2001, para. 1). Up to 60% of classroom learning typically involves listening and participating in spoken communications with the teacher and other students (Bronzaft, 2000, p. 3). Disruption of this communication surely has an effect upon student achievement, particularly for those students with hearing impairments, learning disabilities, or those who are not learning in their native language (Lubman & Sutherland, para. 7). Controlling noise may have a positive influence on achievement (Lanham, 1999, p.131). Schools with less noisy external environments were associated with higher achievement (Cash, 1993, p. 79).

Noise may emanate from many sources including; other classrooms, road traffic, trains, aircraft, and building mechanical systems (Fisher, 2001, p. 4). Noise levels may affect stress, verbal interaction, blood pressure, and the ability to concentrate (Fisher, 2001, p. 4). Noise reducing applications may include: increased use of carpet, acoustic ceiling tiles, softer wall finishes, noise absorbent materials in artwork, softer upholstery, and better sound insulation around adjoining walls and between classrooms as well as the use of sound baffles in larger spaces (Fisher, 2001, p. 4). Earthman (2002) noted that students learn more when the classroom noise level is reduced to approximately 40 decibels (p. 4). Most modern buildings have acoustical control measures, but older buildings generally do not have such measures to control noise (Earthman, 2002, p. 8).

Furniture

Furniture in educational settings should be durable and have a long life, allow students to perform tasks in comfort, have the flexibility to adapt to the varying needs of students, and be affordable so as not to drain school budgets (Kennedy, 2013, p. 36). Due to the changing nature of student activities, ergonomic factors have become more of an issue (Kennedy, 2013, p. 37). Children may be required to sit for long periods of time in front of a computer which may lead to health problems (Kennedy, 2013, p. 37).

The Occupation Health and Safety Administration provides recommendations for proper workstation setup (Kennedy, 2013, p. 37). The mobility of the furniture should also be considered for both cleaning and rearranging purposes and may be enhanced through the use of casters or glides (Michael, 2013, para. 11). As technology becomes more prevalent, it is also important that furniture and equipment be adjustable in order to reduce glare on computer screens (Michael, 2013, para. 6). Studies of science laboratories have indicated strong causal links between the quality and availability of science equipment and furniture design to student behavior and learning outcomes (Fisher, 2001, p. 5). Cash (1993) noted that higher achievement levels were associated with schools with classroom furniture in better condition (p. 79).

Technology

The benefits of technology in combination with reduced costs in hardware and software have presented schools with an opportunity to enhance the educational opportunity for all students (Earthman, 2009, p. 229). Older facilities often lack the flexibility needed for innovative programming as the physical structure often limits the feasibility for the installation of instructional technology (NCES, 1999, p. 2). Of the 29%

of schools determined to be in the “oldest” condition or defined as those more than 25 years old or renovated almost 20 years ago, only 42% were connected to the Internet in 1995 (NCES, 1999, p. 2). Fifty-nine percent of schools in the “newest” condition or those built in 1985 or later were connected to the Internet in 1995 (NCES, 1999, p. 2). Construction and renovation aimed at modernizing libraries includes extensive design remodeling in order to accommodate for Internet access, multi-media, and other new technologies (Fisher, 2001, p. 5). Access to the multitude of teaching and learning materials available on the Internet must remain a priority for financial planners and technology officials (Lanham, 1999, p. 131).

Conflicting Research on School Facilities and the Relationship to Student Achievement

The research is divided on the influence of school facility upon student achievement. Although conventional wisdom would suggest that the condition of school facilities has an effect on student learning, researchers have had trouble demonstrating a statistically significant correlation (Odden & Picus, 2008, p. 174). There are no conclusive findings as to whether school buildings affect student achievement despite the several hundred studies that have been performed (Odden & Picus, 2008, p. 174). A significant number of the studies were based on the open schools movement in the 1970s and no longer apply to today’s schools while others have major methodological flaws and have produced conflicting and ambiguous results (Odden & Picus, 2008, p. 174). Studies that have been completed thus far have only controlled for a small fraction of all of the great many factors that could influence student achievement in addition to the age of the school facilities (Odden & Picus, 2008, p. 175). These factors may include: building renovations, teacher credentials, students on Free and Reduced Lunch (FRL), single-parent families, school size, length of school day, and host of other factors (Odden & Picus, 2008, p. 175).

In a review of over 230 studies pertaining to the relationship between school facilities and student achievement, Earthman and Lemasters (1996) concluded that it was difficult to determine any definite line of consistent findings (p. 3). There are researchers who state that the building has such an insignificant influence upon the user that whatever effect is evident is simply due to chance (Earthman & Lemasters, 1996, p.1). Others contend that the school facility does have a marked influence upon the process of teaching and learning (Earthman & Lemasters, 1996, p.1). These researchers affirm that the building occupants are influenced both positively and negatively by how the built environment either allows them to function or inhibits the process of teaching and learning (Earthman & Lemasters, 1996, p.1). Systematic analysis of whether building has an effect on student achievement on a large enough scale to generalize or predict has not been undertaken (Earthman & Lemasters, 1996, p.1).

Context for Study

> The idea of "America as a land of opportunity" captures an essential part of our national spirit and heritage, and public education is often viewed as the institution that can transform that idea into a reality. Thus, to many, an equitable system of education is one that offsets those accidents of birth that would otherwise keep some children from having an opportunity to function fully in the economic and political life of the community. (*Berne & Stiefel, 1999, p. 7)*

As the quality of school facilities has been linked to student performance, some researchers are concerned about the disproportionate effect of poor air quality in schools on students from racial minority groups and those of lower socioeconomic status (Schneider, 2002, p. 4). Data from the United States General Accounting Office (GAO) report in 1996 on school facilities directly confirms that schools serving poor and minority students do suffer disproportionately from poor IAQ (Schneider, 2002, p. 5). As with many issues that link school facilities to educational outcomes, the demands of environmental justice and social justice overlap and call attention to the disproportionate circumstances that poor and minority students experience in education (Schneider, 2002, p. 5). Higher standards and expectations are repeatedly demanded of urban schools, but far lower standards in ethical respects appear to be expected of the dominant society that isolates these children in unequal institutions (Kozol, 2005, p. 44).

School Facility Finance Litigation in Colorado: *Giardino versus Colorado State Board of Education*

Those advocating for educational equity and adequacy in the United States have been involved in numerous lawsuits since 1896. The focus of the latest round of school finance litigation is based on adequacy claims which contend that state funding formulas prevent students from obtaining an adequate education. The adequacy argument could prove to be a more efficient path toward equity as students could be guaranteed a minimal quality of education (Weiler, Cornelius, & Brooks, 2012, p. 13). However, the adequacy argument, although proven to be more successful, has not achieved the desired outcomes of a quality education and learning environment for all of the nation's students as well as Colorado's as of yet.

A class action lawsuit filed in 1998 changed how Colorado contributes to K-12 capital construction (Donaldson, 2010). This was the *Giardino v. Colorado State Board of Education* case which alleged that the state failed to fulfill its constitutional responsibility to establish and maintain a thorough and uniform system of public schools due to the deteriorating conditions and overcrowding in many public schools throughout the state (Donaldson, 2010). Senate Bill 00-181 required the General Assembly to allocate $190 million for public school capital construction over a period of 11 years, and, in 2008, the Building Excellent Schools Today (BEST) Act was enacted (Donaldson, 2010). The program was created to provide grants to public schools to rebuild, repair, or replace the worst of Colorado's K-12 facilities (Donaldson, 2010). The BEST program is administered by the Capitol Construction Assistance Board (CCAB) and includes experts in school finance and facilities planning (Donaldson, 2010). Further discussion of this program is included in Chapter III.

As those advocating for educational equity have come to realize that an adequacy argument is a more favorable method in approaching a more equitable system, perhaps this is the route that should be taken. However, considering the Constitution calls for a thorough and uniform system of free public education and given the fact that some school facilities are clearly substandard when compared to others, educational leaders must advocate not only for a uniform educational funding system, but also uniform standards for school buildings given the influence that the quality of school facilities may have upon student achievement.

The Problem

Although considerable rigorous and academically sound empirical quantitative research work has been carried out in the United States pertaining to the condition of school facilities and student achievement, the sample sizes vary between studies as do the levels of correlation between achievement and building conditions (Fisher, 2001, p. 1). Therefore, it is suggested that more studies need to be carried out with regard to the correlations between condition of school facilities and academic achievement in order to fully validate the findings (Fisher, 2001, p. 1). Studies by the United States General Accounting Office (GAO) have determined widespread physical deficiencies in many school facilities with an average building age of roughly fifty years (Schneider, 2002, p.1). School districts, states, and communities are working hard to build, renovate, and modernize aging K–12 educational facilities and adapt to shifting student enrollments (Schneider, 2002, p.1). A report by the GAO in 2000 estimated the costs of repairs and renovations to the nation's schools at $322 billion (GAO, 1996, p. 1).

Conclusion and Implications

The system of public education finance in America has created considerable disparities in funding and opportunities for K-12 education among schools, local school districts, and states (Ladd et al., 1999, p. 1). Sadly and all too often, school districts with more-costly-to-educate students have lower property tax bases (Ladd et al., 1999, p. 1). Although, the effects of low wealth are offset by small amounts of aid from the federal government and larger amounts from state governments, significant disparities remain (Ladd et al., 1999, p. 1). It is a common belief that it is inequitable to have high levels of spending in some school districts and low levels in others (Ladd et al., 1999, p. 1). As educational funding significantly influences the condition of school facilities and considering that facilities may affect student achievement, it is important to consider the condition of school facilities. As the link between school funding and improving school performance has received greater attention in recent years, there seems to be a greater awareness of the ways in which educational funds are used and distributed within the public school system as well as a growing awareness of the economic and social disadvantages facing individuals whose academic achievement is low (Ladd et al., 1999, p. 1).

It is clearly evident that schools are not on a level playing field at a time when greater emphasis is being placed upon assessment scores. Lanham (1999) expressed that the expectation that all schools, regardless of socioeconomic status, to achieve at the same level of achievement on the same time schedule is not supported (p. 130). Those setting educational policy should take this information into account as the expectations for student achievement and school accreditation are established (Kozol, 2006, p. 250). United States Representative Chaka Fattah utilized this language, “If the federal government can hold a district or state accountable for demonstrating high performance by its students on their standardized exams, the federal government should also have the power to hold states accountable for making sure that children in all districts are provided with the resources needed to meet these high demands" (Kozol, 2006, p. 250).

CHAPTER III

METHODOLOGY

Included in Chapter III are the following: an identification of the sample population in this study, a review of the setting and context, and a discussion of the research questions. The methods of data collection, including a description of the Colorado Facilities Conditions Index (FCI) and the Colorado Student Assessment Program (CSAP) data used in the study are provided. The independent, dependent, and control variables are identified. The analysis section describes the hierarchical multiple regression (HMR) models that were used in this study.

Participants

Many of Colorado's school districts are coping with aging facilities, changing educational programs, and growth in all or some of their schools (CDE, 2010, p. 15). Addressing school facility condition is critical in meeting the Colorado Department of Education's (CDE) *Forward Thinking* strategic plan (CDE, 2010, p. 15). The FCI as indicated in the Statewide Financial Assistance Priority Assessment, facilitated by and completed in FY 2009-2010, provided a measure of the quality of learning spaces for every public school in the state of Colorado. The school fiscal year is defined as the 12 month school year beginning July 1 and ending June 30.

The participants in this study included all traditional public elementary school facilities with grade 5 as the highest grade level in the state of Colorado as indicated in the Statewide Financial Assistance Priority Assessment during the 2009-2010 school year (N=544). During the 2009-2010 school year, there were 1,041 schools classified as elementary in Colorado (CDE, n.d.[g]). Nine hundred and fifty of these schools were non-charter schools, which consisted of 58.1% of the traditional K-12 public schools in the state (National Alliance for Public Charter Schools, n.d.). Additionally, the schools classified as elementary during the 2009-2010 school year ranged from infant to ninth grade in their configurations. In order to promote consistency and eliminate variability in the population, traditional public elementary schools with grade five as the highest grade level were chosen as they far outnumber both middle and high schools. The charter school movement in Colorado originated in 1993 (A Parents Voice, n.d., para. 2). Charter schools were excluded in this study due to possible differences in student demographics and curricular programming. Furthermore, charter school facilities conditions may differ from traditional public schools as in the case with online charter schools and the complete absence of a physical facility.

Setting

During the 2012-2013 school year, the Colorado Department of Education (CDE) oversaw 178 public school districts which housed 863,561 students with an average per pupil funding of $6,480.00 (CDE, n.d.[b], p. 1). This represented an increase of 9,296 students from the October 2011 count of 854,265 students (CDE, n.d.[f], p. 1). There were approximately 832,368 students with an average per pupil funding of $7,076.00 in FY 2009-2010 or the time that the Statewide Financial Assistance Priority Assessment was completed (CDE, n.d.[b], p. 1). The 1,041 elementary schools during the 2009-2010 school year had a student membership of 425,651, middle/junior high schools totaled 287 with a student membership of 139,885, and senior high schools totaled 457 with a student membership of 266,832 (CDE, n.d.[g]). In reference to the above statements, is important to note that, as the age of Colorado's school facilities has increased, the funding for education has decreased.

Rural is defined as an area with fewer than 2,500 people or a place with a ZIP code designated as rural by the Census Bureau (United States Department of Education (DOE), 1995). The United States Department of Education (DOE) defines a small rural school district as a district with an average daily attendance of less than 600 students or that which is located in a county with a population density of fewer than 10 people per square mile (Rural Assistance Center, n.d.). One hundred and five of the 178 districts in Colorado meet the definition of small rural while 43 are classified as rural (CDE, n.d.[b], p. 1). Eighty percent of the rural districts in the state accommodate just over 150,000 pupils or approximately 20% of the total student population (CDE, n.d.[b], p. 1). Rural school districts have a lower number of students and receive less per-pupil revenue from the state than those in more populated areas. Additionally, they often have greater difficulty in generating revenue for school facilities as property values tend to be less. Eighty-three school districts in Colorado house less than 500 students (CDE, n.d.[b], p. 1). There are currently 1,058 elementary, 287 middle, and 479 high schools for a total 1,824 instructional facilities in Colorado (CDE, n.d.[b], p. 1). Student enrollment has grown every year since 1988 with nearly a 41% growth rate in the last two decades (CDE, n.d.[b], p. 1).

In 2009, the Colorado Department of Education (CDE) created an advisory committee to collaborate with key stakeholders to develop the Education Accountability

Act (CDE, n.d.[d]). These stakeholders included: the Technical Advisory Panel for Longitudinal Growth, the Commissioner's Superintendent Advisory Committee, representatives from regional superintendent groups, the Board of Cooperative Educational Services, the Colorado Association of School Executives, and the Colorado Association of School Boards (CDE, n.d.[d]). According to the Education Accountability Act of 2009 (SB 09-163), the Colorado Department of Education (CDE) is authorized to conduct annual reviews of the performance of public schools and districts throughout the state (CDE, n.d.[c]). Recommendations are also made by CDE to the State Board of Education concerning school improvement plans and accreditation categories for school districts (CDE, n.d.[c]). Accreditation categories are assigned to districts by CDE based on school and district performance frameworks. The frameworks evaluate the attainment of key performance factors which include: academic achievement, academic growth, academic gaps, and postsecondary workforce readiness. School districts may use Colorado state performance frameworks or their own more extensive frameworks (CDE, n.d.[d]).

According to Colorado Education Facts and Figures (CDE, n.d.[b], p. 1), 8.8 % of school districts in Colorado were accredited with distinction, 51.6 % were accredited, 30.2 % needed improvement, 7.7 % were on priority improvement, and 1.1 % were on turnaround status in 2012-2013. However, in her book *The Death and Life of the Great American School System*, former assistant to the secretary of education and educational historian, Diane Ravitch (2010) noted that Colorado has some of the lowest expectations for proficiency in the country and a student in Colorado might pass in-state assessments easily, but may be in academic difficulty in other states (p. 107).

Research Questions and Discussion

The research question proposed in this study specifically attempted to answer the following, "Is there a relationship between the condition of Colorado elementary school facilities and student achievement?" Three specific questions pertaining to the possible relationship between school facility conditions and student achievement were answered through this study:

Q1 Is there a relationship between school facility condition as indicated by the Facilities Conditions Index (FCI) in traditional Colorado public elementary schools during the 2009-2010 school year and student achievement on the Colorado Student Assessment Program (CSAP) in *reading* while controlling for Free and Reduced Lunch (FRL), English Language Learner (ELL), and Special Education (SPED) populations?

Q2 Is there a relationship between school facility condition as indicated by the Facilities Conditions Index (FCI) in traditional Colorado public elementary schools during the 2009-2010 school year and student achievement on the Colorado Student Assessment Program (CSAP) in *writing* while controlling for Free and Reduced Lunch (FRL), English Language Learner (ELL), and Special Education (SPED) populations?

Q3 Is there a relationship between school facility condition as indicated by the Facilities Conditions Index (FCI) in traditional Colorado public elementary schools during the 2009-2010 school year and student achievement on the Colorado Student Assessment Program (CSAP) in *math* while controlling for Free and Reduced Lunch (FRL), English Language Learner (ELL), and Special Education (SPED) populations?

Multiple regression is a statistical procedure for exploring the individual and combined effect of multiple independent variables on a single dependent variable (Creswell, 2008, p. 368). Hierarchical Multiple Regression (HMR) consists of a series of simultaneous multiple regression analyses in which one or more independent variables, also called predictors, are added to those used in the previous analysis (Grimm & Yarnold, 1995, p. 59). Hierarchical multiple regression (HMR) was used in this study in order to determine the relationship between a measure of school facility condition (FCI), as the independent variable, and a measure of student achievement (CSAP) as the dependent variable. Control variables particular to each elementary school included: total SPED, total ELL population, and total FRL population. The following null hypotheses were tested:

H1 There will be no relationship between the Facilities Conditions Index (FCI) and student achievement in Colorado elementary schools on the Colorado Student Assessment Program (CSAP) in *reading* when controlling for the variables of Free and Reduced Lunch (FRL), English Language Learner (ELL), and Special Education (SPED) populations.

H2 There will be no relationship between the Facilities Conditions Index (FCI) and student achievement in Colorado elementary schools on the Colorado Student Assessment Program (CSAP) in *writing* when controlling for the variables of Free and Reduced Lunch (FRL), English Language Learner (ELL), and Special Education (SPED) populations.

H3 There will be no relationship between the Facilities Conditions Index (FCI) and student achievement in Colorado elementary schools on the Colorado Student Assessment Program (CSAP) in *math* when controlling for the variables of Free and Reduced Lunch (FRL), English Language Learner (ELL), and Special Education (SPED) populations.

Data Collection and Instrumentation

This section includes a discussion of the data collection and instrumentation. Data specific to school facilities in Colorado includes an overview of the study participants, the Statewide Financial Assistance Priority Assessment, the FCI, and how the data was used. This is followed by a discussion of the control variables which included: SPED, ELL, and FRL populations. These control variables were used to ensure school similarity beyond the condition of the facility as may have an influence upon student achievement. The section concludes with a discussion of the dependent variable or CSAP data used to evaluate student achievement.

Data on School Facilities in Colorado

The participants in this study included all traditional public elementary school facilities in the state of Colorado with grade 5 as the highest level as indicated in the Statewide Financial Assistance Priority Assessment, FY 2009-2010 (N=544). As part of the Building Excellent Schools Today (BEST) Act, the Public School Capital Construction Assistance Board (CCAB) had the assessment conducted for all school facilities in Colorado during FY 2009-2010. The assessment included approximately 8,419 school facilities in Colorado's 178 school districts (CDE, 2010, p. 5).

Statewide financial assistance priority assessment. Parsons Commercial Technology Group was selected by the CCAB to conduct the assessment of school facilities throughout Colorado. Parsons is a national company specializing in school facility assessment, design, and construction management(CDE, 2010, p. 9) . The assessment was completed in December of 2009 and resulted in the FY 2009-2010 report and the subsequent Facilities Conditions Index (FCI) (CDE, 2010, p. 9).

The FCI was derived through a Condition Assessment that consisted of an evaluation of the physical condition of facilities and included a visual and non-destructive survey to collect facility system and element data. A non-destructive survey indicates that no part of the building or grounds was dismantled or damaged throughout the evaluation. These data were analyzed using a customized cost model per facility. The condition assessment included a system life cycle analysis, detailed descriptions of deferred maintenance deficiencies, and an analysis of condition related guidelines criteria for each facility. Condition capital renewal needs were predicted and an overall FCI was calculated (CDE, 2010, p. 11). This index was calculated as a ratio of the cost to repair any building deficiencies over the cost to replace the entire building resulting in a percentage. An FCI of 100% indicates that a building is in very poor condition and needs to be replaced, while an FCI of 0% indicates that the facility needs no repairs and is in excellent condition. The greater the percentage, the greater the facilities needs or the poorer the condition of the building.

The Statewide Financial Assistance Priority Assessment in FY 2009-2010 categorized the facilities into three distinct tiers. Tier I facilities include academic facilities such as school grounds, classrooms, libraries, and other teaching/learning spaces (CDE, 2010, p. 15). Storage, temporary modular classrooms, and other support facilities are incorporated into Tier II (CDE, 2010, p. 15). Administrative, maintenance, and transportation offices and facilities are included in Tier III (CDE, 2010, p. 15). The Facilities Conditions Index (FCI) pertains only to Tier I facilities or the teaching/learning spaces evaluation. This FCI percentage was used in this study to determine the relationship between school facility condition and student achievement for each traditional public elementary school with grade 5 as the highest level throughout the state of Colorado. The Statewide Financial Priority Assessment FY 2009-2010 also included a Suitability Assessment which evaluated how well each facility supported the educational program and an energy audit to evaluate the facility energy cost and usage. However, these assessments were not used in the FCI calculation and are therefore, not applicable to this study.

Independent Variable

The independent variable influences or affects an outcome or dependent variable (Creswell, 2008, p. 127). The independent variable may also be referred to as one of many predictor variables (Glass & Hopkins, 1996, p. 153). The Facilities Conditions Index (FCI) as a percentage for each traditional public elementary school with grade 5 as the highest level in the state of Colorado was used as the independent variable in this study. The FCI is specific to Tier I facilities or teaching/learning spaces (CDE, 2010, p. 15). As the relationship between the condition of school facility teaching/learning spaces and student achievement was investigated in this study, the Facilities Conditions Index (FCI) served as a suitable independent variable. The FCI was used to establish a relationship or correlation to the dependent variable of CSAP student achievement data from FY 2009-2010 when controlling for SPED, ELL, and FRL populations in each traditional public elementary school with grade 5 as the highest level in the state of Colorado. School assessment data and percentages of SPED, ELL, and FRL populations for the 2009-2010 school year were obtained through data requests to the Colorado Department of Education (CDE) and via the SchoolView database.

Control Variables

Control variables are a type of independent variable that researchers measure for the purposes of eliminating them as a possibility, but they are not a central variable of concern in explaining the dependent variable or outcomes (Creswell, 2008, p. 128). This section explains the rationale for the use of the control variables in this study. Statistical control is a technique that separates out the effect of one particular independent variable (FCI) from the effects of the predictor or control variables (FRL, ELL, and SPED populations) upon the dependent variable (CSAP achievement data). The control variables in this study needed to be held constant in order to establish that an effect (change in CSAP achievement) is due to a particular independent variable (FCI). The

Special Education (SPED), English Language Learner (ELL), and FRL (Free and Reduced Lunch as measure of socioeconomic status) populations may influence the results of standardized test scores. Academic programming and the level of funding available to support these programs may vary within particular schools and districts. These variables were controlled for in this study in order to determine whether school facility condition has a relationship with student achievement. Total percentages of students in grades 3, 4, and 5 was obtained for SPED, ELL, and FRL populations for each traditional Colorado elementary school with grade 5 as the highest level through data request to CDE and via the SchoolView database.

Special education student population. Children in SPED are provided accommodations through an Individualized Education Program (IEP). The Individuals with Disabilities Education Act (IDEA) is a law that mandates services to children with disabilities throughout the United States (DOE, n.d.). According to the Colorado Department of Education (CDE), Colorado provided services to 84,184 SPED students in 2010 (CDE, n.d.[e]). As schools with disproportionate numbers of children enrolled in SPED may result in varying student achievement data, it is important to control for this variable. Children in SPED were provided with IEPs in each traditional public Colorado elementary school during the 2009-2010 school year. The total percentage of students in SPED in grades 3, 4, and 5 for each school in this study was determined in order to control for this variable.

English language learner student population. English language learner (ELL) refers to students being served in appropriate programs of language assistance such as English as a Second Language, High Intensity Language Training, or bilingual education

(National Center for Educational Statistics [NCES], 2013, para. 2). The percentage of public school students in the United States who were English language learners during the 2010-2011 school year was approximately 10 percent, or 4.7 million students (NCES, 2013, para. 2). Achievement gaps between ELL and non-ELL students on the National Assessment of Educational Progress (NAEP) reading assessment in 2011 were 36 points at the fourth grade level and 44 points at the eighth grade level (NCES, 2013, para. 1). Colorado was among eight states with an ELL population of 10 percent or more in 2010-2011 (NCES, 2013, para. 2). As the English Language Learner (ELL) population within a school may have an influence upon student achievement, it is important to control for this variable as well. The total percentage of ELL students in grades 3, 4, and 5 for each school in this study was used in order to control for this variable.

Free and reduced lunch population. School FRL population is an indicator of socioeconomic status which may influence various student outcomes including student achievement. Lower-income students typically tend to score lower on standardized tests than more advantaged students (Paton, 2014, para. 4). Therefore, the number of students eligible for free and reduced lunch in each elementary school was controlled for in this study. The federal poverty level (FPL) is determined by the Department of Health and Human Services (HHS) and is the set minimum amount of gross income that a family needs to acquire necessities for living such as food and shelter (Business Dictionary.com, n.d.). In 2009-2010 this value was set as $18,310 for a family of three and $22,050 for a family of four (Low Income Home Energy Assistance Program [LIHEAP] Clearinghouse, n.d.). Public school students may qualify for free lunches if their families' income is below 130% of the federal poverty level and reduced price lunches if their family's income is below 185% of the federal poverty level. In 2009, 38% of Colorado's children were eligible for FRL (Kids Count Data Center, n.d.). Children who are members of households receiving food stamp benefits or cash assistance through the Temporary Assistance for Needy Families block grant, homeless, runaway, and migrant children also qualify for free meals (New America Foundation, 2013a, para. 6). In a study of physical fitness, academic achievement, and socioeconomic status, lower SES students scored significantly worse on all tests (Coe, Peterson, Blair, Schutten, & Peddie, 2013, p. 500). The total percentage of students eligible for FRL in grades 3, 4, and 5 for each school in this study was determined in order to control for this variable.

Dependent Variable

The dependent variable is an outcome variable that is measured in response to the independent variable (Glass & Hopkins, 1996, p. 153). The dependent variable is dependent upon or influenced by the independent variable (Creswell, 2008, p. 126). The following section includes a discussion of the Colorado Student Assessment Program (CSAP) as the dependent variable in this study and details the assessment's history and standards, content and structure, and reliability and validity. The cumulative percentage of those students scoring proficient and advanced on CSAP in reading, writing, and math for each traditional public Colorado elementary school with grade 5 as the highest level during the 2009-2010 school year was used as the dependent variable in this study. Students are scored as unsatisfactory, partially proficient, proficient, and advanced on CSAP. However, data pertaining to student achievement may be obtained as a cumulative percentage of those students scoring proficient/advanced on CSAP. In the era of accountability, schools are challenged to have all students scoring proficient and advanced. As academic performance is measured by the number of students scoring proficient and advanced within a particular school, this study used this cumulative percentage. The objective was to determine whether the relationship between student achievement and school facility condition.

Standards of Colorado Student Assessment Program achievement data. The Colorado Student Assessment Program (CSAP) began in 1997 with assessments in 4th grade reading and writing and were originally designed to provide an indication of how well Colorado students were achieving the content standards in reading, writing, math, and science that were adopted in 1995 (Dehoff, 2011, para. 1). In the year 2000, the assessments included 8th grade math and science, 7th grade reading and writing, and 3rd grade reading (Dehoff, 2011, para. 1). According to Colorado law, every student enrolled in a public school is required to take the CSAP or CSAP-A (an assessment for students with significant cognitive disabilities) (CDE, 2011). Prior to the adoption of the Transitional Colorado Assessment Program (TCAP) in FY 2011-2012, the latest CSAP assessments were administered in grades 3 through 10 in reading, writing, and mathematics and in grades 5, 8, and 10 in science (CDE, 2011). In 2010, the participation rate among Colorado students taking the CSAP was 99% with 1,608,846 tests administered (CDE, 2011). Students in grades three through ten spent approximately nine to twelve hours in CSAP testing every year (CDE, 2011). Colorado received approximately $500 million in federal Title I funding each year, and therefore, the federal government required Colorado to assess all students in CSAP content areas and report student performance (CDE, 2011).

Content and structure. Achievement data from the CSAP was obtained through data requests to the Colorado Department of Education (CDE) and via CDE's SchoolView database. This study used CSAP achievement data for the FY 2009-2010 as the Statewide Financial Assistance Priority Assessment was completed in December of 2009 for the FY 2009-2010. The CSAP assessments are comprised of the following: reading, writing, and math given in grades 3-10; and science given in grades 5, 8, and 10 (Dehoff, 2011, para. 1). As the assessment of school facilities was completed in December 2009, it was most beneficial to obtain student assessment data from the 2009-2010 school year given that the condition of school facilities may change over time. The cumulative percentage of those students scoring proficient and advanced on CSAP in reading, writing, and math for each traditional Colorado elementary school during the 2009-2010 school year was used as the dependent variable in this study.

Reliability and validity. CSAP is a criterion-referenced assessment as students are assessed and scored relative to a fixed, objective standard (Dehoff, 2011, para. 2). This standard is the score that is determined to be "Proficient" in the standards for a particular subject and grade level (Dehoff, 2011, para. 2). A criterion-referenced test is different than a "norm-referenced" test such as the Iowa Test of Basic Skills (Dehoff, 2011, para. 3). A norm-referenced test reports results in percentiles (Dehoff, 2011, para. 3). A student scoring at the 50th percentile did better than half of the students that took the test. Norm referenced tests provide little information regarding performance relative to a standard (Dehoff, 2011, para. 4). A student scoring at the 50th percentile on a grade-level reading test may in fact be reading below level (Dehoff, 2011, para. 4). Therefore, Colorado and eventually every other state in the nation began using criterion-referenced assessments (Dehoff, 2011, para. 4).

Data Analysis

The data analysis section includes a discussion of the Facilities Conditions Index (FCI), how data in this study was obtained, hierarchical multiple regression (HMR), data handling procedures, reliability and validity, and risks, discomforts, and beliefs. An examination of the relationship between the dependent variable (CSAP) and independent variable (FCI) when controlling for the control or predictor variables of FRL, ELL, and SPED population was conducted through this study. These analyses were conducted within the Statistical Program for the Social Sciences (SPSS) program. This study used hierarchical multiple regression (HMR) analyses. The basis for linear regression models is the assumption of a linear relationship between one variable and another (Davis, 2007, p. 64). The basis for hierarchical multiple regression (HMR) analysis is to evaluate the relationship between a group of metric or numeric independent variables and a dependent variable when controlling for the effects of some other independent variables (predictor or control variables) on the dependent variable (Salkind, 2014, p. 294). The feature that distinguishes multilevel models from traditional regression is the modeling of the variation between groups (Gelman & Hill, 2006, p. 2).

Statewide school results derived from the Statewide Financial Assistance Priority Assessment completed in FY 2009-2010 were provided by CDE via an Excel spreadsheet. All data in this study were obtained through data requests to CDE or via the SchoolView database. All percentages in the final data collection were rounded to the nearest hundredths place. Data requests to the Colorado Department of Education (CDE) were made by completing a data request form available on the CDE website. An application to the Institutional Review Board (IRB) at the University of Northern Colorado was submitted and approved. As all data included in this study are accessible to the public, there was no need to obtain consent. Additionally, no names or any identifying information of specific schools or students were disclosed in this research. All relevant data were accumulated onto an Excel spreadsheet and uploaded into the Statistical Program for the Social Sciences (SPSS) program in order to acquire a final code sheet. Variables and data for each school in this study included the following names and codes:

- elementary school (ELEM) coded as 001,002,003...
- Facilities Conditions Index (FCI) as a percentage.
- Student achievement (CSAPR) as a percent proficient or advanced in Reading.
- Student achievement (CSAPW) as a percent proficient or advanced in Writing.
- Student achievement (CSAPM) as a percent proficient or advanced in Math.
- English Language Learners (ELL) as a cumulative percentage in grades 3, 4, 5.
- Free and Reduced Lunch (FRL) as a cumulative percentage in grades 3, 4, 5.
- Special Education (SPED) as a cumulative percentage in grades 3, 4, 5.

Facilities Conditions Index and Correlation to Student Achievement

The Facilities Conditions Index (FCI) as obtained via an existing data set through CDE was used to conduct this study. The FCI for each public elementary school facility as indicated in the Statewide Financial Assistance Priority Assessment completed in FY 2009-2010 was used as the independent variable. Student achievement data on CSAP in reading, writing, and math for FY 2009-2010 were used as the dependent variables. Cumulative percentages of Free and Reduced Lunch (FRL), English Language Learner (ELL), and Special Education (SPED) populations were used as control variables in order to determine the relationship between facility condition according to the FCI and student achievement on CSAP. A negative correlation between the FCI and student achievement was predicted. In other words it was hypothesized that higher student achievement would be associated with better building condition and lower student achievement would be associated with school facilities in worse condition. As measures of correlation are used to describe relationships between two variables (Glass & Hopkins, 1996, p. 103), this was a correlation study in order to test for trends and statistical significance in the relationship between the condition of school facilities and student achievement data. The Facilities Conditions Index (FCI) as indicated in the Statewide Financial Assistance Priority Assessment FY 2009-2010 was used as the independent variable (CDE, 2010, p.104). As larger sample sizes increase the generalizability of the results, this study included all traditional public elementary school with grade 5 as the highest level in the state of Colorado (N = 544). The FCI was used in order to establish a relationship to the dependent variable of FY 2009-2010 CSAP data. As there are many factors that may have an effect upon student achievement in addition to the condition of the school facility, this research controlled for SPED population, ELL population, and socioeconomic status through FRL population. This research included hierarchical multiple regression (HMR) analyses in order to examine the relationship between achievement data (CSAP) and building condition (FCI) across the state while controlling for ELL, SPED, and FRL populations. Further analyses were conducted in order to determine the influence of the of FCI upon CSAP scores beyond the influence of individual control variables as well as control variable variations. Simple linear regression analyses between the CSAP in reading, writing, and math and the FCI were also completed. See Appendix A for a conceptual model of this study.

Hierarchical Multiple Regression

Multiple regression is used to explore the relationship between one continuous dependent variable and a number of independent variables or predictors that are usually continuous (Pallant, 2013, p. 154). In hierarchical multiple regression (HMR), successive linear regression models are created in levels through the addition of independent or control variables into the model (Gelman & Hill, 2006, p. 4). The Statistical Program for the Social Sciences (SPSS) program is conducive to hierarchical multiple regression (HMR) as it allows for the statistical control of variables through the fixed order of entry into the program (Pallant, 2013, p. 155). Pearson's product moment correlation matrixes and hierarchical multiple regression analyses were completed in this study. An alpha of .05 was used for all tests as this level of significance ensures a high measure confidence in the predictability of statistical significance between variables (Glass & Hopkins, 1996, p. 158). Cresswell (2008) expressed the significance or alpha level as the probability level that reflects the maximum risk you are willing to take that any observed differences are due to chance (p. 196). The control variables of: Free and Reduced Lunch (FRL), English Language Learner (ELL), and Special Education (SPED) were entered into the first Model in order to examine the effect upon student achievement (CSAP). The independent variable of interest Facilities Conditions Index (FCI) was entered into Model 2 in order to examine the relationship to the dependent variable (CSAP) above the influence of the control variables (FRL, ELL, SPED populations). Separate analyses were ran for the dependent variable (CSAP) in reading, writing, and math. The following represents the HMR equation used in this study:

$$Yij = \beta 0j + \beta 1j(Xij_{1} + Xij_{2} + Xij_{3}) + eij$$

The score on the dependent variable (CSAP) is represented by Yij for an individual observation at level 1 pertaining to a particular school (subscript i) within the state (subscript j). The Model 1 control variables of FRL, ELL, and SPED populations are represented by $Xij_{1,}$ $Xij_{2\text{ , and}}$ $Xij_{3.}$ The symbol β0j refers to the intercept of the dependent variable (CSAP) in group (state) j (Level 2). The slope for the relationship in group (state) between the Model 1 control variables (ELL/SPED/FRL) and the dependent variable (CSAP) is represented by β1j. Random errors of prediction for the Model 1 equation are represented by eij (Tabachnick & Fidell, 2006, p. 791).

In Model 2, the dependent variables are the intercepts and the slopes for the control variables in Model 1. These are placed into the regression equation in Model 2:

$$Yij = \beta 0j + \beta 1j(Xij_{1} + Xij_{2} + Xij_{3}) + eij$$

$$\beta 0j = \gamma 00 + \gamma 01Wj + u0j$$

$$\beta 1j = \gamma 10 + u1j$$

The overall intercept or grand mean of scores on the dependent variable (CSAP) across the group (state) when all the predictors are equal to 0 is represented by $\gamma 00$. The independent variable of interest or Facilities Conditions Index (FCI) is represented by Wj. The overall regression coefficient or the slope, between the dependent variable (CSAP) and the Model 2 independent variable of interest (FCI) is symbolized by $\gamma 01$. The random error component for the deviation of the intercept of a group (state) from the overall intercept is represented by u0j. The overall regression coefficient or the slope, between the dependent variable (CSAP) and the Model 1 control variables (ELL/SPED/FRL) is represented by $\gamma 10$. The error component for the slope or deviation of the group slopes from the overall slope is symbolized by u1j (Tabachnick & Fidell, 2006, p. 791).

The Statistical Program for the Social Sciences (SPSS) program allows for the fixed order of entry of variables in steps or blocks in order to control for the effects of covariates or predictor variables or to test for the effects of certain predictor variables independent of the influence of others (Pallant, 2013, p. 155). The dependent variable (CSAP) is placed into the main dependent box of the linear regression model. The control or predictor variables (ELL, FRL, and SPED) are entered into the independent box. Clicking next clears out the box and allows for the entry of the independent variable of interest (FCI). The Facilities Conditions Index (FCI) is entered last so that any facility condition effect can remain independent of the effects of the control variables. The analysis is run by clicking "OK".

Figure 6

Hierarchical Multiple Regression Model

D.V.				Block 1				Block 2
CSAP: Student Achievement	=	SPED Population	+	FRL Population	+	ELL Population	+	FCI

The change in the coefficient of determination (R^2) in the model summary is examined to compare the results of the input of the Model 1 variables (ELL, FRL, SPED) with the input of the Model 2 variable or Facilities Conditions Index (FCI). The R^2 represents the percent of variability that can be accounted for by the FCI in Model 2 and the control variables (FRL, ELL, and SPED) in Model 1. The significance at both Model 1 and Model 2 is then evaluated. Again, an alpha of .05 was used for all tests as this level of significance ensures a high measure of confidence in the predictability of statistical significance between variables (Glass & Hopkins, 1996, p. 158). A p value of significance for Models 1 and 2 must be less than .05 in order to determine that the scores on the dependent variable (CSAP) are statistically significant when controlling for the variables of ELL, FRL, and SPED in Model 1 and the independent variable of interest (FCI) in Model 2. If a p value below .05 is obtained, the Coefficients table is examined to determine the weight of the individual variables within the model. The Beta (β) coefficients are examined to determine the weight of each variable within Model 1 and Model 2 as well as whether the variables are positively or negatively correlated. These β weights can multiplied by each score on the independent variable in order to obtain the predicted score on the dependent variable.

Data Handling Procedures

All document data including building characteristics, demographics, and student achievement data were password protected, stored, and locked in the researcher's home residence. The researcher was the only individual with access to the documentation. Specific facility or school district names and any identifying information were protected via the use of pseudonyms when necessary and were known only to the researcher. All data will be destroyed two years following the completion the researcher's doctoral dissertation at the University of Northern Colorado.

Reliability and Validity

The study of the relationship between school building quality and student achievement is complicated due to numerous factors that are difficult to isolate and measure objectively. The condition of school buildings may vary greatly in relation to the variables over which the school system has control (Earthman & Lemasters, 1996, p. 3). It is also important to note that facilities assessments provide a snapshot of conditions at the time of inspection and that building conditions do change subtly over time. Therefore, the facilities assessment and corresponding data should be viewed as ever-changing tools (CDE, 2010, p. 12).

To use student achievement (CSAP) as a dependent variable and the condition of the school building (FCI) as an independent variable is one avenue of study. However, it is understandable that difficulties may arise when trying to assess each building and corresponding achievement levels (Odden & Picus, 2008, p. 175). It may be difficult to control for the other factors such as thermal control, principal experiences, single-parent families, teacher credentials, and building upkeep, as well as other factors and how they affect student achievement as well as their relation to one another (Odden & Picus, 2008, p. 175). An example could be that a 40 year old building may have been built to last 100 years, but a building similar in age could have been built to last 35 years (Odden & Picus, 2008, p. 175). Many studies that have been completed have only controlled for a small fraction of all of these factors (Odden & Picus, 2008, p. 175). However, with each study conducted, more evidence mounts in the making of a stronger argument for the correlation between student achievement data and the condition of school facilities. The study included hierarchical multiple regression (HMR) analyses in order to determine the percentage of the variance in the dependent variable of student achievement (CSAP) to be explained by the independent predictor variable of building condition (FCI) above the influence of the control for the influence of FRL, ELL, and SPED populations upon student achievement across the state.

Risks, Discomforts, and Beliefs

There were no foreseeable risks as all facility evaluations, student achievement data, and field notes were kept confidential. Although, student achievement data was evaluated, there was no review of data specific to individual students. Benefits of this study included the establishment of a relationship between the condition of school facilities and student achievement in the state of Colorado and further evidence to support the funding of school facilities based on the influence of facility conditions upon student achievement.

Conclusion

The relationship between school facility condition as indicated by the Facilities Conditions Index (FCI) and student achievement on the Colorado Student Assessment

Program (CSAP) while controlling for total Special Education (SPED) population, total English Language Learner (ELL) population, and socioeconomic status through Free and Reduced Lunch (FRL) data was investigated in this study. Given the possible relationship between school facility condition and student achievement, it is critical that all children be able to learn in an adequate school facility. However, given the disparities among educational facility conditions throughout Colorado, it is important to note that the definition of adequate seems to differ among areas of varying socioeconomic status. As the condition of school facilities may influence student achievement, this study attempted to provide further evidence to support the funding of public school facilities on a more equitable basis.

CHAPTER IV

ANALYSIS

The purpose of this study was to answer the following question, "Is there a relationship between the condition of Colorado elementary school facilities and student achievement?" Initially, three hierarchical multiple regression analyses were ran in order to answer the following research questions:

Q1 Is there a relationship between school facility condition as indicated by the Facilities Conditions Index (FCI) in traditional Colorado elementary schools during the 2009-2010 school year and student achievement on the Colorado Student AssessmentProgram (CSAP) in *reading* while controlling for Free and Reduced Lunch (FRL), English Language Learner (ELL), and Special Education(SPED) populations?

Q2 Is there a relationship between school facility condition as indicated by the Facilities Conditions Index (FCI) in traditional Colorado elementary schools during the 2009-2010 school year and student achievement on the Colorado Student AssessmentProgram (CSAP) in *writing* while controlling for Free and Reduced Lunch (FRL), English Language Learner (ELL), and Special Education(SPED) populations?

Q3 Is there a relationship between school facility condition as indicated by the Facilities Conditions Index (FCI) in traditional Colorado elementary schools during the 2009-2010 school year and student achievement on the Colorado Student Assessment Program (CSAP) in *math* while controlling for Free and Reduced Lunch (FRL), English Language Learner (ELL), and Special Education (SPED) populations?

These analyses were completed in order to determine the percentage of the variance in the dependent variable of student achievement on the Colorado Student Assessment Program (CSAP) in reading, writing, and math as explained by the independent variable of interest or Facilities Conditions Index (FCI) as a depiction of school facility condition. The influence of the FCI upon student achievement was measured above the influence of the control variables of ELL, SPED, and FRL populations. Due to minimal R^2 changes indicating little or no variance in student achievement on the CSAP as explained by the FCI, as well as suggestions of multicollinearity between control variables, further analyses were conducted using multiple variations of the three control variables. Simple linear regression analyses between student achievement on the CSAP in reading, writing, and math and the FCI were also completed. These analyses were conducted to confirm the assumption of a weak correlation between CSAP scores and the FCI as well as to determine if the variance in CSAP scores was being explained completely by the control variables in Model 1 prior to the input of the FCI in Model 2. A total of 24 separate analyses were ran in order to confirm as well as examine the results in various models.

Data Cleaning

As this study sought to determine the relationship between the condition of Colorado elementary school facilities and student achievement, the population of the study was limited to traditional or non-charter, elementary schools with grade 5 as the highest level. There were 1,041 schools classified as elementary in Colorado during the 2009-2010 school year (CDE, n.d.[g]). Grade level configurations of these elementary schools varied from infant to 9th grade. Creswell (2008) defined a study population as a group that shares similar characteristics (p. 151). Therefore, in order to promote consistency and eliminate variability in the population, traditional Colorado public elementary schools with grade 5 as the highest grade level were chosen as the selection criteria for this study. Data pertaining to student achievement on the CSAP and the control variables of ELL, SPED, and FRL populations was obtained for each school and represented overall average percentages or whole-school indicators as derived from the combination of grades 3, 4, and 5. These elementary grade levels were subject to the CSAP testing at the time of this study and consequently, average scores of students scoring proficient or advanced in reading, writing, and math among the grade levels was obtained. Therefore, as with the FCI, all variables denoted whole-school indicators for each school. This process removed variability, allowed for a more standardized data set, and promoted greater consistency and accuracy in the assessment and demographic data across the elementary schools. According to Creswell (2008), the accuracy of data is of paramount concern in the collection process (p. 10). The steps described above served to enhance the overall consistency and accuracy of the overall data set in this study.

Stevens (1996) declared that the number of cases in a multiple regression should be 15 per predictor or independent variable (p. 72). The number of predictor or independent variables in this study is 4, which is conducive of a sample size of 60. Tabachnick and Fidell (2006) provide a formula for calculating sample size in regression analyses:

$N > 50 + 8m$

where m represents the number of independent variables (p. 123). According to this formula, an appropriate sample size for this study would be 82. However, this research included the entire population of traditional Colorado public elementary schools with grade 5 as the highest level (N=544). Including the entire population eliminated the need for generalizability that is assumed with small samples and the associated risk of obtaining a result that cannot be repeated with other samples (Pallant, 2013, p. 156). Displayed in Table 1 are grade level configurations and corresponding totals within the overall population.

Table 1

School Grade-Level Configurations within the Sample Population

Grade Level Configuration	I-5th	2nd-5th	3rd-5th	Pre-K-5th	K-5th	Total
Number of schools	1	3	7	358	175	544

Note. Definition of abbreviations: I=Infant, Pre-K=Pre-Kindergarten, K=Kindergarten

The Facilities Conditions Index (FCI) is a continuous single-level variable that represents the overall facilities condition of a particular school. This index was obtained by calculating the cost of recommended repairs divided by the cost to replace an entire facility and resulted in an index ranging from 0-100% (CDE, 2010, p. 5). An FCI of 100% indicates that a building is in very poor condition and needs to be replaced, while an FCI of 0% indicates that the facility needs no repairs and is in excellent condition. The greater the percentage, the greater the facility's needs or the poorer the condition of the building. As the FCI increases or approaches 100%, school facility conditions worsen. The integrity of the FCI index was maintained as a continuous variable in order to minimize the loss of information. The categorization of otherwise continuous variables comes with the expense of throwing away information (Tabachnick & Fidell, 2006, p. 6).

Consequently, data representing overall average percentages or whole-school indicators particular to each school as derived from grades 3, 4, and 5 combined were collected for the continuous dependent variable and continuous control variables.

Assessment data on the CSAP in reading, writing, and math was obtained from the Colorado Department of Education (CDE) via the SchoolView database. Data pertaining to the control variables of ELL, SPED, and FRL populations were obtained via an Excel spreadsheet as provided by CDE. This spreadsheet provided the total number of students in grades 3, 4, and 5 combined for each elementary school as well as the total number of students represented in grades 3, 4, and 5 combined for each of the control variables. Formulas were created in order to calculate the total average population for each of the control variables of ELL, SPED, and FRL in grades 3, 4, and 5 combined at each elementary school. The total number of students for each of the three control variables in each of the grade levels were added together and divided by the total number of students in grades 3, 4, and 5 at each elementary school in order to obtain an average whole-school percentage for each control variable. Therefore, all variables in this study depicted overall school percentages or whole-school indicators for each school in the study population (N=544). The variables were maintained as continuous single-level variables and were representative of overall school facilities in accordance with the independent variable of interest or Facilities Conditions Index (FCI).

Descriptive Statistics

Descriptive data for the dependent variable of CSAP in reading, writing, and math, the independent variable of FCI, and the control variables of English Language Learner (ELL), Special Education (SPED), and Free and Reduced Lunch (FRL) for the 544 schools in the study population during the 2009-2010 school year are displayed in Table 2. The study population consisted of all traditional Colorado public elementary schools with grade 5 as the highest level. The the mean percentage of students scoring proficient or advanced on the reading CSAP among the 544 schools in grades 3, 4, and 5 combined in the study population was 66.42%. The mean number of students scoring proficient or advanced on the CSAP in math was slightly higher at 67.54%, while the mean percentage of students scoring proficient or advanced in writing was 50.79%. The mean percentages of the control variables of ELL, SPED, and FRL populations in grades 3, 4, and 5 combined at each school was 19.90%, 10.99%, and 49.12% respectively. The mean Facilities Conditions Index (FCI) was 33.47% with a standard deviation of 21.05%.

Table 2

Descriptive Statistics

Variable	Mean	SD	N
Cum % CSAP-RDG in grades 3, 4, 5	66.42	17.64	544
Cum % CSAP-WRIT in grades 3, 4, 5	50.79	18.26	544
Cum % CSAP-MA in grades 3, 4, 5	67.54	16.77	544
Cum % ELL in grades 3, 4, 5	19.90	21.85	544
Cum % SPED in grades 3, 4, 5	10.99	4.07	544
Cum % FRL in grades 3, 4, 5	49.12	28.69	544
FCI % for each school	33.47	21.05	544

Note. Definition of abbreviations: Cum=Cumulative, RDG=Reading, MA=Math, WRIT=Writing, ELL=English Language Learner, SPED=Special Education, FRL=Free and Reduced Lunch, FCI=Facilities Conditions Index

Hierarchical Multiple Regression Analyses

Initially, three separate hierarchical multiple regression analyses were ran in order to answer the research questions and measure the variance in the dependent variable of Colorado Student Assessment Program (CSAP) in *reading, writing, and math* as a result of the independent variable of Facilities Conditions Index (FCI) when controlling for English Language Learner (ELL), Special Education (SPED), and Free and Reduced Lunch (FRL) populations. Variance is an indicator of the dispersion of scores around the mean (Creswell, 2008, p. 194). Further analyses were ran to eliminate any concern due to suggestions of multicollinearity between control variables as well as minimal R^2 changes after the Facilities Conditions Index (FCI) was entered into Model 2. These minimal R^2 changes indicated that little or no variance in the dependent variable of student achievement on the CSAP was explained by the input of the independent variable of FCI in Model 2 after the control variables of ELL, FRL, and SPED populations were entered in Model 1. Simple bivariate correlation or zero-order analyses between the CSAP in reading, writing, and math and the FCI were also completed. Additional analyses were ran using individual control variables as well as control variable variations. These analyses were conducted to confirm the assumption of a weak correlation between CSAP scores and the FCI as well as to determine if the variance in CSAP scores was being explained completely by the control variables in Model 1, particularly FRL population, prior to the input of the FCI into Model 2.

In hierarchical multiple regression (HMR), preliminary analysis includes checking the assumptions of normality, linearity, homoscedasticity, and multicollinearity. According to the assumptions of normality and linearity residuals should be normally distributed and have a straight-line relationship with predicted dependent variable scores (Pallant, 2013, p. 157). Residuals are the differences between the obtained and predicted dependent variable scores (Pallant, 2013, p. 157). In the scatterplot of standardized residuals the variance of residuals about the predicted dependent variable scores should be the same for all predicted scores or show a roughly rectangular distribution (Pallant, 2013, p. 165). Standardized residual plots and casewise diagnostics revealed the presence of a few outliers. However, with large sample sizes, such as applicable to the population in this study (N=544), a few outliers are expected and generally do not impact the results (Parke, 2013, p. 84). Analysis was completed with and without these cases and indicated no significant change in the results. Therefore, these cases were maintained in the analyses.

Multicollinearity occurs when independent, or predictor variables, are correlated with a Pearson r of .9 or above (Pallant, 2013, p. 157). However, variables with a bivariate correlation of .7 or above are subject to further scrutiny (Pallant, 2013, p. 164). Collinearity diagnostics are performed in order to detect issues with multicollinearity that may not be evident in the correlation matrix (Pallant, 2013, p. 164). The values for Tolerance and Variance Inflation Factor must then be examined. Tolerance is an indicator of how much variability in a particular independent variable is not explained by the other independent variables in the model (Pallant, 2013, p. 164). Tolerance is equal to 1- R^2 and values less than .10 indicate that further evaluation pertaining to multicollinearity is warranted (ResearchConsultation.com., n.d., para. 2). The Variance Inflation Factor is the inverse of the tolerance (one divided by the tolerance) and values above 10 indicate multicollinearity (Pallant, 2013, p. 164). Tolerance and Variance Inflation Factor values were evaluated for all analyses and indicated no Tolerance values less than .10 and FRL as the only variable with a Variance Inflation Factor above 2.5 in any of the analyses: reading (2.518), writing (2.520), math (2.520). The strength of the correlations between variables should be evaluated in the correlation matrix as these tolerance and Variance Inflation Factor values are commonly used cut-off points, but may still allow for quite high correlations (Pallant, 2013, p. 164). Therefore, due to Variance Inflation Factor values for FRL above 2.5, bivariate correlation values above .7 between ELL and FRL, and minimal R^2 change values following the addition of Facilities

Conditions Index (FCI) into the models; further analyses were conducted that included multiple control variable variations and simple bivariate or zero-order correlations.

Research Question 1:
Reading Analysis

The first analysis performed utilized hierarchical multiple regression (HMR) analysis to investigate the ability of the Facilities Conditions Index (FCI) to predict levels of student achievement on Colorado Student Assessment Program (CSAP) in reading after controlling for English Language Learner (ELL), Special Education (SPED), and Free and Reduced Lunch (FRL) populations. Preliminary analysis ensured no violation of the assumptions of normality, linearity, and homoscedasticity. Correlations revealed a negative relationship between CSAP scores in *reading* and the FCI as well as ELL, SPED, and FRL populations. Therefore, greater percentages of students scoring proficient or advanced in reading were associated with lower FCI indices or better facility conditions and lower percentages of ELL, SPED, and FRL populations. The values for ELL students (-.80) and FRL students (-.86) indicated a strong negative correlation between these control variables and the percentage of students scoring proficient or advanced on the reading CSAP during the 2009-2010 school year. Although weak, the values associated with SPED (-.25) and FCI (-.21) also indicated a negative correlation. Correlations with reading as the dependent variable are shown in Table 3. The bivariate correlation between ELL and FRL (.73) suggested possible mutlicollinearity. As mentioned above, this issue was addressed through the performance of further analyses.

Table 3

Reading Analysis Correlations Table

Pearson Correlation	RDG	ELL	SPED	FRL	FCI
Cum % RDG in grades 3, 4, 5	1.000	-.800	-.254	-.856	-.208
Cum % ELL in grades 3, 4, 5	-.800	1.000	.037	.734	.170
Cum % SPED in grades 3, 4, 5	-.254	.037	1.000	.270	.202
Cum % FRL in grades 3, 4, 5	-.856	.734	.270	.000	.239
FCI % for each school	-.208	.170	.202	.239	1.000

Note. Definition of abbreviations: Cum=Cumulative, RDG=Reading, ELL=English Language Learner, SPED=Special Education, FRL=Free and Reduced Lunch, FCI=Facilities Conditions Index

The coefficients table (Table 4) in the Model 2 row was evaluated to determine the contribution of each of the variables to the final equation. The three control variables of ELL, SPED, and FRL populations were statistically significant. In the final model, FRL recorded the highest beta value (beta = -.54, $p < .001$) with ELL (beta = -.41, $p < .001$) and SPED (beta = -.10, $p < .001$) contributing significantly as well. The Facilities Conditions Index (FCI) (beta = .007, $p = .713$) as the independent variable of interest did not significantly contribute.

Table 4

Reading Analysis Coefficients Table

Model		Unstandardized Coefficients B	Unstandardized Coefficients SE	Standardized Coefficients Beta	Sig.
1	(Constant)	93.556	1.024		.000
	Cum % ELL in grades 3, 4, 5	-.327	.023	-.405	.000
	Cum % SPED in grades 3, 4,5	-.410	.088	-.095	.000
	Cum % FRL in grades 3, 4, 5	-.328	.018	-.534	.000
2	(Constant)	93.447	1.067		.000
	Cum % ELL in grades 3, 4, 5	-.327	.023	-.405	.000
	Cum % SPED in grades 3, 4, 5	-.415	.089	-.096	.000
	Cum % FRL in grades 3, 4, 5	-.329	.019	-.535	.000
	FCI % each school	.006	.017	.007	.713

Note. Definition of abbreviations: Cum=Cumulative, ELL=English Language Learner, SPED=Special Education, FRL=Free and Reduced Lunch, FCI=Facilities Conditions Index

The model summary with CSAP reading as the dependent variable is displayed in Table 5. After the variables of ELL, SPED, and FRL were entered into block 1, the model explained 80.5% of the variance in the dependent variable of CSAP reading. After the independent variable of interest or Facilities Conditions Index (FCI) was entered into block 2, the R^2 change was of 0% and the significant F change value indicated an insignificant contribution ($p = .713$). The total variance explained by the model as a whole was 80.4% $F(4,539) = 557.01$, $p < .001$ and the model as a whole was significant as indicated in the ANOVA table (Table 6). Therefore, in this study, one fails to reject the null hypothesis: There will be no relationship between the Facilities Conditions Index (FCI) and student achievement in Colorado elementary schools on the CSAP in reading when controlling for the variables of FRL, ELL, and SPED populations. Further analyses were conducted to confirm the weak correlation between CSAP scores and the FCI as well as to determine if the variance in CSAP scores was being explained completely by the control variables, particularly Free and Reduced Lunch (FRL) population, prior to the input of the FCI into Model 2.

Table 5

Reading Analysis Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Sq. Change	F Change	df1	df2	Sig. F Change
1	.897[a]	.805	.804	7.80958	.805	743.824	3	540	.000
2	.897[b]	.805	.804	7.81585	.000	.135	1	539	.713

Table 6

Reading Analysis ANOVA Table

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	136096.624	3	45365.541	743.824	.000[b]
	Residual	32934.385	540	60.990		
	Total	169031.009	543			
2	Regression	136104.882	4	34026.220	557.009	.000[c]
	Residual	32926.127	539	61.087		
	Total	69031.009	543			

Research Question 2:
Writing Analysis

The second analysis performed utilized hierarchical multiple regression (HMR) analysis to investigate the ability of the Facilities Conditions Index (FCI) to predict levels of student achievement on Colorado Student Assessment Program (CSAP) in writing after controlling for English Language Learner (ELL), Special Education (SPED), and Free and Reduced Lunch (FRL) populations. Preliminary analysis indicated no violations of the assumptions of normality, linearity, and homoscedasticity within the model with CSAP writing as the dependent variable. Correlations for ELL (-.72), SPED (-.28), FRL

(-.84), and FCI (-.19) all revealed a negative relationship with CSAP writing with ELL and FRL showing a strong negative correlation. As in the reading analysis, greater percentages of students scoring proficient or advanced in writing were associated with lower FCI indices or better facility conditions as well as lower percentages of ELL, SPED, and FRL populations. The variables of FRL and ELL indicated a strong negative correlation with reading scores. As mentioned in the reading analysis, the strong bivariate correlation between ELL and FRL (.73) was addressed through the performance of further analyses. Displayed in Table 7 are correlations with writing as the dependent variable.

Table 7

Writing Analysis Correlations Table

Pearson Correlation	WRITING	ELL	SPED	FRL	FCI
Cum % WRIT in grades 3, 4, 5	1.000	-.723	-.276	-.841	-.191
Cum % ELL in grades 3, 4, 5	-.723	1.000	.037	.734	.170
Cum % SPED in grades 3, 4, 5	-.276	.037	1.000	.270	.202
Cum % FRL in grades 3, 4, 5	-.841	.734	.270	1.000	.239
FCI % for each school	-.191	.170	.202	.239	1.000

Note. Definition of abbreviations: Cum=Cumulative, WRIT=Writing, ELL=English Language Learner, SPED=Special Education, FRL=Free and Reduced Lunch, FCI=Facilities Conditions Index

Again, the three control variables of ELL, SPED, and FRL populations were statistically significant as indicated in the Coefficients table (Table 8). In the final model, FRL recorded the highest beta value (beta = -.62, $p < .001$) with ELL (beta = -.27, $p < .001$) and SPED (beta = -.10, $p < .001$) contributing significantly as well. The FCI (beta = .02, $p = .308$) as the independent variable of interest did not significantly contribute to the final equation.

Table 8

Writing Analysis Coefficients Table

Model		Unstandardized Coefficients B	Unstandardized Coefficients SE	Standardized Coefficients Beta	Sig.
1	(Constant)	79.445	1.226		.000
	Cum % ELL in grades 3, 4, 5	-.221	.028	-.264	.000
	Cum % SPED in grades 3, 4, 5	-.443	.106	-.099	.000
	Cum % FRL in grades 3, 4, 5	-.395	.022	-.620	.000
2	(Constant)	79.084	1.276		.000
	Cum % ELL in grades 3, 4, 5	-.222	.028	-.265	.000
	Cum % SPED in grades 3, 4, 5	-.460	.107	-.102	.000
	Cum % FRL in grades 3, 4, 5	-.397	.022	-.624	.000
	FCI % for each school	.020	.020	.023	.308

Note. Definition of abbreviations: Cum=Cumulative, ELL=English Language Learner, SPED=Special Education, FRL=Free and Reduced Lunch, FCI=Facilities Conditions Index

The model summary with CSAP writing as the dependent variable is shown in Table 9. The model, as indicated by the R^2 value, explained 74% of the variance in CSAP scores in writing after the control variables of ELL, SPED, and FRL were entered into block 1. After the independent variable of interest or Facilities Conditions Index (FCI) was entered into block 2, the R^2 change of .001 indicated a 0.1% change in the variance in CSAP writing. The significant F change value indicated an insignificant contribution at ($p = .308$). The total variance explained by the model as a whole was 74% $F (4,539) = 383.64$, $p < .001$ and the model as a whole was significant as displayed in the ANOVA table (Table 10). Therefore, in this study, one fails to reject the null hypothesis: There will be no relationship between the FCI and student achievement in Colorado elementary schools on the CSAP in writing when controlling for the variables of FRL, ELL, and SPED populations. As mentioned, further analyses were conducted to confirm the weak correlation between CSAP scores and the FCI as well as to determine if the variance in CSAP scores was being explained completely by the control variables, particularly Free and Reduced Lunch (FRL) population, prior to the input of the FCI into the model.

Table 9

Writing Analysis Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Sq. Change	F Change	df1	df2	Sig. F Change
1	.860[a]	.740	.738	9.34667	.740	511.135	3	540	.000
2	.860[b]	.740	.738	9.34630	.001	1.043	1	539	.308

Table 10

Writing Analysis ANOVA Table

Model		Sum of Squares	df	Mean Square	F	Sig.
	Regression	133958.679	3	44652.893	511.135	.000[b]
1	Residual	47174.556	540	87.360		
	Total	181133.235	543			
	Regression	134049.781	4	33512.445	383.642	.000[c]
2	Residual	47083.455	539	87.353		
	Total	181133.235	543			

Research Question 3:
Math Analysis

The third analysis performed utilized hierarchical multiple regression (HMR) analysis to investigate the ability of the Facilities Conditions Index (FCI) to predict levels of student achievement on the Colorado Student Assessment Program (CSAP) in math after controlling for English Language Learner (ELL), Special Education (SPED), and Free and Reduced Lunch (FRL) populations. There were no violations of the assumptions of normality, linearity, and homoscedasticity revealed through the preliminary analysis. Similar to the reading and writing analyses, the correlations in the math analysis revealed a negative relationship for the predictor variables of ELL (-.73), SPED (-.25), FRL (-.84), and FCI (-.21). Again, FRL and ELL showed a strong negative correlation with CSAP scores in math while SPED and FCI indicated a weak correlation. As in the reading and writing analyses, this also indicates that greater percentages of students scoring proficient or advanced in math were associated with lower FCI indices or better facility conditions as well as lower percentages of ELL, SPED, and FRL populations. As in the previous analyses the relationship between ELL and FRL (.73) indicated a strong bivariate correlation and further analyses were conducted to address this potential issue. Correlations for the math analysis are displayed in Table 11.

Table 11

Math Analysis Correlations Table

Pearson Correlation	MATH	ELL	SPED	FRL	FCI
Cum % MA in grades 3, 4, 5	1.000	-.734	-.252	-.838	-.209
Cum % ELL in grades 3, 4, 5	-.734	1.000	.037	.734	.170
Cum % SPED in grades 3, 4, 5	-.252	.037	1.000	.270	.202
Cum % FRL in grades 3, 4, 5	-.838	.734	.270	1.000	.239
FCI % for each school	-.209	.170	.202	.239	1.000

Note. Definition of abbreviations: Cum=Cumulative, MA=Math, ELL=English Language Learner, SPED=Special Education, FRL=Free and Reduced Lunch, FCI-Facilities Conditions Index

Once again, the coefficients table (Table 12) revealed similar contributions of the three control variables of ELL, SPED, and FRL to the final equation and that they were statistically significant. The variables of ELL (beta -.28, $p < .001$) and SPED (beta -.08, $p = .001$) contributed significantly to the final equation while FRL was the highest contributor for a third time (beta -.61, $p < .001$). As in the reading and writing analyses, the FCI (beta .00, p = .995) as the independent variable of interest did not contribute significantly to the final equation.

Table 12

Math Analysis Coefficients Table

Model		Unstandardized Coefficients		Standardized Coefficients	Sig.
		B	SE	Beta	
1	(Constant)	92.818	1.128		.000
	Cum % ELL in grades 3, 4, 5	-.218	.026	-.284	.000
	Cum % SPED in grades 3, 4, 5	-.315	.097	-.077	.001
	Cum % FRL in grades 3, 4, 5	-.356	.020	-.609	.000
2	(Constant)	92.820	1.175		.000
	Cum % ELL in grades 3, 4, 5	-.218	.026	-.284	.000
	Cum % SPED in grades 3, 4, 5	-.315	.098	-.076	.001
	Cum % FRL in grades 3, 4, 5	-.356	.020	-.609	.000
	FCI %for each school	.000	.018	.000	.995

Note. Definition of abbreviations: Cum=Cumulative, ELL=English Language Learner, SPED=Special Education, FRL=Free and Reduced Lunch, FCI=Facilities Conditions Index

The model summary with CSAP Math as the dependent variable is displayed in Table 13. The model, as indicated by the R^2 value, explained 74% of the variance in the DV of CSAP reading after the CV's of ELL, SPED, and FRL were entered into block 1. After the independent variable of interest or Facilities Conditions Index (FCI) was entered into block 2, the R^2 change was 0% and the significant F change value indicated an insignificant contribution at ($p = .995$). The total variance explained by the model as a whole was 74% $F(4,539) = 380.20$, $p < .001$ and the model as a whole was significant as indicated in Table 14. Therefore, in this study, one fails to reject the null hypothesis: There will be no relationship between the FCI and student achievement in Colorado elementary schools on the CSAP in math when controlling for the variables of FRL, ELL, and SPED populations.

As mentioned, further analyses were conducted to confirm the weak correlation between CSAP scores and the FCI as well as to determine if the variance in CSAP scores was being explained completely by the control variables, particularly Free and Reduced Lunch (FRL) population, prior to the input of the Facilities Conditions Index (FCI) into the model. It is also interesting to note that in all of these analyses, FCI was positively correlated with ELL, SPED, and FRL populations. In other words, as the FCI decreases or indicates better facility conditions, percentages of ELL, SPED, and FRL populations also decrease and vice versa.

Table 13

Math Analysis Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Sq. Change	F Change	df1	df2	Sig. F Change
1	.859[a]	.738	.737	8.6004	.738	507.867	3	540	.000
2	.859[b]	.738	.736	8.6084	.000	.000	1	539	.995

Table 14

Math Analysis ANOVA Table

Model		Sum of Squares	df	Mean Square	F	Sig.
	Regression	112696.153	3	37565.384	507.867	.000[b]
1	Residual	39942.139	540	73.967		
	Total	152638.292	543			
	Regression	112696.156	4	28174.039	380.195	.000[c]
2	Residual	39942.136	539	74.104		
	Total	152638.292	543			

Reading, Writing, and Math Analyses with ELL Population as the Control Variable

The first of the analyses that utilized a single control variable were conducted in order to determine the influence of the Facilities Conditions Index (FCI) upon student achievement on the Colorado Student Assessment Program (CSAP) in reading, writing, and math when controlling for English Language Learner (ELL) population. These analyses were conducted in order to single out ELL population as this variable was highly correlated with student achievement on the CSAP in reading (-.80), writing (-.72), and math (-.73). The ELL and FRL variables also indicated a strong bivariate correlation (.73), so these variables were singled out due to suggestions of multicollinearity.

The R^2 value in the reading analysis showed that the ELL population explained 64% of the variance of CSAP scores entered into block 1. After the Facilities Conditions Index (FCI) was entered into block 2, the R^2 change was 0.5% and the significant F change value indicated a significant contribution ($p = .004$). The total variance explained by the model as a whole was 65% $F(2,541) = 493.48$, $p < .001$ and the model as a whole was significant. The correlation between CSAP scores in reading and the FCI and was negative and weak (-.21) while the correlation with ELL was negative and strong (-.80). The correlation between FCI and ELL was positive and weak (.17). Both variables were statistically significant, ELL with a beta value (beta = -.788, p. < .001) and FCI with beta value (beta = -.075, p = .004). The FCI accounted for a small portion (0.5%) of the variance or dispersion of scores around the mean in CSAP scores in reading after controlling for ELL population.

The ELL population in the writing analysis, as indicated by the R^2 value, explained 52% of the variance of CSAP scores after ELL was entered into block 1. After FCI was entered into block 2, the R^2 change was 0.5% and the significant F change value indicated a significant contribution ($p = .019$). The total variance explained by the model as a whole was 53% $F(2,541) = 302.24$, $p < .001$ and the model as a whole was significant. The correlation between CSAP scores in writing and the FCI was negative and weak (-.19) while the correlation with ELL was negative and strong (-.72). Both variables were statistically significant, ELL (beta = -.711, p. < .001) and FCI (beta = -.071, $p < .019$). Again, the Facilities Conditions Index (FCI) accounted for 0.5% of the variance or dispersion of scores around the mean on CSAP scores in writing after controlling for ELL population.

The ELL population in the math analysis, as indicated by the R^2 value, explained 54% of the variance of CSAP scores after ELL was entered into block 1. After FCI was entered into block 2, the R^2 change was 0.7% and the significant F change value indicated a significant contribution ($p = .003$). The total variance explained by the model as a whole was 55% $F(2,541) = 325.79$, $p < .001$ and the model as a whole was significant. The correlation between CSAP scores in math and the FCI and was negative and weak (-.21) while the correlation with ELL was negative and strong (-.73). Both variables were statistically significant, ELL (beta = -.719, p. < .001) and FCI (beta = -.087, $p = .003$).

Once again, as in the reading and writing analyses, the FCI accounted for a small portion (0.7%) of the variance or dispersion of scores around the mean on CSAP scores in math after controlling for ELL population. Although, there is a relationship between

CSAP scores and the FCI when controlling for English Language Learner (ELL) population, the relationship is weak and the FCI accounts for little variance in CSAP scores.

Reading, Writing, and Math Analyses with SPED as the Control Variable

The analyses below were conducted in order to determine the influence of the Facilities Conditions Index (FCI) upon student achievement on the Colorado Student Assessment Program (CSAP) in reading, writing, and math when controlling for Special Education (SPED) population. As the correlations between CSAP scores in reading (-.25), writing (-.28), and math (-.25) and SPED were much weaker than that of both ELL and FRL when correlated with CSAP scores, these analyses were conducted in order to single out SPED as a control variable and determine whether Facilities Conditions Index (FCI) would account for greater variance in CSAP scores.

The R^2 value in the reading analysis showed that the SPED population explained 6.4% of the variance of CSAP scores after SPED was entered into block 1. After the FCI was entered into block 2, the R^2 change was 2.6% and the significant F change value indicated a significant contribution ($p = .000$). The total variance explained by the model as a whole was 9.0% $F(2,541) = 26.813$, $p < .001$ and the model as a whole was significant. The correlations between CSAP scores in reading with the FCI (-.21) and SPED (-.25) were negative and weak. The correlation between FCI and SPED (.20) was positive and weak. Both variables were statistically significant, SPED (beta = -.221, p. < .001) and FCI (beta = -.164, p = .000). The FCI accounted for 2.6% of the variance or dispersion of scores around the mean on CSAP scores in reading after controlling for SPED population.

The SPED population in the writing analysis, as indicated by the R^2 value, explained 7.6% of the variance of CSAP scores after SPED was entered into block 1. After FCI was entered into block 2, the R^2 change was 1.9% and the significant F change value indicated a significant contribution at ($p = .001$). The total variance explained by the model as a whole was 9.5% $F(2,541) = 28.508$, $p < .001$. and the model as a whole was significant. The correlations between CSAP scores in writing with the FCI (-.19) and SPED (-.28) were negative and weak. Both variables were statistically significant, SPED (beta = -.248, p. < .001) and FCI (beta = -.141, $p = .001$). Again, the variance explained by the Facilities Conditions Index (FCI) was low and only accounted for an additional 1.9% of the variance or dispersion of scores around the mean on CSAP scores in writing after controlling for SPED population.

The SPED population in the math analysis, as indicated by the R^2 value, explained 6.3% of the variance of CSAP scores after SPED was entered into block 1. After the FCI was entered into block 2, the R^2 change was 2.6% and the significant F change value indicated a significant contribution ($p = .000$). The total variance explained by the model as a whole was 8.9% $F(2,541) = 26.558$, $p < .001$ and the model as a whole was significant. The correlations between CSAP scores in writing and the FCI (-.21) and SPED (-.25) were negative and weak. Both variables were statistically significant, SPED (beta = -.218, p. < .001) and FCI (beta = -.165, $p = .000$). Again, the FCI accounted for a small portion (2.6%) of the variance or dispersion of scores around the mean on CSAP scores in math after controlling for SPED population.

Although, the relationship between CSAP scores and the FCI when controlling for SPED population was slightly higher than when controlling for ELL, the relationship remained weak and the FCI accounted for little variance in the CSAP scores. The slightly stronger relationship between the FCI and CSAP scores found in these analyses aligns with the fact that Special Education (SPED) demonstrated a weaker correlation to CSAP scores and allowed for more explained variance in the scores by the FCI.

Reading, Writing, and Math Analyses with FRL as the Control Variable

The final analyses that included a single control variable were conducted in order to determine the influence of the Facilities Conditions Index (FCI) upon student achievement on the Colorado Student Assessment Program (CSAP) in reading, writing, and math when controlling for Free and Reduced Lunch (FRL) population. These analyses were conducted in order to single out the control variable of FRL population as this variable showed the highest correlation with student achievement on the CSAP in reading (-.86), writing (-.84), and math (-.84). Again due to the strong bivariate correlation (.73) between FRL and ELL, these variables were singled out and separate analyses were conducted to control for these variables.

The R^2 value in the reading analysis showed that the FRL population explained 73.4% of the variance of CSAP scores after FRL was entered into block 1. After Facilities Conditions Index (FCI) was entered into block 2, the R^2 change was 0.0% and the significant F change value indicated an insignificant contribution ($p = .852$). The total variance explained by the model as a whole was 73.4% $F(2,541) = 744.925$, $p < .001$ and the model as a whole was significant. The correlation between CSAP scores in reading and the FCI (-.21) was negative and weak while the correlation with FRL (-.86) was negative and strong. The correlation between FCI and FRL was positive and weak (.24). In the final model, only FRL was significant (beta = -.855, $p < .001$) while FCI was not (beta = -0.04, $p = .852$). The FCI accounted for 0.0% of the variance or dispersion of scores around the mean on CSAP scores in reading after controlling for FRL population.

The FRL population in the writing analysis, as indicated by the R^2 value, explained 70.7% of the variance of CSAP scores after FRL was entered into block 1. After FCI was entered into block 2, the R^2 change was 0.0% and the significant F change value indicated an insignificant contribution at ($p = .667$). The total variance explained by the model as a whole was 70.7% $F(2,541) = 652.264$, $p < .001$. and the model as a whole was significant. The correlation between CSAP scores in writing and the FCI (-.19) was negative and weak while the correlation with FRL (-.84) was negative and strong. In the final model, FRL was significant (beta = -.843, $p < .001$) while FCI was not significant (beta = -0.01, $p = .667$). Again, the Facilities Conditions Index (FCI) accounted for 0.0% of the variance or dispersion of scores around the mean on CSAP scores in writing after controlling for FRL population.

The FRL population in the math analysis, as indicated by the R^2 value, explained 70.3 % of the variance of CSAP scores after FRL was entered into block 1. After FCI was entered into block 2, the R^2 change was 0.0% and the significant F change value indicated an insignificant contribution ($p = .691$). The total variance explained by the model as a whole was 70.3% $F(2,541) = 639.488$, $p < .001$ and the model as a whole was significant. The correlation between CSAP scores in math and the FCI (-.21) was negative and weak while the correlation with FRL (-.84) was negative and strong. In the final model, only FRL was significant (beta = -.836, p < .01) while FCI was not (beta = -0.01, p = .691). The FCI accounted for an additional 0.0% of the variance or dispersion of scores around the mean on CSAP scores in math after controlling for FRL population.

The results of the analyses indicated no relationship between the FCI and student achievement in traditional Colorado public elementary schools on the CSAP in reading, writing, and math when controlling for Free and Reduced Lunch (FRL) population. In the previous analyses when controlling for ELL and SPED independently, the FCI was found to be significant, but explained very little variance in CSAP scores. The FCI accounted for 0.0% of the variance in CSAP scores when controlling for FRL. These analyses confirmed that Free and Reduced Lunch (FRL), which exhibited the strongest negative correlation with CSAP scores (reading (-.86), writing (-.84), and math (-.84)), and as the variable that explained the most variance in CSAP scores after being entered into block 1 (reading (73.4%), writing (70.7%), and math (70.3 %)) was the greatest predictor of student achievement.

Reading, Writing, and Math Analyses with ELL and SPED as the Control Variables

The first of the analyses using two control variables were conducted in order to determine the influence of the Facilities Conditions Index (FCI) upon student achievement on the Colorado Student Assessment Program (CSAP) in reading, writing, and math while controlling for English Language Learner (ELL) and Special Education (SPED) populations. Although low, the variance explained in CSAP scores by the FCI, was found to be significant in the previous analyses that included these two control variables independently. The following analyses were conducted in order to determine the variance explained by the FCI in CSAP scores when controlling for both ELL and SPED.

The R^2 value in the reading analysis showed that the ELL and SPED populations explained 69.1% of the variance of CSAP scores in reading after ELL and SPED were entered into block 1. After the independent variable of interest of FCI was entered into block 2, the R^2 change was 0.1% and the significant F change value indicated an insignificant contribution ($p = .212$). The total variance explained by the model as a whole was 69.2% $F(3,540) = 403.668$, $p < .001$. and the model as a whole was significant. The correlation between CSAP scores in reading and the FCI (-.21) as well as SPED (-.25) were negative and weak while the correlation with ELL was negative and strong (-.80). The correlations between FCI and ELL (.17) and SPED (.20) were positive and weak. In the final model, ELL (beta = -.787, $p < .001$) and SPED (beta = -.218, $p < .001$) were significant while FCI was not significant (beta = -0.031, $p = .212$). The FCI accounted for an additional 0.1% of the variance of CSAP scores in reading after controlling for ELL and SPED populations.

The ELL and SPED populations in the writing analysis, as indicated by the R^2 value, explained 58.5% of the variance of CSAP scores after ELL and SPED were entered into block 1. After the Facilities Conditions Index (FCI) was entered into block 2, the R^2 change was 0.0% and the significant F change value indicated an insignificant contribution at ($p = .461$). The total variance explained by the model as a whole was 58.5% $F(3,540) = 254.164$, $p < .001$. and the model as a whole was significant. The correlations between CSAP scores in writing and the FCI (-.19) and SPED (-.28) were negative and weak while the correlation with ELL was negative and strong (-.72). In the final model, ELL (beta = -.710, $p < .001$) and SPED (beta = -.245, $p < .001$) were significant while FCI was not significant (beta = -.021, $p = .461$). The FCI accounted for 0.0% of the variance of CSAP scores in writing after controlling for ELL and SPED populations.

The ELL and SPED populations in the math analysis, as indicated by the R^2 value, explained 58.9% of the variance of CSAP scores after ELL and SPED were entered into block 1. After the independent variable of interest of FCI was entered into block 2, the R^2 change was 0.2% and the significant F change value indicated an insignificant contribution ($p = .126$). The total variance explained by the model as a whole was 59.1% $F(3,540) = 260.176$, $p < .001$ and the model as a whole was significant. The correlation between CSAP scores in writing and the FCI (-.21) and SPED (-.25) were negative and weak while the correlation with ELL (-.73) was negative and strong. In the final model, ELL (beta = -.719, $p < .001$) and SPED (beta = -.216, $p < .001$) were significant while FCI was not significant (beta = -.044, $p = .126$). The FCI only accounted for an additional 0.2% of the variance of CSAP scores in math when controlling for both ELL and SPED populations.

Although, the variance explained in CSAP scores by the Facilities Conditions Index (FCI) was found to be significant when controlling for ELL and SPED independently; when controlling for both of these variables together, the variance explained by the FCI was much lower and made an insignificant contribution.

Reading, Writing, and Math Analyses with ELL and FRL as the Control Variables

The analyses below were conducted in order to determine the influence of the Facilities Conditions Index (FCI) upon student achievement on the Colorado Student Assessment Program (CSAP) in reading, writing, and math when controlling for English Language Learner (ELL) and Free and Reduced Lunch (FRL) populations. Both ELL and FRL had strong negative correlations with CSAP scores. The ELL population had lower correlations in reading (-.80), writing (-.72), and math (-.73) than FRL in reading (-.86), writing (-.84), and math (-.84). Although very low, the FCI was found to be significant in explaining the variance in CSAP scores in reading (0.5%), writing (0.5%), and math (0.7%) when controlling for ELL alone. However, the FCI was not significant in explaining the variance in CSAP scores in reading (0.0%), writing (0.0%), and math (0.0%) when controlling for FRL alone.

The R^2 value in the reading analysis showed that the ELL and FRL populations explained 79.7% of the variance of CSAP scores in reading after controlling for ELL and FRL. After the independent variable of interest or Facilities Conditions Index (FCI) was entered into block 2, the R^2 change was 0.0% and the significant F change value indicated a insignificant contribution ($p = .745$). The total variance explained by the model as a whole was 79.7% $F(3,540) = 708.455$, $p < .001$. and that the model as a whole was significant. The correlation between CSAP scores in reading and the FCI (-.21) was negative and weak while the correlations with ELL (-.80) and FRL (-.86) were negative and strong. The correlations between FCI and ELL (.17) and FCI and FRL (.24) were positive and weak. In the final model, ELL (beta = -.372, $p < .001$) and FRL (beta =

-.582, $p < .001$) were significant while FCI was not (beta = -.007, $p = .745$). The FCI accounted for 0.0% of the variance of CSAP scores in reading after controlling for ELL and FRL.

The ELL and FRL populations in the writing analysis, as indicated by the R^2 value, explained 73.1% of the variance in CSAP scores after controlling for ELL and FRL. After the FCI was entered into block 2, the R^2 change was 0.0% and the significant F change value indicated an insignificant contribution ($p = .708$). The total variance explained by the model as a whole was 73.1% $F(3,540) = 489.49$, $p < .001$ and the model as a whole was significant. The correlation between CSAP scores in writing and the FCI (-.19) was negative and weak while the correlations with ELL (-.72) and FRL (-.84) were negative and strong. In the final model, ELL (beta = -.230, $p < .001$) and FRL (beta = -.674, $p < .001$) were significant while FCI was not (beta = -.009, $p = .708$). As in the reading analysis, the FCI accounted for 0.0% of the variance of CSAP scores in writing after controlling for ELL and FRL populations.

The math analysis, as indicated by the R^2 value, explained 73.3% of the variance of CSAP scores after controlling for ELL and FRL. After the Facilities Conditions Index (FCI) was entered into block 2, the R^2 change was 0.0% and the significant F change value indicated an insignificant contribution ($p = .626$). The total variance explained by the model as a whole was 73.3% $F(3,540) = 489.49$, $p < .001$ and the model as a whole was significant. The correlation between CSAP scores in math and the FCI (-.21) was negative and weak while the correlations with ELL (-.73) and FRL (-.84) were negative and strong. In the final model, ELL (beta = -.258, $p < .001$) and FRL (beta = -.646, $p < .001$) were significant while FCI was not (beta = -.011, $p = .626$). Again, the FCI accounted for 0.0% of the variance of CSAP scores in math when controlling for ELL and FRL populations.

Although, one could foresee the results obtained in the above analyses, they were completed in exploration as to confirm predictions and attain associated figures while controlling for ELL and FRL.

Reading, Writing, and Math Analyses with SPED and FRL as the Control Variables

The final analyses consisting of two control variables were conducted in order to determine the influence of the Facilities Conditions Index (FCI) upon scores on the Colorado Student Assessment Program (CSAP) in reading, writing, and math after controlling for Special Education (SPED) and Free and Reduced Lunch (FRL) populations. Although very low, the FCI was found to be significant in explaining the variance in CSAP scores in reading (6.4%), writing (7.6%), and math (6.3%) when controlling for SPED alone. As stated previously, the FCI was not significant in explaining the variance in CSAP scores in reading (0.0%), writing (0.0%), and math (0.0%) when controlling for FRL alone. Again, these analyses were completed to confirm predictions and obtain associated figures while controlling for these variables.

The R^2 value in the reading analysis showed that the SPED and FRL populations explained 73.4% of the variance of CSAP scores in reading after controlling for SPED and FRL. After the Facilities Conditions Index (FCI) was entered into block 2, the R^2 change was 0.0% and the significant F change value indicated a insignificant contribution ($p = .975$). The total variance explained by the model as a whole was 73.4% $F(3,540) = 497.048$, $p < .001$. and the model as a whole was significant. The correlations between

CSAP scores in reading and the FCI (-.21) and SPED (-.25) and were negative and weak while the correlation with FRL (-.86) was negative and strong. The correlations between FCI and SPED (.20) and FRL (.24) were positive and weak. In the final model, only FRL (beta = -.582, $p < .001$) was significant while SPED (beta = -.024, $p = .299$) and FCI (beta = -.001, $p = .975$) were not significant. The FCI accounted for 0.0% of the variance of CSAP scores in reading after controlling for SPED and FRL populations.

The SPED and FRL populations in the writing analysis, as indicated by the R^2 value, explained 70.9% of the variance of CSAP scores after controlling for SPED and FRL. After the FCI was entered into block 2, the R^2 change was 0.0% and the significant F change value indicated an insignificant contribution ($p = .453$). The total variance explained by the model as a whole was 71.0% $F(3,540) = 439.964$, $p < .05$. and the model as a whole was significant. The correlations between CSAP scores in writing and the FCI (-.19) and SPED (-.28) were negative and weak while the correlation with FRL (-.84) was negative and strong. In the final model, FRL (beta = -.830, $p < .001$) and SPED (beta = -.056, $p = .023$) were significant while the FCI (beta = -.018, $p = .453$) was not. The Facilities Conditions Index (FCI) accounted for an additional 0.0% of the variance of CSAP scores in writing after controlling for SPED and FRL populations.

The math analysis, as indicated by the R^2 value, explained 70.3% of the variance of CSAP scores after controlling for SPED and FRL. After the FCI was entered into block 2, the R^2 change was 0.0% and the significant F change value indicated an insignificant contribution($p = .813$). The total variance explained by the model as a whole was 70.3% $F(3,540) = 426.817$, $p < .001$ and the model as a whole was significant. The correlation between CSAP scores in writing and the FCI (-.21) and

SPED (-.25) were negative and weak while the correlation with FRL (-.84) was negative and strong. In the final model, only FRL (beta = -.830, $p < .001$) was significant while SPED (beta = -.026, $p = .286$) and FCI (beta = -.006, $p = .813$) were not. The FCI accounted for 0.0% of the variance of CSAP scores in math after controlling for SPED and FRL populations.

Although, one could foresee the results obtained in the above analyses, they were completed in exploration as to confirm predictions and attain associated figures while controlling for SPED and FRL. Although a minimal contribution, it was interesting to notice that SPED was found to contribute significantly to the variance in CSAP in the writing analysis when controlling for SPED and FRL.

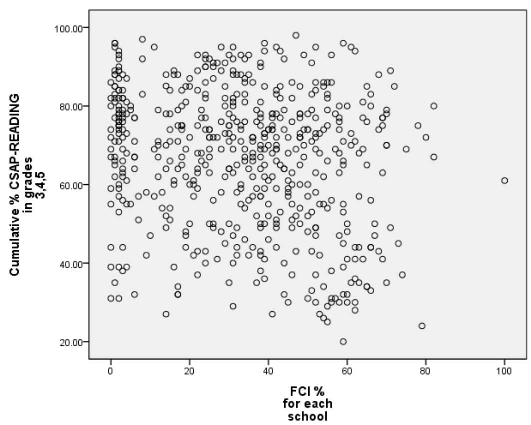
Simple Bivariate Correlations between Reading, Writing, Math and the Facilities Conditions Index

Simple bivariate, or zero-order, correlations were conducted to determine the relationship between student achievement on the Colorado Student Assessment Program (CSAP) in reading, writing, and math and facilities conditions according to the Facilities Conditions Index (FCI) independent of the control variables of English Language Learner (ELL), Special Education (SPED), and Free and Reduced Lunch (FRL). Preliminary analyses were performed to ensure no violations of the assumptions of normality, linearity, and homoscedasticity.

There was a negative and weak correlation between student achievement on the CSAP in reading and facilities conditions as depicted by the Facilities Conditions Index (FCI), $R = -.208$, $n = 544$, $p < .001$. High levels of student achievement were associated with low FCI levels or better facilities conditions for the population of elementary schools in this study (N=544). Although the correlation was negative, it was also weak and indicated that school facility condition has little influence upon student achievement. The coefficient of determination or R^2 was calculated in order to determine the variance shared between scores in CSAP reading and the FCI. This value was determined to be 4.3% which indicates little overlap between the two variables or minimal shared variance. This negative and weak correlation is evident in Figure seven.

Figure 7

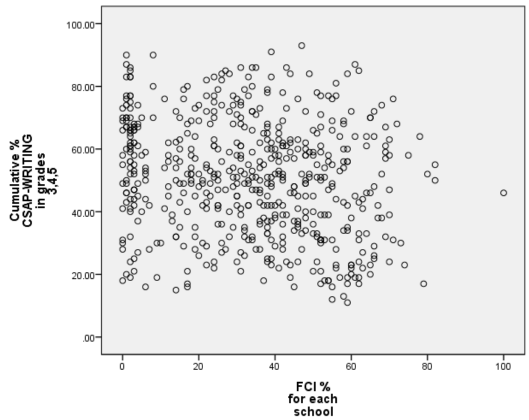
Scatter Plot: CSAP Reading and FCI



The writing analysis revealed the weakest negative simple bivariate correlation between student achievement on the CSAP and the FCI index, R = -.191, n = 544, $p < .001$. Again, high levels of student achievement were associated with a lower FCI or better facilities conditions for the population in this study (N=544). Again, this was a weak correlation and indicated that school facility condition has little influence upon student achievement. The coefficient of determination or R^2 was calculated in order to determine the variance shared between scores in CSAP writing and the Facilities Conditions Index (FCI). This value was determined to be 3.6% which indicates little overlap between the two variables or minimal shared variance. This negative and weak correlation is evident in Figure eight.

Figure 8

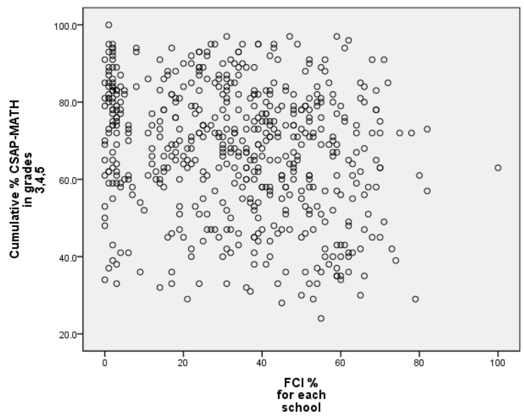
Scatter Plot: CSAP Writing and FCI



The results of the math analysis indicated a slightly stronger although, weak and negative correlation between student achievement on the CSAP and the Facilities Conditions Index (FCI), R = -.209, n =544, $p < .001$ than the previous two analyses in reading and writing. This third analysis, yet again, showed that higher student achievement was associated with a lower FCI or better facility condition for the population in this study (N=544). Once again, this was a weak correlation and indicated that school facility condition has little influence upon student achievement. The coefficient of determination or R^2 was calculated in order to determine the variance shared between scores in CSAP math and the FCI. This value was determined to be 4.4% which, again, indicates little overlap between the two variables and minimal shared variance. The negative and weak correlation between the dependent variable of student achievement on the CSAP and the independent variable of interest or FCI as an indicator of school building condition is evident in Figure nine.

Figure 9

Scatterplot: CSAP Math and FCI



The simple bivariate, or zero-order, correlations revealed negative and weak correlations as well as little shared variance between student achievement on the CSAP and the Facilities Conditions Index (FCI). As hypothesized, higher levels of student achievement were associated with lower FCI levels or better facility conditions and vice versa. The R^2 values between facilities conditions and student achievement on the CSAP for reading (4.3%), writing (3.6%), and math (4.4%) indicated little overlap between the variables or little variance shared. These simple bivariate or zero-order correlations were found to be significant in reading, writing, and math ($p = .000$) for all three of the analyses at the .05 level of significance. Although, much confidence should be placed in the results, student achievement on the CSAP in traditional Colorado public elementary schools and the FCI as an indicator of school facility condition have a weak negative relationship and exhibit little shared variance.

Conclusion

The results of the hierarchical multiple regression (HMR) analyses in reading, writing, and math that addressed the original research questions indicated that one would fail to reject the null hypotheses: There is no relationship between student achievement on the Colorado Student Assessment Program (CSAP) and the Facilities Conditions Index (FCI) when controlling for English Language Learner (ELL), Special Education (SPED), and Free and Reduced Lunch (FRL) populations. These analyses found ELL, SPED, and FRL to be significant in explaining the variance in CSAP scores while FCI was found to be insignificant. The correlations revealed that greater percentages of students scoring proficient or advanced on the CSAP were associated with lower FCI indices or better facility conditions. Although, negative, the correlations were very weak which indicated that school facility condition has little influence upon student achievement. Better student performance on CSAP was also associated with lower percentages of ELL, SPED, and FRL populations. The correlations also revealed that FCI is positively correlated with ELL, SPED, and FRL populations or that poorer facility conditions are associated with greater percentages of ELL, SPED, and FRL populations. The variable of FRL population, an indicator of socioeconomic status, was found to be the greatest predictor of student achievement.

However, due to suggestions of multicollinearity between the control variables of ELL and FRL as well as minimal R^2 change values following the addition of the Facilities Conditions Index (FCI) into the models in the original analyses; further analyses were conducted which included control variable variations as well as simple bivariate or zero-order correlations. Consequently, a total of 24 separate analyses were ran in order to confirm as well as examine the results in various models. As predicted and revealed in the results of the simple bivariate or zero-order correlations, student achievement on the CSAP in traditional Colorado public elementary schools and the FCI as an indicator of school facility condition have a weak negative relationship and exhibit little shared variance. In other words, facility condition does not have a significant relationship with student achievement.

It became evident that FRL as a measure of socioeconomic status was the greatest predictor of student achievement. In each of the analyses that included FRL, FCI was not significant and indicated no relationship between CSAP scores and FCI. This was due to the variable of FRL population explaining 70.0% or more of the variance in CSAP scores prior to the addition of FCI into the Model and due to the weak relationship between CSAP and FCI. In the analyses that included ELL and SPED populations independently as single control variables and in the simple bivariate or zero-order correlations which included no control variables, the FCI was found to be significant. Then again, this study included a population of N=544, and in large samples (N = 100+), very small correlations, such as R = .2, may reach statistical significance (Pallant, 2013, p. 140). The very weak correlations between CSAP scores in reading ($R = -.208$, $n = 544$, $p < .001$, $R^2 = 4.3\%$), writing ($R = -.191$, $n = 544$, $p < .001$, $R^2 = 3.6\%$), and math ($R = -.209$, $n = 544$, $p < .001$, $R^2 = 4.4\%$) and the FCI were found to be significant for this reason.

Although, much confidence can be placed in the results when p values below .05 were obtained after the Facilities Conditions Index (FCI) was put into the Model, student achievement on the CSAP in traditional Colorado public elementary schools and the FCI as an indicator of school facility condition have a very weak negative relationship and exhibit little shared variance. While statistical significance must be reported, the focus should be on the strength of the relationship and the amount of shared variance between the two variables (Pallant, 2013, p. 140). It is important to note that this research revealed that higher levels of student achievement on the CSAP are associated with better building conditions and lower percentages of ELL, SPED, and FRL populations. In other words, schools with higher percentages of ELL, SPED, and FRL students attend schools in poorer condition and have lower student achievement.

CHAPTER V

CONCLUSIONS AND RECOMMENDATIONS

The emphasis upon high-stakes testing and the potential ramifications have ignited the debate between the inequities that exist among America's public schools and student outcomes. Educational leaders are concerned about school facilities as research has shown the possible correlation between the condition of school facilities and student achievement (Buckley, Schneider, & Shang, 2004, p. 3). The condition of school facilities and the relationship to student achievement was the focus of this research.

The inequities that many children in the United States endure in regard to school facilities and the need for further research in this area became evident to the researcher in this study through the literature review process (Center for Green Schools, 2013; Colorado's Crumbling Classrooms, n.d.; Colorado Department of Education (CDE), 2010; Earthman & Lemasters, 1996; General Accounting Office 1995; National Center for Educational Statistics (NCES), 1999; NCES 2007b). According to a study by the United States General Accounting Office (GAO) in 1995, every state in America was identified as having school buildings in substandard condition (GAO, 1995a, p. 3). Reports issued since the 1995 report by the GAO, *Condition of America's Schools*, indicate that school facilities continue to deteriorate and that a comprehensive assessment of the current conditions is needed (Center for Green Schools, 2013, p. 4). However, Earthman and Lemasters (1996) concluded that it was difficult to determine any definite line of consistent findings in a review of over 230 studies pertaining to the relationship between school facilities and student achievement (p. 3). Much of the previous research on this topic has attempted to link school facility condition or particular aspects of the school facility with student achievement or student behavior (Al-Enezi, 2002; Bailey, 2009; Buckley, Schneider & Shang, 2004, Burnett, 1996; Bronzaft, 2000; Chan, 1980; Duran-Narucki, 2008; Earthman, 2002; Earthman & Lemasters, 1996; Greenwald, Hedges & Laine, 1996; Kennedy, 2013; MacNeil, Prater & Busch, 2009; Mendall & Heath, 2005, Lubman & Sutherland, 2001; Schneider, 2002; Uline & Tschannen, 2008). Studies also included surveys that were completed by school personnel in order to evaluate school building condition (Berner, 1993; Cash, 1993; Earthman, Cash & Van Berkum,1996; Hines, 1996; McGowen, 2007; Lanham, 1999).

Therefore, the researcher in this study sought to move away from survey research or the focus on particular aspects of a school facility. As a result, the focus of this research was on overall facilities condition. The Facilities Conditions Index (FCI) as the independent variable in this study was an indicator of overall facility condition and was obtained through the Colorado Statewide Financial Assistance Priority Assessment completed in fiscal year 2009-2010 (CDE, 2010). The FCI data represented a one-time depiction of school facility conditions as the 2009-2010 school year was the only year that this study was completed. The FCI was derived as a ratio of the cost of the overall facilities conditions needs over the cost to replace the entire facility (CDE, 2010, p. 5). Therefore, a Facilities Conditions Index (FCI) of 100% indicates that a building is in very poor condition and needs to be replaced, while an FCI of 0.00% indicates that the facility needs no repairs and is in excellent condition. The greater the percentage, the greater the facilities needs or the poorer the condition of the building.

According to the Statewide Financial Assistance Priority Assessment, completed in fiscal year 2009-2010, Colorado is coping with aging facilities and initiatives that envision the revolving relationship between school facilities and student performance (CDE, 2010, p. 15). Although the distribution of these "substandard" schools in relation to their local wealth is a question for another study, it is important to note that Colorado was ranked 35th in educational funding, received a "D" rating and was noted as regressive in education funding distribution in 2009 (Baker, Sciarra, & Farrie, 2012, p. 12). The state also received an "F" rating in educational funding effort based on the state's gross domestic product (Baker et al., 2012, p. 14).

Additionally, former assistant to the secretary of education and educational historian, Diane Ravitch noted that Colorado has some of the lowest expectations for proficiency in the country and that a student in Colorado might pass in-state assessments easily, but may be in academic difficulty in other states (Ravitch, 2010, p. 107). These facts are important to reveal given the varying conditions of school facilities, the emphasis on outcomes in accordance with standardized testing, and the lack of equity in school funding, not only in Colorado, but across the entire United States.

The focus of this study was the relationship between student achievement and school facility condition and whether or not the condition of the building influences student achievement outcomes above that of English Language (ELL) Leaner, Special Education (SPED), and Free and Reduced Lunch populations (FRL). There were three research questions proposed in the study:

Q1 Is there a relationship between school facility condition as indicated by the Facilities Conditions Index (FCI) in traditional Colorado pubic elementary schools during the 2009-2010 school year and student achievement on the Colorado Student Assessment Program (CSAP) in *reading* while controlling for Free and Reduced Lunch (FRL), English Language Learner (ELL), and Special Education (SPED) populations?

Q2 Is there a relationship between school facility condition as indicated by the Facilities Conditions Index (FCI) in traditional Colorado public elementary schools during the 2009-2010 school year and student achievement on the Colorado Student Assessment Program (CSAP) in *writing* while controlling for Free and Reduced Lunch (FRL), English Language Learner (ELL), and Special Education (SPED) populations?

Q3 Is there a relationship between school facility condition as indicated by the Facilities Conditions Index (FCI) in traditional Colorado public elementary schools during the 2009-2010 school year and student achievement on the Colorado Student Assessment Program (CSAP) in *math* while controlling for Free and Reduced Lunch (FRL), English Language Learner (ELL), and Special Education (SPED) populations?

The following null hypotheses were tested:

H1 There will be no relationship between the Facilities Conditions Index (FCI) and student achievement in Colorado elementary schools on the Colorado Student Assessment Program (CSAP) in *reading* when controlling for the variables of Free and Reduced Lunch (FRL), English Language Learner (ELL), and Special Education (SPED) populations?

H2 There will be no relationship between the Facilities Conditions Index (FCI) and student achievement in Colorado elementary schools on the Colorado Student Assessment Program (CSAP) *writing* when controlling for the variables of Free and Reduced Lunch (FRL), English Language Learner (ELL), and Special Education (SPED) populations.

H3 There will be no relationship between the Facilities Conditions Index (FCI) and student achievement in Colorado elementary schools on the Colorado Student Assessment Program (CSAP) in *math* when controlling for the variables of Free and Reduced Lunch (FRL), English Language Learner (ELL), and Special Education (SPED) populations.

Due to suggestions of multicollinearity between the control variables of ELL and FRL as well as minimal R^2 change values following the addition of the FCI into the original models, further analyses were conducted. These analyses included control variable variations as well as simple bivariate or zero-order correlations. A total of 24 analyses were ran in order to confirm as well as examine the results of various models.

Findings

The three research questions proposed in this study were answered through hierarchical multiple regression (HMR) analyses that were completed for reading, writing, and math. These analyses investigated the relationship between student achievement on the Colorado Student Assessment Program (CSAP) and school facility condition according to the Facilities Conditions Index (FCI) while controlling for English Language Learner (ELL), Special Education (SPED), and Free and Reduced Lunch (FRL) populations. According to this study one would fail to reject the null hypothesis for all three of the analyses. In conclusion, there is no relationship between student achievement on the CSAP in reading, writing, and math and the FCI when controlling for ELL, SPED, and FRL populations. These analyses found ELL, SPED, and FRL to be significant in explaining the variance in CSAP scores in reading, writing, and math while the FCI was found not to be significant. The R^2 values indicated that 0.00% of the variance in CSAP scores was explained by the Facilities Conditions Index (FCI) after the addition of this variable into model two following the addition of the control variables of ELL, SPED, and FRL into model one.

This research also included 21 additional analyses and the results varied depending upon the particular model and associated variables. Facility condition according to the FCI was found not to be significant in explaining the variance in student achievement on the CSAP in 15 out of the 24 analyses completed. Nine of the analyses revealed the FCI to be significant in influencing the variance in student achievement on the CSAP. However, the relationship between student achievement on the CSAP and the FCI was very weak and these variables exhibited little shared variance. Additionally, in large samples (N = 100+) very small correlations (e.g. R = .2), may reach statistical significance (Pallant, 2013, p. 140). The population in this study included 544 traditional Colorado public elementary schools with grade five as the highest level which provides validation for this assumption. Although the FCI reached statistical significance in nine of the analyses in this study, the focus should be on the strength of the relationship and the amount of shared variance between the two variables or between student achievement on the CSAP and facility conditions according to the FCI (Pallant, 2013, p. 140). The relationship between student achievement on the CSAP and facilities conditions according to the FCI was very weak and indicated very little, if any, shared variance in all 24 of the analyses completed. Therefore, according to this research there is little to no relationship between student achievement and school facility condition.

The correlations in this study revealed a negative relationship between student achievement and the FCI and that greater percentages of students scoring proficient or advanced on the CSAP were associated with better school facility conditions or a lower Facilities Conditions Index (FCI). Although the correlations were negative, they were also weak which indicated that school facility condition has little influence upon student achievement. Correlations also revealed higher student achievement to be associated with lower percentages of ELL, SPED, and FRL populations. These correlations between student achievement and ELL and FRL populations were strong. Although the correlations between the FCI and the control variables were positive and weak, they indicated that poorer facility conditions were associated with greater percentages of ELL, SPED, and FRL populations.

As mentioned in Chapter IV, Free and Reduced Lunch (FRL) as a measure of socioeconomic status was the greatest predictor of student achievement. In all of the analyses that controlled for FRL, the Facilities Conditions Index (FCI) was found not to be significant and indicated no relationship between scores on the Colorado Student Assessment Program (CSAP) and the FCI. However, this was due to the variable of FRL population explaining 70.0% or more of the variance in CSAP scores prior to the addition of FCI into the model, not to mention the weak relationship between student achievement on the CSAP and facility conditions according to the FCI. A table depicting the results obtained in each of the analyses is provided in Appendix B.

Implications

Included in this section are the implications for research as well as the implications for practitioners in relation to this study. The implications below add to existing body of research pertaining to the relationship between school facility conditions and student achievement.

Research Stance

I have been employed as a classroom teacher, gifted teacher, and administrator in both Pennsylvania and Colorado. I have witnessed diverse school facility conditions in areas of varying socioeconomic status. Based on my experiences, I assumed that the school facility condition would have a significant influence upon student achievement.

As one who advocates for educational equity, I had hoped the research in this study would support the notion that school facility condition does influence student achievement, particularly given the lack of consensus in this area (Odden & Picus, 2008; Earthman & Lemasters, 1996). The linking of school facility condition to student achievement could aid in the argument for a more equitable school environment for all students. However, as this study indicated, school facility condition in traditional Colorado public elementary schools has little to no influence upon student achievement.

The results of this study contribute to an abundance of research that has been conducted pertaining to the condition of school facilities and student achievement. Several implications may be drawn from the results and research. According to the descriptive statistics in Table 2, the mean Facilities Conditions Index (FCI) for traditional Colorado public elementary schools during the 2009-2010 school year was 33.47. This indicated that the traditional public elementary schools in Colorado that were included in this study were in better condition than one would have expected given an average facility age of 45 years. The National Center for Education Statistics (NCES) (1999), indicated that a school facility begins to deteriorate rapidly at age 40 and most schools are abandoned after 60 years (p. 1). Future study could include a population of schools with an FCI above of seventy-five percent. Traditional Colorado public elementary are on the brink of rapid deterioration. If this study were replicated in the future, the results could yield significantly different findings.

The research in this study revealed that school facility condition has very little if any influence upon student achievement. However, even if the variance that the built environment can account for is slight, the important fact to keep in mind is that there is a portion of the variance that then can be controlled through the efforts of educators and design professionals (Earthman & Lemasters, 1996, p.3). Therefore, educators and scholars have a responsibility to continue to pursue research in this area and school officials must consider school facilities in their long-range planning.

Application for Educators

Throughout the literature review process it became evident that school facility conditions in the United States, as well as in the state of Colorado, are not uniform and the resources available to students in varying states and school districts are inequitable. Based on the findings of this study, school officials should direct attention to student instruction, curriculum, and associated materials and channel the limited resources available to support student learning in lieu of school facilities.

The research in this study indicated that English Language Learner (ELL) and Free and Reduced Lunch (FRL) populations significantly influence student achievement. The strong correlations between student achievement on the Colorado Student Assessment Program (CSAP) and ELL and FRL populations should alert school officials to channel resources and efforts toward the instruction of these student populations. Paton (2014), confirmed that lower-income students typically tend to score lower on standardized tests than more advantaged students (para. 4). According to the National Center for Educational Statistics (NCES) (2013), achievement gaps between ELL and non-ELL students on the National Assessment of Educational Progress (NAEP) reading assessment in 2011 were 36 points at the fourth grade level and 44 points at the eighth grade level (para. 1). Colorado was among eight states with an ELL population of 10 percent or more in 2010-2011 (NCES, 2013, para. 2). In 2009, 38% of Colorado's children were eligible for FRL (Kids Count Data Center, n.d.).

Again, the research in this study revealed a negative correlation between student achievement on the CSAP and ELL, SPED, and FRL populations as well the Facilities Conditions Index (FCI). In other words, higher student achievement was associated with lower populations of ELL, SPED, and FRL students as well as better facility conditions. Additionally, the results of this study revealed that the variables of ELL, SPED, FRL, and FCI were positively correlated. In other words, higher percentages of ELL, SPED, and FRL populations were associated with poor school facility conditions. This is interesting given the correlations between student achievement, per-pupil funding (PPR), and the percent of ELL and FRL students in Colorado during the 2012 school year that are shown in Figure 10.

Figure 10

Correlations between Student Achievement, Per-pupil Funding, English Language Learners, and Free and Reduced Lunch in Colorado 2012

CDE Rating Categories	Average % of students who are English Language Learners	Average % of students who on Free and Reduced-Price Lunch	Average Per-Pupil Funding
Accredited with Distinction (18 districts)	4.4%	31.2%	$ 9,184
Accredited (94 districts)	7.2%	42.3%	$ 8,570
Accredited with Improvement Plan (45 districts)	10.5%	54.6%	$ 7,856
Accredited with Priority Plan (17 districts)	22.1%	61.7%	$ 7,191
Accredited with Turnaround Plan (7 districts)	24.3%	61.9%	$ 6,899

Retrieved from: Weld County School District 6: *State of the District*, PowerPoint presented at a Weld County School District 6 administrative staff meeting, March 2012.

The table shows that increased percentages of ELL and FRL students depicted decreased per pupil revenue and decreased student achievement. This supports the notion that all too often school districts with more-costly-to-educate students have lower property tax bases (Ladd, Chalk, & Hansen, 1999, p. 1). Given that greater percentages of ELL and FRL children typically reside in areas of lower socioeconomic status and more often attend schools in poorer condition, it is somewhat of a predictable outcome that students may score inequitably on achievement tests. As a quality education is viewed as a vital element in creating jobs and restoring economic prosperity, it is important that the United States develop a more equitable public school system so the nation's children can be given quality instruction in quality school facilities.

Often left out of the debate of educational reform in the United States is the fact that having a predictable, stable, and equitable system of educational finance is of critical importance to the success of any school improvement initiative (Baker et al., 2012, p. 1). Sufficient school funding that is fairly distributed regardless of concentrated poverty is an essential foundation to an equitable school system and without it, educational reforms, cannot be achieved or sustained (Baker et al., 2012, p.1). Where funding has not been equalized, students continue to attend dilapidated schools without adequately paid teachers or necessary equipment (Rothstein, 1993, p. 31). It is my contention that everyone who has an interest or investment in public education in the United States must make educational funding equity the priority prior to advocating for any other school reform initiative and that no school reform initiative will be sustainable or deemed adequate within our current inequitable system.

Limitations

The body of research pertaining to the relationship between student achievement and school facility conditions was broadened due to the research completed in this study. Again, the results of this study indicated that school facility condition has little to no influence upon student achievement. While this study controlled for ELL, SPED, and FRL populations, it would be unreasonable to suggest that any study could control for the innumerable magnitude of variables that may influence student achievement. This study included the entire population of traditional Colorado public elementary schools with grade five as the highest level during the 2009-2010 school year. The results may only apply to this population of students in the state of Colorado as well as may only be applicable to traditional elementary schools. The Facilities Conditions Index (FCI) was obtained through the Statewide Financial Assistance Priority Assessment completed under the direction of the Colorado Department of Education (CDE) in fiscal year 2009-2010. In order to conduct similar research using the FCI in other states, similar assessments would need to be completed in those states. As the CSAP assessment was given at a particular point in time at each particular school in this study, it is reasonable to say that the FCI may not have taken into account the exact conditions in individual classrooms at the time the CSAP was given.

Future Research

The purpose of this study was to investigate the relationship between student achievement and school facility condition. Although this research indicated that school facility has little to no influence upon student achievement, the lack of consensus among research in this area strengthens the argument for additional study.

Although, the Facilities Conditions Index (FCI) as a whole-school indicator of school facility condition did not prove to have a significant influence upon student achievement on the CSAP, researchers may use the FCI as a predictor in other measures of student performance as the results according to the CSAP may be limiting. Previous studies have focused on certain aspects of the school facility or included surveys completed by school personnel to evaluate school facility conditions (Earthman and Lemasters, 1996, p. 11). The FCI provided a whole-school indicator of school facility condition and was a suitable variable for investigating the relationship with student performance. The entire population of traditional Colorado public elementary schools with grade five as the highest level during the 2009-2010 school year was included in this study. Further research may include the replication of this study with aggregated and disaggregated K-12 school populations. Future correlation studies using the Facilities Conditions Index (FCI) may include: a link to teacher attitude and perceptions, student attitude and perceptions, graduation rates, and resources available to school districts. There was one school in this study that had an FCI of 100% which indicated a school in the worst possible condition. However, the percentages of students scoring proficient or advanced on the CSAP at this school were just below the mean. A qualitative study at this school could include interviews in order to determine the quality of instruction. The use of alternative assessments to measure student achievement as the dependent variable could also be used to confirm the results. Given the correlation between student achievement, PPR, ELL and FRL noted in Figure 10, the inclusion of PPR data from the 2009-2010 school year in Colorado as an additional independent variable is warranted. Research could also include the funding set aside for capital outlay projects by school district.

Conclusion

I believe that education should be equitable among all socioeconomic classes and that equity is the greatest challenge facing our schools and one of the greatest challenges facing the nation. It is well past the time for us to start the work that it will take to change these inequities (Kozol, 2005, p. 54). If America were to obtain educational funding equity, it is also my belief that a great many issues in America's public education system and society would soon dissipate. Despite conflicting research relating school facility condition and student achievement, it is important that the nation address deficiencies in the condition of school facilities regardless of community location or zip code. Many children in the United States are attending schools in substandard facilities due to an inequitable educational funding system that funds schools based on local wealth. I believe that current educational reforms must first address the inequitable funding system in order to maintain an adequate and equitable school environment for all of America's children. Perhaps then all of the nation's children will score proficient and advanced on standardized tests and student achievement outcomes will be more equitable. Perhaps then all of our nation's children will have the opportunity to become productive members of society.

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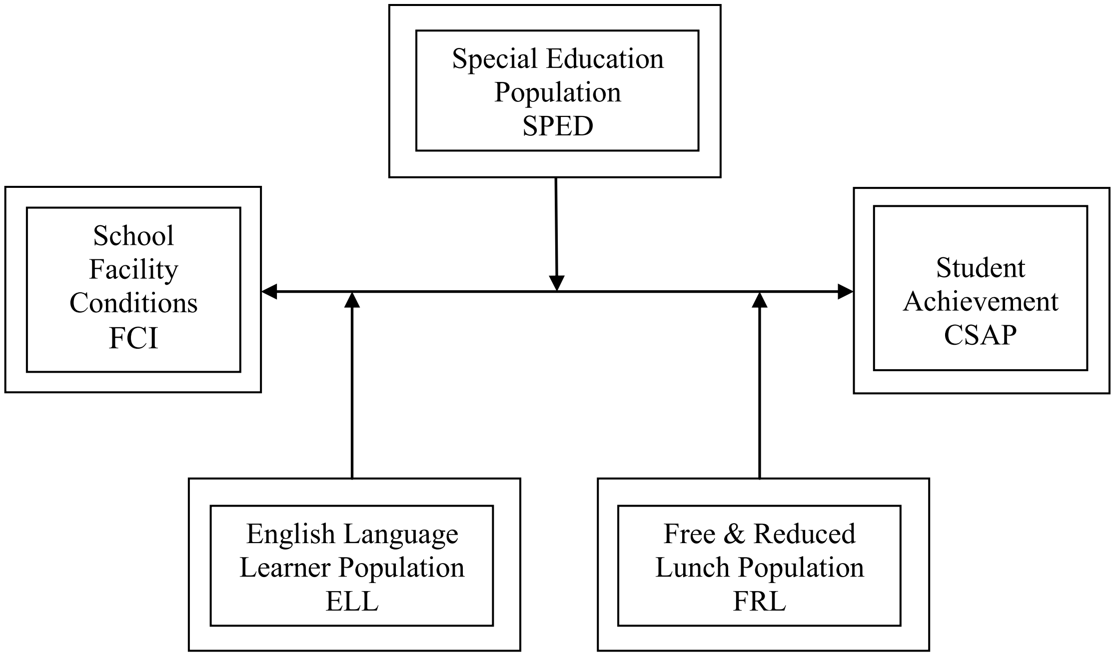
APPENDIX A

CONCEPTUAL MODEL



The conceptual model was created to illustrate the relationship between school facility conditions and student achievement while controlling for English Language Learner (ELL), Special Education (SPED), and Free and Reduced Lunch (FRL) populations.

APPENDIX B

ANALYSES RESULTS TABLE

ANALYSES RESULTS TABLE

A	DV CSAP	CV1	ELL: B+Sig.	CV2	SPED: B+Sig.	CV3	FRL: B+Sig.	IV	FCI: B+Sig.	Model 1 R^2 +p	R^2 Change	Model 2 R^2 +p	ANOVA MODEL AS A WHOLE	NULL HYPOTHESIS
1	R	ELL	beta = -.41, p < .001	SPED	beta = -.10, p < .001	FRL	beta = -.54, p < .001	FCI	beta = .007, p = .713	80.4%, p = .000	0.00%	80.4%, p = .713	80.4% F (4,539) = 557.01, p < .001	Fail to Reject
2	W	ELL	beta = -.27, p < .001	SPED	beta = -.10, p < .001	FRL	beta = -.62, p < .001	FCI	beta = .02, p= .308	74%, p =000	0.10%	74%, p = .308	74% F (4,539) = 383.64, p < .001	Fail to Reject
3	M	ELL	beta = -.28, p < .001	SPED	beta = -.08, p = .001	FRL	beta = -.61, p < .001	FCI	beta = .00, p= .995	74%, p =000	0.00%	74%, p =.995	74% F (4,539) = 380.20, p < .001	Fail to Reject
4	R	ELL	beta =-.788, p. < .001					FCI	beta = -.075, p = .004	64%, p = 0.00	0.50%	65%, p = .004	65% F (2,541) = 493.48, p < .001	Reject
5	W	ELL	beta = -.711, p. < .001					FCI	beta = -.071, p < .019	52%, p = 0.00	0.50%	53%, p = .019	53% F (2,541) = 302.24, p < .001	Reject
6	M	ELL	beta = -.719, p. < .001					FCI	beta = -.087, p = .003	54%, p = 0.00	0.70%	55%, p = .003	55% F (2,541) = 325.79, p < .001	Reject
7	R			SPED	beta = -.221, p. < .001			FCI	beta = -.164, p = .000	6.4%, p = 0.00	2.60%	9.0%, p = .000	9.0% F (2,541) = 26.813, p < .001	Reject
8	W			SPED	beta = -.248, p. < .001			FCI	beta = -.141, p = .001	7.6%, p = 0.00	1.90%	9.5%, p = .001	9.5% F (2,541) = 28.508, p < .001	Reject
9	M			SPED	beta = -.218, p. < .001			FCI	beta = -.165, p = .000	6.3%, p = 0.00	2.60%	9.5%, p = .000	8.9% F (2,541) = 26.558, p < .001	Reject
10	R					FRL	beta = -.855, p < .001	FCI	beta = -0.04, p = .852	73.4%, p = 0.00	0.00%	73.4%, p = .852	73.4% F (2,541) = 744.925, p < .001	Fail to Reject
11	W					FRL	beta = -.843, p < .001	FCI	beta = -0.01, p = .667	70.7%, p = 0.00	0.00%	70.7%, p = .667	70.7% F (2,541) = 652.264, p < .001	Fail to Reject
12	M					FRL	beta = -.836, p < .01	FCI	beta = -0.01, p = .691	70.3%, p = 0.00	0.00%	70.3%, p = .691	70.3% F (2,541) = 639.488, p < .001	Fail to Reject
13	R	ELL	beta = -.787, p < .001	SPED	beta = -.218, p < .001			FCI	beta = -0.031, p = .212	69.1%, p = 0.00	0.10%	69.2%, p = .212	69.2% F (3,540) = 403.668, p < .001	Fail to Reject
14	W	ELL	beta = -.710, p < .001	SPED	beta = -.245, p < .001			FCI	beta = -.021, p = .461	58.5%, p = 0.00	0.00%	58.5%, p = .461	58.5% F (3,540) = 254.164, p < .001	Fail to Reject
15	M	ELL	beta = -.719, p < .001	SPED	beta = -.216, p < .001			FCI	beta = -.044, p = .126	58.9%, p = 0.00	0.20%	59.1%, p = .126	59.1% F (3,540) = 260.176, p < .001	Fail to Reject
16	R	ELL	beta = -.372, p < .001			FRL	beta = -.582, p < .001	FCI	beta = -.007, p = .745	79.7%, p = 0.00	0.00%	79.7%, p = .745	79.7% F (3,540) = 708.455, p < .001	Fail to Reject
17	W	ELL	beta = -.230, p < .001			FRL	beta = -.674, p < .001	FCI	beta = -.009, p = .708	73.1%, p = 0.00	0.00%	73.1%, p = .708	73.1% F (3,540) = 489.49, p < .001	Fail to Reject
18	M	ELL	beta = -.258, p < .001			FRL	beta = -.646, p < .001	FCI	beta = -.011, p = .626	73.3%, p = 0.00	0.00%	73.3%, p = .626	73.3% F (3,540) = 489.49, p < .001	Fail to Reject
19	R			SPED	beta = -.024, p = .299	FRL	beta = -.582, p < .001	FCI	beta = -.001, p = .975	73.4%, p = 0.00	0.00%	73.4%, p=.975	73.4% F (3,540) = 497.048, p < .001	Fail to Reject
20	W			SPED	beta = -.056, p = .023	FRL	beta = -.830, p < .001	FCI	beta = -.018, p = .453	70.9%, p = 0.00	0.00%	70.9%, p = .453	71.0% F (3,540) = 439.964, p < .001	Fail to Reject
21	M			SPED	beta = -.026, p = .286	FRL	beta = -.830, p < .001	FCI	beta = -.006, p = .813	70.3%, p = 0.00	0.00%	70.3%, p = .813	70.3% F (3,540) = 426.817, p < .001	Fail to Reject
22	R							FCI	Sig. = .000				R = -.208, n = 544, p < .001, R^2 = 4.3%	Reject
23	W							FCI	Sig. = .000				R = -.191, n = 544, p < .001, R^2 = 3.6%	Reject
24	M							FCI	Sig. = .000				R = -.209, n =544, p < .001, R^2 = 4.4%	Reject

Note. Definition of abbreviations: A=Analysis, R=Reading, W=Writing, M=Math, DV=Dependent Variable, CV1=Control Variable 1: ELL-English Language Learner, CV2=Control Variable 2: SPED-Special Education, CV3=Control Variable 3: FRL=Free and Reduced Lunch, IV=Independent Variable: FCI-Facilities Conditions Index, B=beta, Sig.=Significance, R2=R squared-Coefficient of Determination, p=p value

APPENDIX C

APPROVAL LETTER

UNIVERSITY of
NORTHERN COLORADO

Institutional Review Board

DATE:	December 10, 2014
TO:	Edward Brooks, Ed.D.
FROM:	University of Northern Colorado (UNCO) IRB
PROJECT TITLE:	[690092-1] THE RELATIONSHIP BETWEEN THE CONDITION OF COLORADO ELEMENTARY SCHOOL FACILITIES AND STUDENT ACHIEVEMENT.
SUBMISSION TYPE:	New Project
ACTION:	APPROVAL/VERIFICATION OF EXEMPT STATUS
DECISION DATE:	December 9, 2014

Thank you for your submission of New Project materials for this project. The University of Northern Colorado (UNCO) IRB approves this project and verifies its status as EXEMPT according to federal IRB regulations.

Hello Dr. Brooks,

I am the reviewer on your IRB application and would like to commend you on this interesting and well prepared application. You are approved to conduct your research and good luck.

Sincerely,

Nancy White, PhD, IRB Co-Chair

We will retain a copy of this correspondence within our records for a duration of 4 years.

If you have any questions, please contact Sherry May at 970-351-1910 or Sherry.May@unco.edu. Please include your project title and reference number in all correspondence with this committee.

This letter has been electronically signed in accordance with all applicable regulations, and a copy is retained within University of Northern Colorado (UNCO) IRB's records.

CURRICULUM VITAE

EDWARD B. BROOKS, Ed.D.
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EDUCATION:

University of Northern Colorado, Greeley, CO
- Ed.D., successfully defended dissertation May 8, 2015, GPA 3.68

Immaculata University, Immaculata, PA
- Elementary Certification, May '98, GPA 3.94
- M.A. in Leadership Administration, Spring '01, GPA 3.96
- Acquired PA K-12 Administrative Certification in Fall '05, Instructional II Permanent certification in July '04, and middle school math and science certifications in Fall '03
- Elected to Who's Who Among Students in American Colleges and Univ. '00-'01
- Acquired CO K-12 Administrative Certification, Fall '10, Elementary Certification, May '02

Indiana University of Pennsylvania, Indiana, PA
- B.S. in Safety Sciences, Dec. '94, GPA 2.93, Major GPA 3.03

EDUCATION EXPERIENCE:

Graduate Assistant - University of Northern Colorado, Greeley, CO
(Aug. '10 - May '15) GA in Educational Leadership and Policy Studies (ELPS)
- Created and circulated ELPS newsletter, assisted professors with research studies and projects.
- Assisted with research on nationwide principal and teacher standards and evaluations.
- Assisted with research and presentation on CO at-risk funding at the National Education Finance Conference in'11 (influential in CO HB 12-1240 legislation), assisted with research and presentations on school finance litigation in '12 and '13, and charter school trans. in '13.

Program Director/Activity Coordinator - Boys & Girls Clubs, Larimer County, CO
(June '12 - Aug. '14) Program Director, Activity Coordinator, and Maintenance Technician
- Facilitated prevention of summer learning loss program and member activities and in Loveland, Ft. Collins, and Wellington in summer '12, activity coordinator in Wellington from (May - July) in summer '13, '14, maintenance technician for all clubs (summer '12 & '13).

Education Consultant/Special Project Coordinator (Nov. '14 - April '15)
- Collaborated with the Wellington mayor, Chamber of Commerce, and community members regarding the formation of a potential trade-school program in Wellington, CO.
- Attended Chamber and school district meetings.
- Facilitated visitation to Warren Tech Career and Technical High School in Lakewood, CO.
- Project was suspended following announcement of a high school in Wellington by Poudre SD.

Administrative Intern - Weld County School District 6, Greeley, CO
(March '12 - May '12) Assisted with administrative projects as a district-level intern.
- Attended weekly staff meetings for elementary, middle, and high school administration.
- Conducted visitations to elementary, middle, and high school facilities throughout the district.
- Assisted with student discipline, teacher observations and walk-throughs, teacher interviews, TCAP assessment, the revision of student/parent handbooks and district-wide policies, etc.

Teacher of the Gifted and Talented - Steamboat Springs School District, Steamboat, CO
(Sept. '08 - June '10) Teacher of Gifted and Talented Students grades K-5
- Responsibilities included: enrichment, compacting and acceleration, creation of ALP and meeting facilitation, curriculum development, data analysis, collaboration with teachers, etc.

Assistant Principal - Brandywine Heights School District, Topton, PA
(Aug. '06 - June '08) Assistant Middle School Principal, approx. 540 students.
- Responsibilities included: supervision, discipline, scheduling, school budgeting, curriculum development, staff development, facilities management, community relations, the creation and circulation of monthly community newsletter, coordination of 8th gr. college visitation, etc.

Fourth Grade Teacher - Berthoud Elem. - Thompson School District, Loveland, CO
(Aug. '05-May '06) Taught approx. 60 students due to skills grouping in Reading and Math.
- 98.5 KYGO/Applebee's Teacher of the Week Award, Advisory Council Excellence Award.
- Member of Technology and Social Committees, coordinated after school ball clubs.

Practicum Experience - West Chester Area School District, West Chester, PA
(Jan. '05 - April '05) Completed Principal's Practicum through Immaculata University.
- Worked closely with the elementary principal on administrative projects.
- Responsibilities: created gifted pilot schedule, trainings and presentations, assessment, survey design and evaluation, newsletter, budget, enrichment activities, teacher observations, created and facilitated school-wide behavior program and tsunami relief fundraiser.

Teacher of the Gifted - West Chester Area School District, West Chester, PA
(Aug. '04 - June '05) Taught 2nd to 5th grade in ***homeschool pilot*** program at Hillsdale Elem.
- Pulled out students for enrichment, pushed into classroom for compacting, acceleration, etc.
- Responsibilities included: creation of GIEP and meeting facilitation, curriculum development, data analysis, staff training, collaboration with regular ed. teachers, etc.
- Member of Positive Building Climate Committee, assisted in program implementation.

(Aug. '03 - June '04) Taught 2nd to 5th grade in LEEP ***total pull out*** program at admin. bldg.
- Taught three courses pertaining to business, the 20th century, and sign language.
- Member of Site Based Action Committee, created classroom website, robotics coach.

Eighth Grade Math Teacher - Peyton Middle/High School, Peyton School Dist., Peyton, CO
(Aug. '02 - May '03) Exclusive Pre-Algebra instructor for approx. 80 students.
- Assistant middle school football coach, raised funds and remodeled locker room.

Fourth Grade Teacher - Kings Highway Elem.-Coatesville Area School Dist., Coatesville PA
(Sept. '98 - June '02) Responsible for fourth grade classroom.
- PTO Outstanding Service Award '01, Head Start Volunteer Award '01, Coatesville Area Parent Council Outstanding Service Award '01
- Classroom-plus Tutor, Roller Hockey Club Coordinator, Ski Trip Chaperone
- **Student Teacher** - (Jan. - April '98) Student taught in third grade at Kings Highway.

RELATED EXPERIENCE

Ski Instructor - Steamboat Springs Ski Resort, Steamboat Springs, CO
('09 - present) Ski instructor for beginner skiers in Rough Riders Kids Program
Ski Instructor - Bear Creek Ski Resort, Macungie, PA
('01/'02, '03/'04) Ski instructor for beginner skiers in Alpine Kids Program
Educator/Leader - Earth Explore Learning Adventures, Spokane, WA
(Feb. - July '02) Chaperoned 34 MS students on a two-week science trip in Northwestern U.S.
Roller Hockey Coach - Gap, PA - (Fall '00) Head Coach in eight to ten year old division.

WORK EXPERIENCE:

Intrawest Resort Corp., Steamboat Springs, CO (Aug. '09 - Aug. '10, June '13 - July '14)
Resident Manager – Provided general maintenance, unit inspections, and security.
TMI Commercial Mechanical Contractors, Honey Brook, PA (Jun. '85 - Jan. '12)
Plumber/Laborer - Summer work included all aspects of industrial plumbing installation.
Pacific Environmental Services, Herndon, VA (Jan. - Jul. '95)
Industrial Hygienist - Involved 50% travel to enforce Air Force, OSHA and EPA regulations.
ARCO Chemical Company, Newtown Square, PA (Jan. '94 - Jul. '94)
Safety Science Co-op. - Accumulated, monitored, and analyzed injury and illness data, conducted air monitoring and safety training, and maintained MSDS chemical inventory.

COMP. SKILLS: eSchoolPlus, Microsoft Word, Publisher, Power Point, Excel, Media Player, Photo-shop, InterVideo WinDVD Creator, MacIntosh I-Movie, Alpine Achievement, Infinite Campus

ACTIVITIES: Hiking, camping, motorcycling, weight lifting, skiing, backpacking, woodworking, traveling. I.U.P. ice hockey - team captain '93, Shirk's Bicycles mountain bike racing '01.