DIFFERENCES IN THE QUALITY OF JAMAICAN PRIMARY SCHOOL FACILITIES ARE CORRELATED TO DIFFERENCES IN THE PERFORMANCE OF THE SCHOOLS IN THE GRADE SIX ACHIEVEMENT TESTS

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ABSTRACT

This study examined the differences in the facility quality of Jamaican primary schools and how these differences correlated to the performance of the schools (students) in the Grade Six Achievement Tests (GSAT). The small sample included 18, whole-day Jamaican primary schools. The quality of the schools was measured using Principals' Questionnaire adapted from *The International Pilot Study on the Evaluation of Quality in Educational Spaces (EQES) User Manual Final Version*, (OECD/CELE, 2009), to measure the principals' perception of the school facility quality, and the Facility Inspection Tool adapted from the *Facility Inspection Tool Guidebook* (CASH, 2008) to assess the physical condition of the schools. Non-parametric correlations were calculated for the facility quality variables and the schools' (students') average GSAT scores for 2009 and 2010.

The results, though not generalizable, indicated that differences in several variables, namely: classroom ventilation controls, external noise and internal classroom acoustics, school safety, attractiveness of school interiors, availability of computers for students and teachers, classroom air circulation and temperature, meeting space for staff and parents, classroom layout and space for teacher movement, and overall physical facility condition, are linked to differences in GSAT scores for the primary schools. The results also showed that the differences in the performance of girls and boys in GSAT may be linked to the quality of primary school facility.

Therefore, as the findings suggested that the quality of primary school facilities was correlated to academic performance, then future primary school improvements should prioritize these variables in the design: ventilation and acoustical control, school safety and aesthetics. The school policy makers and managers should also

consider the necessity for proper facility maintenance. The school building standards should include real measurable goals for the different environmental factors in the school facilities, in addition to their enrollment capacity (space provision). Finally, all stakeholders should ensure the school facilities are planned, designed, built and maintained as high quality, user centered environments.

BIOGRAPHICAL SKETCH

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LIST OF ABBREVIATIONS

ASHA	American Speech-Language-Hearing Association
CASH	California's Coalition for Adequate School Housing
CEE	Common Entrance Examinations
CIBSE	Chartered Institution of Building Services Engineers, United Kingdom
CO_2	Carbon Dioxide
DfEE	Department for Education and Employment, United Kingdom
DfES	Department for Education and Skills, United Kingdom
EPA	Environmental Protection Agency
GSAT	Grade Six Achievement Test
IAQ	Indoor Air Quality
IRB	Institutional Review Board, Cornell University
MOE	The Ministry of Education, Jamaica
NEI	National Education Inspectorate, Jamaica
OECD	Organization for Economic Co-operation and Development
PIOJ	The Planning Institute of Jamaica
UNICEF	United Nations Children's Fund
WHO	World Health Organization

1 Introduction

Public education is the foundation of personal development for the average Jamaican citizen. According to Jamaica's *Task Force on Educational Reform* (2004), improving the education system is a fundamental part of national development. The Task force stated the main goal of the transformation of the education system was to provide "equitable and accessible education for all" (Task Force on Educational Reform, 2004, p.2). Therefore, as the primary schools are a vital part of public education, provision of equitable education, should include the provision of high quality facilities, accessible to every child.

Certainly, the quality of the primary school facilities is important, as the buildings, equipment, furniture and grounds play a significant role in the daily lives of children. According to UNICEF (2000) children have a right to high quality schools facilities that not only provide adequate educational resources but are also safe and secure environments. The school facilities are not only learning environments, they are like a homes, providing basic shelter from the elements; acting as childcare centers, athletic facilities, healthcare facilities, and community centers. In fact, high quality educational facilities should be spaces suitable for all the school processes (educational, administrative and social); having the required variety of spaces allow for the school and the whole communities to function effectively. (Branz Ltd, 2007; WHO, 1998; Duke, 1998).

However, many people, even within the education system do not consider school facilities as an important part of school life, when compared to other factors like teacher quality or new textbooks (Duke, 1998; Hanushek, 1997). Perhaps the relevance of school buildings is lost on those whose school days are a distant memory. Especially in Jamaica, where the public depends on popular media reports to provide them with information on the status of school buildings, these reports tend to show the extremes: the brand new state of the art school facilities or the schools in such poor condition that they require the

intervention of health and safety experts. The significance of this seemingly wide disparity on student performance is often lost as media focus shifts to more newsworthy items.

Therefore to thoroughly explore the links between school facility and student achievement it is necessary to look at studies that rigorously examine the effects of educational facilities on student achievement. Internationally, many researchers have chosen to focus on the perceived inequities these differences in facility quality or condition bring to the education process. An overview of the of literature (Chapter Two) shows that there are different areas of research concentration, these include: the amount of financial resources invested into the schools' infrastructure, the building standards and design, the physical condition, user perception of the building quality, and environmental and human factors. All studies have sought to determine how relevant the differences in the physical environment were to the differences in student performance.

Generally, from the education economics perspective, the financial investment into school infrastructure is at the heart of policy research into school facilities. There is ongoing debate among economists as to how effective, increased spending on school buildings is at improving student performance. Though there is little consensus on this specific point, many researchers have concluded that the total amount invested in school facilities, especially in developing countries may be a determinant of student performance. (Green and Turrell, 2005; Greenwald, Hedges and Laine, 1996; Hanushek, 1997; DfEE, 2001)

In addition to the financial discussions, the quality of the school building design has also been explored. School designers, planners and international aid agencies have sought to establish exactly what constitutes high quality learning environments and how these are beneficial to student and teachers. International standards for different building systems have also been included in the design guidelines. These studies have concluded that school facilities that provide a suitable variety of functional spaces that

are, flexible, safe and healthy make the best learning environments. (Branz Ltd, 2007; Tanner, 2009; WHO, 1998; Duke, 1998, Earthman, 2004)

Furthermore, to find out if the school spaces are suitable for use, researchers examine the relationship between differences in environmental factors and students' academic achievement. Researchers have shown that the quality of classroom lighting, ventilation, indoor air, temperature, and acoustics were correlated to differences in student performance. The importance of students having visual comfort, clean air, thermal comfort, and low noise levels in the classroom were emphasized. Especially, as classrooms with poor environment quality can affect students' cognitive functions, their learning processes, and ultimately their health. (Hygge, 2011; Evans and Maxwell, 1997; Boyce, 2010; Heschong, 1999 ; Wargocki and Wyon, 2007; WHO, 1998).

Consequently, the overall condition of school facilities (that is the fitness of all building systems for their proposed use) has also been linked to the performance of students in school. In addition, school condition has been associated with differences in school morale, teacher and student attendance, and student behavioral problems. In fact, studies have shown that there is a link between the physical condition of elementary schools in the USA and student achievement, especially in performance in fundamental subjects like Mathematics and Reading (Schneider, 2002; Sheets, 2011; Earthman, Cash and Berkum, 1995). When school conditions were not conducive to learning the attendance levels and school morale suffered (Uline and Tschannen-Moran, 2008). Earthman, Cash and Berkum(1995) linked poor school conditions to increased indiscipline. Moreover, other studies indicated that incidences of vandalism increased when schools were poorly maintained. (Schneider, 2007; DfEE, 1996; MOE, 2008)

Clearly the quality of the school design, building standards, environment standards and physical condition are important. Internationally studies have indicated that low quality school facility is linked to poor student performance in some subjects. This is especially true for developing countries, where financial resources may limit the building and maintenance of adequate learning environments. If this

problem of facility quality is examined from a Jamaican perspective, then the above statements may be true for Jamaican many primary schools as well; where deficiencies in the development of the education system have made it a challenge to provide adequate facility for all students.

1.1 Jamaica's Education System and Primary School Facilities

Jamaica is an island located in the Caribbean, and whose "formal" education system was historically based on the British education system, as it is a former British colony that gained its independence in 1962. An overview of the existing education sector shows the Jamaicans currently have access to public and private education at the all levels. The Pre-Primary level schools include basic, infant and kindergarten schools for students: 3 to 6 years. Primary level schools include primary and preparatory schools for Grades: 1 to 6. Secondary level schools include secondary and high schools Grades: 7 to 11. Tertiary institutions cater to students above Grade 11and include colleges, universities and institutes. All-Age Schools caters to students at both the primary and lower secondary levels.

Table1 shows the number of educational institutions existing at each level of the Jamaican education system according to the *2009/2010 Education Statistics* (MOE, 2011). At the primary level only 546 schools are Primary schools, while 132 are Preparatory schools and the rest being All-Age or Primary Junior High schools. Therefore, the primary schools account for a significant portion of the schools at the "primary" level and the construction and maintenance of these public schools have remain a challenge since many were first established as colonial elementary schools.

Table 1. Distribution of educational institutions in Jamaica 2009/2010

Education Level	Number of Schools
Pre-primary	2,203
Primary	924
Secondary	420
Tertiary	17

1.2 Historical Elementary School Buildings

Jamaica's public education system was established in1835 with the emancipation of slaves and the creation of the British Negro Education Grant. Prior to this there was no formal system of education on the island for the population in general or for the slaves in particular. Any learning (reading and writing) was limited to what occurred via religious education in churches (Task Force on Educational Reform, 2004).

The education of ex-slaves was up to missionaries from the various denominations. This included the construction of elementary schools, which was carried out by the different churches with the minimal aid from the Education Grant. Schools were also constructed by ex-slaves, in the interest of their own personal development. During this period of ad-hoc expansion of the elementary school system, many problems arose due to a lack of central planning, management and adequate financial support. (Rooke, 1981)

According to the Education Commission of 1898, one such problem was the number of elementary schools that were created (approximately 900). The Education Commission (1898, p.16) recommended the closing of "inefficient schools", that were "too close together" owing to denominational rivalry. As a result many schools in the early 20th century were located far away from the villages requiring students to walk long distances, more schools were on the plains but few in the hilly interior (King, 2002). As some schools were often inaccessible and were rarely inspected, many buildings were in a poor condition.

King (2002) also reported that schools housed in chapels provided the best environment for learning, although the layout made teaching a challenge; they were hygienic, with good ventilation and relatively well equipped. In contrast, the schools built independently with limited resources (without funds from a church or the state) were described as crowded mud huts, without windows or adequate furniture or teaching aids. School inspectors associated these substandard conditions with low attendance

and poor student performance. Therefore, historically there were already anecdotal links between the condition of the learning environments and academic achievement of children in Jamaica.

Figures1 and 2 show the features of the interior and exterior of rural school in early 1900s. The one room schoolhouse was a simple wooden building, typical of those times; naturally ventilated; and furnished with backless wooden benches. The different ages groups were taught in one classroom. It is possible that most of these schools also small served as churches or church halls as they were sometimes called. It is also possible that the simplicity of this ideal church-style design influence the simplicity of the modern primary school building.

1.3 Modern Primary School Buildings

According to the *Jamaica Task Force on Educational Reform Report* (2004) real modernization of the Jamaican education system began in 1953, with intense development following Independence in 1962. The education policy was aimed at providing "Education for All", especially at the primary level (p.42). In 1970s this push towards improving access to primary education included the construction of new primary schools to increase classroom spaces. It is said that the goal of universal access to primary education was "achieved during the first 15 years of Independence" (Jamaica Task Force on Educational Reform, 2004, pp. 41- 43).

Miller (1997) stated that improvements were made to classroom and furniture design in 1987 following recommendations from the research of James (1977) for more student centered classroom arrangements. Also the space standard (11.5 square feet per child) was also a reflection of the new recommendations from the Inter-America Development Bank whose support was used in the improvement of the primary education system (Miller, 1989). As only new or upgraded schools benefited from the improvements; older schools that were built to lower standards still experienced the problems

outlined by James (1977) such as: overcrowding, inflexible furnishing and noisy conditions from lack of proper classroom separation (Miller,1997).

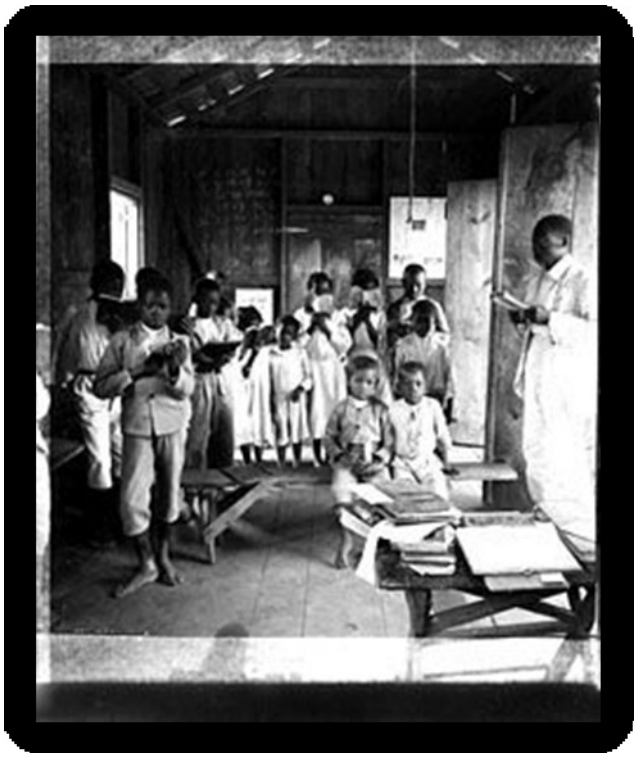


Figure 1. The interior of a Jamaican elementary schoolhouse in early the 1900s. Photo adapted from "Native Jamaican School Children Reciting in Their Little Rough Schoolhouse, Jamaica" by H. C. White, 1904, Keystone-Mast Collection, UCR/California Museum of Photography, University of California, Riverside. Retrieved from: http://www.oac.cdlib.org/ark:/13030/kt9580166c/?order=2&brand=oac4

Figure 2. The exterior of a Jamaican elementary schoolhouse in early the 1900s. Photo adapted from "A Native Country Schoolhouse Among the Banana Trees, Jamaica." by unknown, 1904, Keystone-Mast Collection, UCR/California Museum of Photography, University of California, Riverside. Retrieved from: http://www.oac.cdlib.org/ark:/13030/kt9580166c/?order=2&brand=oac4

Although some of the problems that affected the physical facilities and the performance of students in early Jamaica elementary school system still existed, the modern primary school building was a major improvement over the 19th century one-room school houses. Figure 3 shows a modern three story, urban, multiple grade primary school facility, with all the modern amenities on the school grounds. The buildings are made of reinforced concrete, able to withstand most of the natural disasters that affect the island from time to time. While Figure 4 shows the interior of a rural classroom with students seated at traditional double wooden desks, painted concrete walls, fixed louver style ventilated blocks and decorated by posters and mobile teaching aids.

Figure 3. The exterior of a typical large urban primary school in Jamaica. Photo adapted from "Allman Town Primary School Courtyard" by airborneshodan. Retrieved from: http://www.flickr.com/photos/airborneshodan/5479021960/

Figure 4. The interior of a rural primary school classroom in Jamaica. Photo adapted from "Standardized Texting" by Mina Mikhail. Retrieved from: http://www.flickr.com/photos/fighting-the-boss/2585024831/in/photostream/

Notwithstanding the physical progress that has been made since 1962, the problem of increasing the literacy rate of primary schools students remains a pressing problem. Therefore the Jamaican government has continued to devise and implement programs to improve primary education. To this end the Jamaica Task Force on Educational Reform (2004) also identified the need for physical improvement to the primary schools namely: improved facility maintenance and the overall aesthetic appeal of the facilities; increased provision of student restrooms, perimeter fencing, classroom furniture, and accommodation for special needs students.

Additionally the lack of specialized learning areas (e.g. labs) spaces and spaces for social and administrative activities needed to be addressed. The task force report concluded that 50% of the schools required physical improvements. Specifically "school capacity and the state of the physical plant [school facilities] require … upgrading and expansion to internationally accepted standards, with the needs of learners at the core [of the improvement works]". (Jamaica Task Force on Educational Reform, 2004 p.14).

Furthermore, the Jamaica Task Force on Educational Reform (2004) believed that when these physical upgrades were completed, they would help the government to achieve their goals for the transformation of primary level education. The stated goals include: increasing the national GSAT scores from the low 60% to 80%, improving attendance, facilitating more co-curricular programs, creating a learner centered environment, improving new school location planning to match demographic needs, and providing school buses in addition to basic school infrastructure. Therefore, improving student performance (GSAT) remained a top priority for the Jamaican education system.

1.4 The Importance of GSAT (Grade Six Achievement Test)

The GSAT was piloted by the Ministry of Education (MOE) in1996 and totally replaced the older Common Entrance Examinations (CEE) in 1999 as the placement exam for secondary schools. GSAT is used to measure the performance of Grade 6 students (or 12 year olds) in five subject areas, namely:

Mathematics, Science, Social Studies, Language Arts and Composition (Communication Task). The Grades 4 to 6 curriculums are used to prepare the tests. The exams are taken in March of each year and the scores standardize to create a total score used for placement and the awarding of scholarships. (MOE, 2006)

The students are required to create a prioritized list of five high schools before taking GSAT. Their total scores are then used to place students from primary, preparatory (private) and all-age schools into secondary schools. Depending on their performance and the availability of spaces students are awarded their 1st to 5th choice by a computerized selection process. Where spaces are not available in the chosen high schools the computer selects a school for the student based on its proximity to the primary school. Where students performed well below average they are placed anonymously by Education Officers in their region. (MOE, 2006)

Therefore, the students' GSAT results are a significant part of their academic life and can be compared to the importance of SATs in the USA to college admissions, only without a guaranteed reward for their efforts. The GSAT results also help to determine the students' future prospects in the Jamaican society, as many parents and students believe that getting into an elite traditional high school is a step up on the social ladder. Hence from the preceding discussion of some of the issues affecting Jamaica primary schools, two significant problems can be highlighted:

1. Many Jamaican primary school facilities maybe of a substandard quality and this may have created environmental conditions unsuitable for learning.
2. Many students leave primary schools performing well below the required levels in the GSAT.

1.5 Statement of the Problem

Clearly we can theorize that the quality of the physical facility of Jamaican Primary Schools is associated with differences in the schools' and or students' performance in the Grade Six Achievement Test (GSAT). This is supported by the findings of the international studies, which have illustrated that

school facility quality is associated with students' academic. Also because there is substantial anecdotal evidence that many Jamaican primary schools may not be providing suitable learning environments and many students are underperforming.

1.6 Rationale for the Research

Therefore, there are several reasons to undertake this study. Firstly to confirm the theory that schools' physical environment do matter (Duke, 1998) and to show that inequity in the provision of suitable school facilities are associated with differences in students' performance in the Jamaican context, as a developing country struggling to provide education opportunities for all. Consequently, this research will add to the existing literature by providing information on the relationship between the physical facility of Jamaican primary schools and students' performance in standardized tests. This information will fill the gap in the local literature on primary educational inputs, as there is clearly lack of Jamaican school facility research on the general influences of the physical environment variables on student outcomes (Miller, 1997).

1.6.1 Purpose of the Study

The main aim is to examine correlations between Jamaican primary school facility quality (of the buildings, grounds, furniture and equipment), selected environmental conditions such as lighting ventilation and acoustics, and student performance in GSAT. Secondly, is to examine the correlations between GSAT scores and the overall physical conditions of the primary schools. As this study takes an exploratory approach, to understand the top physical factors in Jamaican school facilities associated with student performance, the focus is not on the effect of any single variable on specific performance differences of students. The goal is to make recommendations for improvements to the primary school facilities that are most needed, specifically in Jamaica, based on the identified key correlations and to propose topics and methodology for future in-depth studies.

1.7 Research Questions:

In order to fulfill the stated research goals the following questions were posed:

1. Are differences in the principals' perception of quality of the physical facilities of Jamaican primary schools associated with differences in GSAT scores for the schools/students?
2. Are differences in the condition of Jamaican primary school facilities associated with differences in GSAT scores for the schools/students?

1.8 Overview of the Thesis Methodology (Chapter Three)

To answer the research questions the study took an exploratory approach and utilized quantitative and qualitative methods using the schools as the unit of analysis. Two questionnaires and a school inspection tool were used to collect data from the random stratified sample of selected schools (18 schools participated); GSAT scores were obtained from the Ministry of Education, Jamaica. Both questionnaires were adapted from *The International Pilot Study on the Evaluation of Quality in Educational Spaces (EQES) User Manual Final Version* by the Organization for Economic Co-operation and Development (OECD, 2009). A school inspection tool was adapted from the *Facility Inspection Tool Guidebook* (California's Coalition for Adequate School Housing, 2008) for the study and used to collect data on the physical conditions of the schools.

The Principals' questionnaire measured their perception of different school facility variables, such as the: spatial accommodation, furniture flexibility, classroom layout, equipment availability, special needs accessibility, temperature, ventilation, acoustics, lighting, aesthetics, safety, security and maintenance. The Board Member questionnaire collected information the following school variables: location, demographics, ownership, management, space variety and usage. The inspection tool was used during school visits to assess the physical conditions of the school and to rate the facilities (Poor, Fair,

Good or Exemplary). Statistical analyses were performed on all data collected and non- parametric correlational analysis was used to answer the research questions.

1.9 Outline of Final Thesis Chapters

Chapter Four presented the results of all the data analysis. Descriptive statistics were provided for the following school variables: location, ownership, school capacity, enrollment, community demographics, space inventory and management. In addition a detailed description of the distribution of the Principals' responses was given for each item in the questionnaire, along with the inter-item correlations. This was followed by the observations and ratings from the school facility inspections. Lastly the findings of the hypothesis testing were outlined; only the significant correlations between the school variables and each GSAT subject was highlighted ($p< 0.05$). The complete correlational analysis results were given in Appendix D and E.

Finally in Chapter Five the results were examined and a full discussion of the findings and their implications presented. The significant correlations for each school variable and GSAT subject was analyzed for trends from 2009 to 2010, the results for the schools overall performance were compared to those for the girls and the boys. The relative strength and number of correlations for each variable was identified and the implications of the highest values were discussed. The findings from analysis were compared to the current literature to show whether they confirm or contradict the major studies. Chapter Five was completed with the presentation of the summary, conclusions, limitations and recommendations for future studies.

2 Literature Review

In *Defining Quality in Education*, UNICEF (2000, p.4) stated that children had a right to "quality education"; which included schools that were "environments that are healthy, safe, protective and gender-sensitive, and [that] provide adequate resources and facilities". In addition to this admittedly broad definition, other studies have also described high quality schools facilities as well planned spaces, designed and built to support educational activities; equipped, maintained and utilized in a way that prevented any negative effects to the teachers and students (Branz Ltd, 2007; WHO, 1998; Duke, 1998).

2.1 School Design

Therefore, school facilities that were planned and designed to adequately accommodate all teaching and learning activities were considered ideal education environments. Sanoff (2001 pp.4-5) highlighted a list created by Jeff Lackney (1998) for good K- 12 school spaces, the following were included: "stimulating environments, places for group learning, public space, active/passive places, personalized space, [and] the [whole]community as a learning environment." But in addition to these space types, truly successful designs were flexible and effective at adapting to changes in the schools' programs overtime (Gislason, 2010).

Additionally, good designs created stimulating learning environments; these designs were fundamentally linked to the physical environmental factors within the spaces (DfES, 2002). Factors such as "lighting, air [and] sound" helped to create pleasant classrooms spaces (DfES, 2002, p.36). A classroom with windows helped to bring in natural light and was enhanced by appropriate use of paint colors. The design of the acoustical system was also important as the sound insulation helped to reduce noise interruption. Lastly, suitable ventilation systems were necessary for the provision of good indoor air quality, thermal comfort and an overall healthy facility. (DfES, 2002)

Furthermore, other studies have illustrated that some successful school designs were associated with better performance and higher morale for teachers and students. Tanner (2009, p. 447) showed that the following school design patterns: "movement and circulation, large group meeting places, day lighting and views, and instructional neighborhoods" were correlated to students' achievement in elementary school. Similarly, Uline, Tschannen-Moran and Wolsey (2008) found that school designs that included the following features: "unique spaces, movement flow, aesthetics, comfort, cleanliness, flexible classrooms, natural light with views, personal space and sense of security" had a positive effect on teachers and students.

2.2 School Facility Quality

High quality effective school facilities were not limited to those with good designs, but also included schools that were well maintained. In fact numerous studies on school condition have been done by educators, economists, psychologists, human factors specialists, anthropologists, medical doctors, architects and engineers (Duke, 1998). Although these researchers were from diverse backgrounds they have identified several common problems that affected the overall condition of the schools, these included the following: space inadequacy (size and overcrowding), poor indoor air quality, poor thermal comfort, noise, inadequate maintenance of spaces and aging facilities. These studies illustrated that there were links between student achievement and the overall condition of the school facilities (Schneider, 2002; Sheets, 2011; Earthman, Cash and Berkum, 1995; Lewis, 2001; Branham 2004; Stevenson, 2001).

Specifically, one study the in USA, found that schools that were in better overall condition had a higher percentage of students performing above basic or grade level in Math and Reading (Schneider, 2002). Other studies have also discovered that the overall facility condition was associated with students' average scores in not only Math and Reading but also in Writing, Science and Social studies (Sheets;

2011; Lewis, 2001). In each case the schools that lacked adequate school facilities were more likely to have a significant number of underperforming students.

In addition to student achievement, school conditions were also associated difference in students' attendance and behavior. Students in schools with substandard conditions had more behavioral problems (Earthman, Cash and Berkum, 1995). Sheets (2011, p.62) stated that schools with disciplinary problems were likely to have overcrowded classrooms, where both teachers and students were frustrated by the school conditions. While, Branham (2004) showed that poor facility conditions, especially in schools where temporary structures were used, had a negative effect on attendance. This finding was later supported by Duran-Narucki (2008 p.283), whose study indicated that differences in the condition of school facilities "predicted attendance …after controlling for other possible predictors".

Furthermore, school facility condition was also linked to school climate or perception of school experiences. Uline and Tschannen-Moran (2008, p. 66) analyzed school data from middle schools in Virginia and stated that "when learning is taking place in inadequate facilities, there tends not to be a focus on academics, and the learning environment is less likely to be perceived as orderly and serious." This theory was also supported by a Jamaican study by Lockheed and Harris (2005); a follow-up to the study done by Glewwe, Grosh, Jacoby and Lockheed (1995). The study theorized that underperforming schools were associated with noisy and crowded classrooms along with poor community conditions. The researchers concluded that these physical conditions helped to produce a school climate that was not conducive to learning.

2.3 School Facility Improvement

Going beyond existing conditions, some studies have focused on the effects of school facility improvements on student performance. A case study on Hong Kong "millennium primary schools" showed that new classroom designs with improved lighting, ventilation and space management were

positively correlated to changes in students' "learning behavior"(Leung and Kong, 2005). Maxwell (1999) also found that the Math scores of elementary school students improved after school renovation the buildings' interior surfaces and lighting.

In addition, Green and Turrell (2005) concluded that the morale of the whole school increased when school facilities were improved. Buckley, Schneider and Shang (2004) found that improving school facility increased teacher retention. This conclusion was supported by a Loeb, Darling-Hammond and Luczak (2005) study which reported that teachers' perception of the physical facility was significant in predicting the level of teacher turnover in California schools.

2.4 Student Safety and Health

Education processes were also affected by safety and health problems in school. Earthman (2004) listed the "*31Criteria for School Building Adequacy*" and put safety and health in schools as the most important elements for school buildings suitability. The study stated that schools should have "potable water, fire safety, adequate lavatories, security systems, and a good communication system to use in emergencies" on their critical list (Earthman, 2004, p.17).

Safety and security were therefore very important factors when creating high quality school facilities. A safe school environment contributed to the emotional wellbeing of both teachers and students. Both international and local schools have established minimum school safety standards, some common requirements included the following: secured entry/exits/perimeter, secured windows and doors, fire safety systems and building layouts that allowed for easy surveillance. The standards emphasized that poorly maintained spaces encouraged indiscipline and acts of vandalism. (Schneider, 2007; DFEE, 1996; MOE, 2008)

In addition to safety, schools that were free from disease provided the best support for teaching and learning. Buckley et al. (2004) reported that health and safety standards in schools were linked to academic performance in school. The researchers suggested that improving compliance with public health standards would help to improve the schools' performance because less time would be lost to ill health.

Historically, healthy schools are especially important in developing countries where poor environmental conditions have caused the deaths of many children (WHO, 2004). In Jamaica, NEI (2010) reported on a number of potential health concerns for some primary schools. Problems indentified include: open drains, poor ventilation, hot and noisy overcrowded classrooms, unsanitary restrooms, improper food storage, intermittent water supply, leaky roofs and poorly maintained grounds. There were a few primary schools with no health issues but in many cases "unhygienic restrooms" was a recurring concern.

Internationally, health problems associated with unsanitary school restrooms were also a major concern (Jewkes and O'Connor, 1990; Lungblad and Hellstrom, 2005; Lungblad, Hellstrom and Berg 2010). In the UK, Kaltenthaler, Elsworth, Scheweiger, Mara and Braunholtz (1995) found that improper maintenance of restroom floors resulted in the transportation of biological contaminants to carpets in the classrooms. In Italy, Leoni, Bevini, Esposti and Graziano (1997) traced a local outbreak of Hepatitis A to unsanitary toilet facilities in one primary school. Therefore poorly maintained school facilities were linked not only to children's health but to the health of the whole community.

2.5 Role of Environmental and Human Factors in Learning Outcomes

Duke (1998) implied that student achievement and facility quality had an indirect relationship. In other words, the level of student performance was mediated by other physical factors namely: environmental and human factors. Therefore, many researchers have focused on the impact of these factors on student learning outcomes and extrapolate this to their academic performance.

Schneider (2002) stated that several environmental factors influenced students' achievement. These factors included: indoor air quality, ventilation, and thermal conditions; lighting and acoustics. In addition to which human factors (human physical characteristics) like anthropometrics and humans' physical capabilities helped to determine how well students perform when using the furniture and equipment in the classroom (Human Factors and Ergonomics Society, 2010; Molenbroek, Kroon-Ramaekers and Snijders, 2003)

2.6 School Acoustics

An important quality in any learning environment is the acoustical environment of the spaces and how it supports the education processes. The acoustical environment is affected by several design factors: shape and volume of a room, sound absorbency of the materials used and control of internal and external noise sources. Good acoustics were also dependent on the standards used in the school design. (DfES, 2003)

2.6.1. Acoustical Guidelines

The most recognized standard is the *American National Standards Institute* (ANSI) for schools. Lilly (2010) recommended the use of this standard in school designs as they would help to prevent the acoustical problems associated with high background noise levels (loud noises) and long reverberation times (unwanted echoes). This would mean a maximum background sound level of 35 dBA and the corresponding maximum reverberation time of 0.6 second, in order to control noise in a typical classroom (unoccupied).

In the UK the maximum ambient noise level and reverberation limit for primary school classrooms is as for US schools. The *Building Bulletin 93* (DfES, 2003) stated that all school rooms should be designed acoustically to prevent "disturbances" and to provide acoustical "conditions" appropriate for its "intended

use" (DfES, 2003, p.3). In New Zealand they recommended maximum ambient noise level is as for the US but also recommended a maximum reverberation time of 0.4 seconds for primary school classrooms (Branz Ltd, 2007).

2.6.2 Classroom Acoustics

The fact is, globally, many existing schools do not have classrooms with proper acoustical treatment or conform to any building standards (WHO, 1997). In their study of Ohio public elementary schools Knecht, Nelson and Whitelaw and Feth (2002) found that only 4 out of 32 classrooms met ANSI 2002 acoustic standards for background noise and most exceeded the reverberation time limits recommended by ASHA. Nelson and Soli (2000, p.360) also stated that the classroom noise had the potential to form "acoustical barriers to learning". They identified environmental risk factors as noisy classrooms where the teachers' speech level over the background noise was not enough for young listeners to receive instructional messages.

In a study on primary classrooms in Hong Kong, ambient noise levels were measured and acoustical treatments for different classrooms were also noted. They found that all classrooms had noise levels above ASHA 2005 recommended levels. Even low frequency background noises masked the teachers' voices. The study also found that the classrooms had inadequate acoustical treatments for internal surfaces as thin wood partitions used to separate classrooms helped to the transmit of sound from adjoining classrooms. (Choi and McPherson, 2005)

In Brazil, Zannin and Marcon (2007) found that even properly enclosed, but acoustically untreated classrooms were sources of noise in schools. A study in Taiwan, Chiang and Lai (2008) found that both enclosed closed classrooms with open windows and joint/open classrooms had high noise levels. Another study in Brazil by Zannin and Zwirtes, (2009) discovered that external noise from physical education classes was also a source of acoustical discomfort.

Kruger and Zannin (2004) indicated that these challenges were related to the tradeoff between ventilation and acoustical requirements in tropical architectural designs. They quoted Otto Koenigsberger et al., stating that "There will be a conflict between thermal and aural requirements, especially in warm-humid climates" (Kruger and Zannin, 2004, p.1056). Therefore, it is not surprising that educational studies in Jamaica have also indicated that many classroom problems were associated with poor acoustics.

2.6.3 Acoustical Problems in the Jamaican Classroom

There exist numerous anecdotal references to the noise problem in the Jamaican classroom. Davies (1999, p.30) discussed the difficulties encountered by primary school teachers with "high noise levels" in classes "only divided by movable partitions". The researcher illustrated that the problem is not new as "a high proportion of classrooms today still match the description offered by James (1977) over 20 years ago in the only known Jamaican study of the relationship of physical facilities to instructional strategies" (Davies,1999, p.28).

James (1977, pp. 113-114) said this of the classrooms then, "walls and roofs are not acoustically treated. Noise is a major problem in the primary classroom…and teachers who want to engage in quieter activities or involve their class in noise-producing group activities usually resort to open spaces in the school yard". In addition to these comments, another study declared that "noise is a problem even where desperate attempts are made to ensure quiet" (Miller, 1989, p.142).

Lockheed and Harris (2005 p. 21) stated that "classroom focus … [was] undermined by the crowded conditions where nothing separated classes other than blackboards, and classroom sounds echoed off the high ceilings" . Recently, several primary schools' inspection reports reiterated the mostly negative comments on the use of movable blackboards/chalkboards to separate primary classrooms. The reports included the following comments: "Classrooms are small and divided by blackboards. This allows sound to carry across neighbouring classes and is distracting for students… consequently, students find it

difficult to listen and concentrate during lessons (NEI, 2010). Background noise in the open-styled classroom settings and was clearly a problem in Jamaican primary schools.

2.6.4 Impact of Noise on Children's Performance

Excessive noise levels are a distraction in any setting, but the impact of noise on children goes beyond a mere distraction. Long-term exposure to noise had a negative effect on reading ability and resulted in attention deficit problems in school children (Hygge, 2011; Evans and Maxwell, 1997). Frustration caused by noise exposure could also reduce motivation to perform tasks and "even relatively typical, modest-level exposures to community noise may have detrimental effects on the developing cognitive systems of young children" (Lercher, Evans and Meis, 2003, p. 731). In addition, Shield and Dockrell (2008) that indicated that both internal and external noise affected standardized test scores for children ages 7 – 11.

Moreover, all these findings were supported by many other studies, they have also indicated that noise reduced the effectiveness of classroom communication, and created problems in both teaching and learning activities (Nelson & Soli, 2000; Smith, Gray, Dove, Kirchner and Heras, 1997; Ahlander, Rydell and Lofqvist, 2011; Yang and Bradley, 2009; Berg, Blair and Benson; Crandell and Smaldino, 2000; Klatte, Lachmann and Meis (2010). Therefore, these studies have shown that both long-term learning quality and student achievement were affected by noise and that this was exacerbated by inadequate acoustical treatments in schools.

2.7 Lighting

Quality indoor lighting is defined by its ability to allow for the full utilization of any space without negative effects (Veitch and Newsham, 1998). Proper lighting is task and user specific; it aids performance and is designed to suit the user visual capabilities (Veitch and Newsham, 1996). Good

lighting in schools had a positive effect on the morale of both teachers and student through its enhancement of the physical appearance of any setting (DfEE, 1999). Good quality lighting is therefore a fundamental part of the learning process and the design of a school's lighting system is very important.

2.7.1. Lighting Guidelines

As with other environmental factors lighting quality is sometimes a reflection of lighting standards. The Jamaican *Standards for Primary Education* (1999) stated that classrooms should be "well lit" (p.14). The *Building Bulletin 90* stated that the lighting design for schools should make use of both daylight and artificial lighting. The architectural forms, interior finishes and the quality and quantity of lighting specified must also work together. Where daylighting is used then adequate artificial lighting should be provided for times when the sunlight levels are low. (DfEE, 1999)

According to the UK's lighting code ("CIBSE, 1994"), illuminance levels should be 300 lux for "general teaching spaces"; 500 lux for "close and detailed work"; and 80… [to] 350 lux for common areas (p.23). Every effort should be made to reduce glare, flicker and unwanted reflectance. Special provisions ought to be made for the visually impaired and appropriate user controls included in design. Proper lighting for security and emergency must be a part of the design plan. The lighting system should be designed for ease of maintenance to prolong its effectiveness and to reduce cost. (DfEE, 1999)

Benya (2001) offered other lighting guidelines for schools. Namely, designs using natural lighting should be site specific (determined by local condition). Artificial lighting should use the most suitable lighting technology (lamps and luminaires etc.), so that final designs were cost effective for the long term (ease of maintenance). (Benya, 2001)

2.7.2 Lighting and User Comfort

The effect of light on user comfort is very important within the classroom setting, as bad lighting has the potential to reduce student performance. Boyce (2010) identified radiation from task lighting, eyestrain, severe headaches and general visual discomfort as some of the potential health effects of poor indoor lighting. While visual discomfort was associated with low frequency fluorescent lighting (flicker) and glare (Veitch and Newsham ,1996).

Flicker produced by low frequency fluorescent lighting was identified as a problem for about 70% of classrooms assessed (Winterbottom and Wilkins, 2009). They also discovered that the design of the classroom (windows and artificial lighting) was a problem in more than 50% of the classrooms studied. They concluded that user discomfort was highly likely as illumination levels at the desks often exceeded the maximum required by code (UK: 500 lux). Also glare associated with unwanted surface reflectance could potentially affect students' visual comfort. (Winterbottom and Wilkins, 2009)

A lack of adequate user control over the classroom lighting system (in different work zones) also exacerbated the lighting problems (Winterbottom and Wilkins, 2009). From daylighting experiments, Wang and Boubekri (2011) also concluded that user control of the lighting helped to determine comfort. Where designers were unable to predict the location of work zones, inflexible controls resulted in the limited utilization of internal spaces (Wang and Boubekri, 2011).

2.7.3 Lighting Quality and Achievement

Hathaway (1995) looked at the effect of full spectrum lighting on students in Canada, and found that it was more beneficial than other types of artificial lighting. Benefits included: higher gains in academic achievement, higher attendance rates, less dental problems and accelerated physiological development. Hathaway (1995) also noted that, the effect of lighting on students went beyond the visual; "physiologic",

"pathologic" and "therapeutic" effects were also relevant (p. 231). Full spectrum lighting was also positively associated with students' emotional well being (Samuels, 1999).

The Heschong Mahone Group (1999) discovered strong links between daylighting and achievement. They concluded that there was "a uniformly positive and highly significant correlation between the presence of daylighting and student performance" (p.57). They showed that window areas and daylighting were positively associated with students' reading and math scores. Design features such as skylights and operable windows also helped to produce favorable conditions for the education processes. Additionally, windows that provided an "interesting view" were positively linked to student achievement (Heschong, 2003, p.110).

The importance of color temperature in lighting quality was explored by Berman, Navvab, Martin, Sheedy and Tithof (2006). The researchers found that 5500K lamps were better for reading i.e. near visual acuity. Mott, Robinson, Walden, Burnette and Rutherford (2011) also concluded that use of "focus lighting" of 6000K improved students' oral reading fluency, when compared to "normal lighting" using 3500K lamps.

2.7.4 Drawbacks to Tropical Daylighting

There are clearly many benefits of using daylighting in schools and recent school lighting research has been focused on daylighting (use of natural light) in the classroom. In fact most lighting design guides for schools) encourage the responsible use of daylighting (DfEE, 1999; BRANZ Ltd., 2007). But in the tropical countries, like Jamaica, there are also many challenges to using daylighting.

One study concluded that much more tropical research was needed. Highly variable cloud formations and movements made predicting lighting quantity near buildings difficult. Though the natural light was

abundant, the accompanying tropical heat from the large windows (necessary for adequate lighting), inhibited the use of daylighting. (Chirarattananon, Chaiwiwatworakul and Patanasethanon, 2003)

Kruger and Zannin (2004) have already observed that there is a "strong interdependence among environmental comfort factors" within the tropical classroom (p.1063). Controlling sound, light and temperature through passive methods in the tropics meant that designers had to prioritize among the competing environmental factors. For the sake of immediate health concerns the temperature and ventilation of the classroom usually took precedence.

2.8 Ventilation, Indoor Air Quality and Thermal Comfort

Good ventilation is an important factor in the provision of a healthy school environment. The inflow of outdoor air is essential, to replenish oxygen and to remove carbon dioxide (CO_2) produced from respiration, along with moisture and odors from the human body. Adequate ventilation rates will also help to reduce the concentration of pollutants or contaminants inside the built environment and therefore, improve indoor air quality (IAQ). The cooling effect of air movement also lowers room temperature and humidity and increases the thermal comfort of occupants. (BRANTZ Ltd. 2007)

2.8.1 Ventilation Guidelines

In most countries standards have been developed to ensure the schools provide adequate ventilation. The Jamaica *Standards for Primary Education* (1999) stated that classrooms should be "ventilated" (p.14). The UK's *Building Bulletin 101* (DfES, 2006) stated that classroom ventilation rates required were " minimum 3 l/s person"; "daily average 5 l/s per person"; and the maximum "capability of … 8 l/s per person ". This meant limiting carbon dioxide concentration to average "1500 ppm" (1500 parts per million) not to exceed 5000 ppm; achieved through at least "2.5 air changes per hour" (pp. 5-6). For

thermal comfort, schools should avoid prolonged exposure to temperatures at or above “28 °C” and never to exceed “32 °C” (p.9).

New Zealand standards were more conservative (given their climate). They recommended ventilation rate of “8 l/s per person”; “4 complete air changes per hour”; and keeping carbon dioxide concentration down to 1000 ppm (Brantz Ltd., 2007, p.9-16). Both countries stated that consideration should be given to other environmental factors, like acoustics and lighting when designing passive or active ventilation systems.

2.8.2 Ventilation Systems

A school’s ventilation system may be classified as active (mechanical), passive (natural) or a mixture of both. Passive ventilation is using natural ventilation (fresh air movement through building openings) without the aid of mechanical devices; this system therefore has the potential to reduce the schools energy costs (Brantz Ltd. 2007). But there sometimes a conflict between natural ventilation and other building factors such as acoustics, temperature and daylighting in schools with passive designs. Openings that allowed for air movement and daylighting also facilitated noise intrusion, excess radiant heat and solar glare in the tropical schools (Losso and Viveiros, 2003; Kruger and Zannin, 2004).

Contrarily in colder countries openings resulted in heat loss and may result in a loss of thermal comfort. Some teachers’ reluctance to open windows because of the potential intrusion noise or drafts also reduced the effect of having passive systems in schools (Dutton and Shao, 2010). da Graca, Kowaltowski and Petreche (2007) noted that the best passive ventilation designs came before schools were built and not as a result of retrofits. Therefore many of the user comfort problems indentified were due to inappropriate use of passive systems in some locations and the normal limitations of natural ventilation (Aynsley, 2007).

2.8.3 Ventilation, Indoor Air Quality (IAQ) and Students Health

Although researchers have noted the difficulty in establishing a direct relationship between general indoor environmental quality and performance (Mendell and Heath, 2005; Shaughnessy, Shaughnessy-Haverenen, Nevalainen and Moschandreas, 2006; Wargocki, Wyon, Lynge-Jensen and Bornehag 2008). Good ventilation is necessary to produce better indoor air quality (IAQ) in schools, and to prevent the occupant health problems (Sundersingh and Bearg, 2003; EPA, 2000). Anderson and Bogdan (2007) identified children health problems associated with poor IAQ as: asthma and other respiratory problems; and allergic reactions to mold, pets and insects and volatile organic compounds (VOCs). Gases like radon and fumes from cooking and vehicular exhaust were also identified as dangerous contaminants.

In fact, exposure to traffic fumes in both the home and school were equally related to the development of childhood asthma (McConnell, Islam, Shankardass, Jerrett, Lurmann, Guilliland, Gauderman, Avol, Kunzli, Yao, Peters and Berhane, 2010). Additionally materials used in classroom construction and decoration were potential sources of many other pollutants. This was even more important as physical conditions (related to design and maintenance) inside classrooms helped to produce higher levels of contaminants than generally acceptable (Pegas, Alves, Evtyugina, Nunes, Cerqueira, Franchi, Pio, Almeida and Freitas, 2010; Alsmo and Holmberg 2007; and Alsmo and Holmberg, 2010).

2.8.4 Ventilation and Student Performance

Classrooms that frequently experienced high concentrations of carbon dioxide (above 1000 ppm) were associated with lower attendance levels (Shendell, Prill, Fisk, Apte, Blake and Faulkner, 2004). In one study students had longer response times and generally lower scores on cognitive tests when carbon dioxide levels were above 1500 ppm (Myhrvold, Olsen, and Lauridsen, 1996). For another study, CO_2

levels above 2000 ppm meant, students had shorter attention spans and increased feelings of "calmness" or lethargy (Coley and Greeves, 2004, p.7). Low ventilation rates (high levels of carbon dioxide) affected fifth graders performance in math (Shaughnessy et al., 2006).

In contrast, by using natural ventilation carbon dioxide levels were significantly lowered in classrooms where windows were opened, even for brief periods (at least 15 minutes) during the school day (Griffiths and Eftekhari, 2008). Wargocki, Wyon and Fanger (2000) reported that under experimental conditions increasing ventilation rates had lead to an increase in office workers productivity. This result was believed to be linked to the corresponding reduction in indoor pollutants. Wargocki and Wyon (2007) noted that increasing ventilation rates in school meant faster completion of schoolwork in the Danish classroom. This change in performance was also linked to the cooler temperatures associated with improved airflows.

2.8.5 Thermal Comfort

Provision of adequate ventilation also helps to regulate indoor temperatures. When temperatures are within the recommended ranges then it is possible to ensure indoor thermal comfort. A person is in a state of thermal comfort, when environmental conditions allow for normal thermo-regulating processes (maintaining an internal temperature of 37^{o}C) without any distress (Butera, 1998, p.39). Comfort levels are also affected by personal factors such as activity level, type of clothing and health status. Thermal comfort temperature ranges also differ from country to country and from cool to hot seasons (Guoqiang, Cong, Wei, Quan, and Moschandreas, 2007).

In Cuba, urban thermal comfort was within "24.7 to 30.7°C" (Tablaba, Troyer, Blocken, Carmeliet and Verchure, 2009, p.1957). In Taiwan the comfort range was "20.1 – 28.4°C" (Hwang, Cheng, Lin and

Ho, 2009, p.199). For a naturally ventilated class room in Singapore the range is "27.1 to 29.3 °C" (Wong and Khoo, 2003, p.350). In Japan the preferred temperatures for naturally ventilated classrooms were "26.9 to 27.1 °C, the researcher noted that these temperatures were outside the range recommended by ASHRAE (23 to 26.1 °C) (Kwok and Chun, 2003). Acceptable temperatures were also dependent on the occupants' level of expectation or previous thermal experiences (Hwang, Cheng, Lin and Ho, 2009; de Dear and Brager, 2002).

2.9.1 Thermal Comfort and Learning in Tropical Schools

Jamaican schools are naturally ventilated. The NEI (2010) reported that some classrooms were poorly ventilated and provided minimal thermal discomfort and this was linked to lowered learning quality. This is not surprising as tropical climates are characterizes by relatively high outdoor temperature and humidity (Meteorological Service Jamaica, 2011).

It is this combination of high humidity and high external temperatures that makes use of natural ventilation in tropical schools a challenge (Hwang, Lin, Chen and Kuo, 2009). These conditions may cause the development of heat stress (discomfort due to the inability to regulate body temperature). Heat stress was linked to difficulty in concentrating and lowered learning capabilities. This condition is normally associated temperatures of 28°C and higher (Prescott, 2001).

A study in Cameroon revealed effects of intense heat on students' health and performance. They reported symptoms of "heat exhaustion": headaches, vertigo, fatigue, [feeling] very hot, sleeping in class and thirst (p.6). Even though external temperature did not go beyond 32 °C, the researchers found that afternoon temperatures in the classroom rose to 32.5°C and 36.6°C respectively in the regions studied. They linked this indoor heat to poor ventilation due to closed windows and doors, radiant heat from the roofs, improper clothing and the unavailability of drinking water in class. (Dapi, Rocklov, Nguefack-Tsague, Tetanye and Kjellstrom, 2010)

School uniforms are a normal part of school life in many countries and the style is usually mandatory. Along with the excessively high indoor temperature, school uniforms also restricted the students' ability to achieve thermal comfort. "Adaptive behavior" like clothing adjustments were not permitted schools (Hwang, Lin, Chen and Kuo, 2009; Kwok and Chun, 2003). Reported gender differences in thermal comfort may also be linked to the differences in uniforms (Dapi, Rocklov, Nguefack-Tsague, Tetanye and Kjellstrom, 2010).

Therefore ventilation quality can have a significant impact on students' health and performance. As reported good ventilation rates may make the difference between doing well in school and losing valuable lesson time due to the effects of poor IAQ and poor thermal comfort.

2.9 Classroom Furniture, Ergonomics and Student comfort

The *Interior Graphics Standard* defines anthropometrics as, "information about the dimension and functional capacity of the human body" (p.3). While, "ergonomics is the application of human factors data to design" (p.3). Provision of suitability classroom furniture is therefore dependent on the use of ergonomically designed furniture that matched the anthropometric data for specific student populations and for classroom level activities. (McGowan and Kruse, 2004)

Classroom furniture design is often a reflection of local standards, rather than international ideals. Specifically, the Jamaica *Standards for Primary Education* (1999) spoke of the necessity to provide basic needs: "one seat and desk for each pupil and teacher" (p.15). While the "UK's BS EN 1729, 2008" gave recommendations on the proper design of the furniture (form and performance characteristics), required to enhances student comfort (Gardner and Kelly, 2008). FIRA (2008) encouraged the development of flexible, adjustable, movable furniture that better suited the dynamic nature of the learner centered school environment.

Currently research into the quality of the Jamaican classroom furniture is limited. Although, one researcher has given her opinion as its suitability: Davies (1999) stated that the "wooden desks and benches are attached units able to seat two or three children … they are cumbersome [and] inflexible" (p. 23). The traditional dual/twin desks are found in many Jamaican classrooms but their existence contradicts the one child per desk standard. They also do not reflect the new student centered approach to primary education required by the Ministry of Education (Davies, 1999; NEI, 2010).

In fact, Robson (1874) highlighted the benefits and drawbacks associated with these units, as they were quite popular in the 19th century classroom. The dual/twin desk assembly was believed to be more cost effective than the individual desk and chair. The savings came from the fact that these desks could seat more children while utilizing less floor space. One drawback was the inflexibility of the units, whether they were attached to each other (desk and seat) or to the floor. The author pointed out that it was impossible for these desks to be good for both standing (movement) and for writing. They produced either bad seating postures or limited body movements. They therefore do not satisfy most modern ergonomic design standards.

2.9.1 Anthropometrics and Classroom Furniture

International studies have stated that classroom furniture, especially those manufactured to generic standards, do not match local anthropometrics (Molenbroek, Kroon-Ramaekers and Snijders, 2003). In Australia, Milanese and Grimmer (2004) found that classroom furniture was best suited to smaller students only. While in other studies discovered that the chairs were too high (Chong and Wong, 2007; Parcells, Stommel and Hubbard, 1999). In several cases both seat and desk height did not match local students' measurements (Savanur, Althekar and De, 2007; Panagiotopoulou, Christoulas, Papanckolaou and Mandroukas, 2004; Saarni, Nygard, Kaukiainen, and Rimpela, 2007; Castelluci, Arezes and Viviani, 2010)

Gardner and Kelly (2008) reported that poor furniture design was a contributing factor to back pain in children. Reported incidences were mostly associated with incorrect desk height that resulted in bad posture. Murphy, Buckle and Stubbs (2004) identified the incorrect distance between the desk and chair as the reason for students not utilizing back supports, which then resulted in backaches. Some of the anthropometric studies above also alluded to bad furniture design also being the cause for both neck and chest pain in children.

Given the apparent incompatibility between student anthropometrics and classroom furniture, the need local design changes are apparent. Cardon, De Clercq, De Bourdeaudhuij and Breithecker, (2004) noted that lack of knowledge on the part of educators has limited the use of ergonomic designs in the classroom. Educators saw the freedom of movement given to students by newer designs as a threat to classroom discipline. The study also noted that students would get the maximum benefit (good posture), if they were taught how to properly use ergonomic furniture.

2.10 Summary

Admittedly the relationship between school facility quality and student achievement is complex (Duke, 1998). School facility quality was an aggregation of many mediating variables, such as: facility design, use and upkeep, environmental and human factors; variables that directly affected the education processes. Consequently researchers have examined the links between these variables and students' performance to determine the correlation between school facility quality and the students, academic achievement.

In addition, the quality of the physical facility was not only associated with achievement but also with morale, attendance, behavior and health of students. It was also linked to teachers' perception of the

school environment which affected their morale, retention levels and work quality. Finally, since teaching quality was associated with learning quality, the quality of the school facilities was very important (DfEE, 2001).

3 Methodology

3.1 Research Design

This is a study that utilized both quantitative and qualitative methods. The aim was to examine the association between the physical quality of facilities of the primary schools in Jamaica and the schools' GSAT scores in all five subjects. Two questionnaires (a principal questionnaire and a school board member questionnaire) and a school inspection tool were adapted and used as instruments for data collection. The use of both survey type instruments and the secondary data (GSAT scores) provided a mixture of both subjective and objective information for the analyses. No causal relationships were assumed for this study.

A conceptual framework (Figure 5) was created for this study based on the literature review. This framework was used to identify the associations between differences in the Jamaican primary school facility quality and the corresponding differences in GSAT performance.

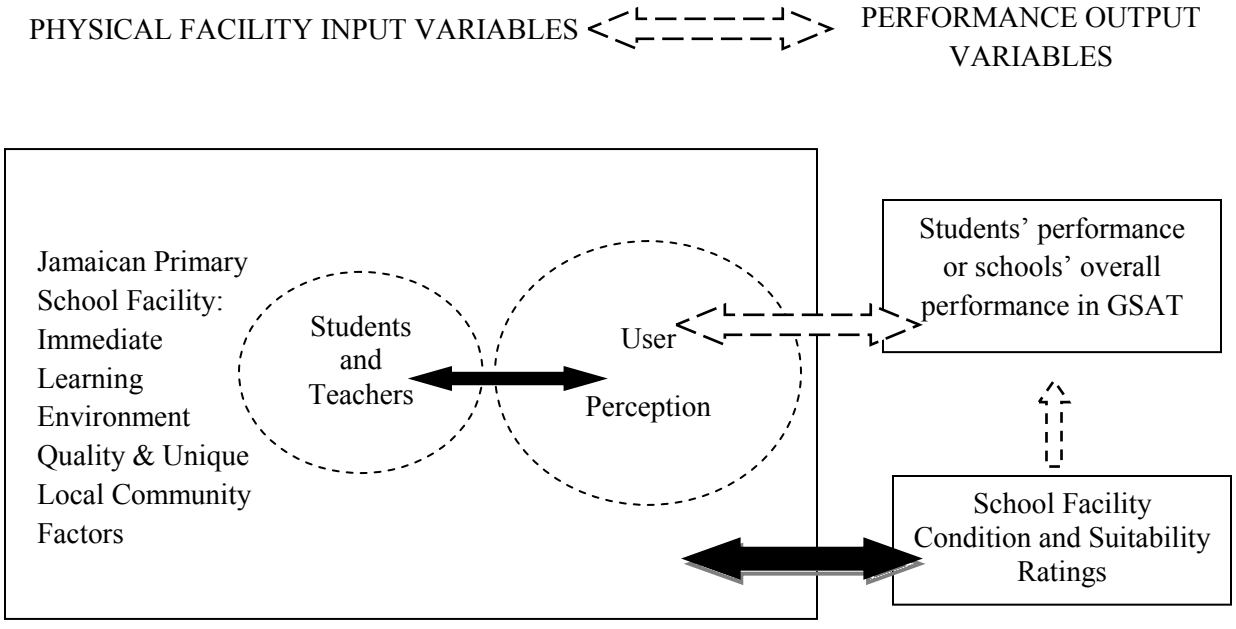


Figure 5. Conceptual Framework created for the research

Hypotheses

1. Differences in the principals' perception of school facilities quality are associated with differences in the schools' GSAT Scores for all subjects (2009 and 2010).
2. Differences in the condition of the schools' physical facilities (or FIT Scores) are associated with differences in the schools' GSAT Scores for all subjects (2009 and 2010).

3.2 **Sample**

After the initial recruitment process, a random stratified sample of 42 whole-day Jamaican primary schools was selected for the study (controlling for double-shift primary schools). The sample included schools from all 14 parishes and all three locales: urban, rural and remote. Locales were defined based on road accessibility; urban being the most accessible and remote being the least (very rough road conditions).

The final sample contained 18 of the selected schools. The individual schools were chosen as the unit of analysis; this meant a response rate of 42% (18 out of 42 schools selected). These schools completed at least one questionnaire with the accompanying school inspection or completed both questionnaires without the school inspection. Schools that did not complete any of the questionnaires were not included in the final sample set.

3.3 **Participants**

The participants were school principals (17) and school board members (14). They were invited to participate and voluntarily completed the two questionnaires for their schools.

3.4 Research Procedure

The research proposal was approved by the IRB at Cornell University. The formal request for the GSAT scores was also submitted to the Ministry of Education Jamaica in June, 2010 and the data received in August 2010.

Recruitment letters were mailed in August, 2010 to the 64 primary schools. Each parish had at least one primary school selected from each of the three locales (urban, rural and remote). Information on the two questionnaires and a formal request for the researcher to conduct a school condition assessment was included in the recruitment letters, should the schools agree to participate in the research.

By September, 2011, a month after sending out the letters, follow-up contacts were made with the principals via telephone to confirm receipt of letters and the possibility of the schools participating in the research. Phone contact was made with 31 schools; it was not possible to contact all schools because many of the rural and remote schools had intermittent telephone service.

The final random stratified sample was selected in October 2011 (from an initial list of 64 recruited schools), which consisted of 42 schools (3 from each of the 14 parishes and one for each locale). Printed copies of the two questionnaires were mailed to the schools along with instructions, consent forms and stamped self addressed return envelopes. Contact information (telephone and email) was provided so that participants could contact the researcher for information on the questionnaires or the research in general or to request electronic copies of the questionnaires. The participants were aware that they were under no obligation to complete the questionnaires.

By December, 2010 verbal commitments had been made by 21 schools: in which 5 schools had returned the completed questionnaires and 16 schools had promised to return the questionnaires to the researcher during the school visit. Arrangements were then made for the physical assessments to be conducted between January 5th and 28th, 2011. In total, 19 school assessments were completed in January, 2011.

3.5 **Educational Facility Analysis Questionnaire**

Educational Facility Analysis Questionnaire or Board Member's Questionnaire was adapted from the Facility Analysis Questionnaire taken from *The International Pilot Study on the Evaluation of Quality in Educational Spaces (EQES) User Manual Final Version*, (OECD/CELE, 2009, pp 44-52). The original Facility Analysis Questionnaire was adapted by changing some questions. Questions: 1.1 was shortened for simplification, in 5.1 references to secondary schools were deleted and 5.2 were completely deleted. Changes to punctuation were made as necessary. The general page layouts were changed to allow for more space for written responses on the printed copies. See Appendix A for sample of the questionnaire.

The questionnaires were completed by members of the school boards who were knowledgeable of the school history and current management. Background information on the schools was collected from this questionnaire. Most of the questions allowed for open responses and these were coded to created nominal variables covering: location, demographics, ownership, management, use, activities, site, improvements, space inventory and safety and security (OECD/CELE, 2009). Table 1 shows the list of selected variables created form the questionnaire.

Table 2

List of Variables created from Educational Facility Analysis Questionnaire

Variable	Description
SCHSET	School location
COMDEC	Community socioeconomic status
TOTENR	Total School Enrollment
NUMTEACH	Number of Teachers
TSRATIO	Teacher student ratio (**TOTENR/ NUMTEACH)**
GOVTFUND	% of School Funding from Government
BUDMNT	% of School Budget Spent on Maintenance
BLDMGT	School's Building Manager
COMMUSE	Community use of school
SCHFLOD	School located in flood zone
SCHPOLL	School located near pollution source
NYRMPR	Total number of major repairs at school in the last five years
NUMCLRMS	Total number of classrooms

3.6 **Principal's Questionnaire**

The Principal's Questionnaire was adapted from the Teaching Staff Questionnaire taken from T*he International Pilot Study on the Evaluation of Quality in Educational Spaces (EQES) User Manual Final Version*© OECD, (OECD/CELE, 2009, pp 55-63). The researcher made changes to the Likert Scale for the answers by pairing the numbers on the scale with specific statements: 1-Strongly Disagree, 2-Disagree, 3-Mostly Agree, 4-Agree and 5- Strongly Agree. An open response section was created for each question to allow for comments or explanations. The layout of the answer scale and punctuation was also adjusted where necessary. All items using a 5-point Likert scale were used to form ordinal variables. These variables were assumed to measure the principals' perception of the quality of the school facilities. See Appendix A for the complete questionnaire.

The questionnaires were completed by the principals or their appointed representatives. The questionnaire collected information from items or statements: on the quality or suitability of the learning spaces or building systems, user comfort, physical appearances of the spaces, safety and security and school maintenance (OECD/CELE, 2009, p. 58). Items 2.2a ("Sound echoes too much in the classroom").and 2.2b ("I have to raise my voice to ensure that students hear me at the back of the classroom") were reverse coded for analysis (OECD/CELE, 2009, p. 60). A list of the items used to measure the perception of schools' facilities is shown in Table 3.

Table 3

List of Variables created from the Principal's Questionnaire (1st, 2nd and 3rd Item Groupings)

Variable	Descriptive Statement/Item
	1st Item Grouping: General suitability of teaching spaces that are currently used.
TSPACE	The spaces in general are large enough to accommodate the number of students being taught.
TFURN	Furniture can be easily moved and arranged to accommodate different learning activities (*e.g.* activities in large or small groups; seating arrangements in circles, rows or groups).
TSPACEV	There are different areas for students to pursue different learning activities (*e.g.* quiet space for individual study or reading; space for computer work; space for group work).
CLAYOUT	The physical layout of the classroom allows for new methods and teaching practices.
TSDISPLA	There are areas where students' work can be displayed (*e.g.* wall boards).
TLSTOR	There is enough storage space for teaching materials and students' work.
TEACHSPA	There is enough space for me to work at my desk or move around when teaching.
ACOMPU	Students have adequate access to functioning computers (with Internet).
EQUIPRED	I can use electronic equipment - such as video projector, DVDs and projection screens.
SCSPEC	The school is accessible for students with special needs.
CLSPEC	Classrooms are accessible for students with special need.
CLSEQUIP	Classrooms are equipped for students with special needs.
	2nd Item Grouping: Suitability of spaces available for teaching staff in the school
ADMSPACE	There is enough space in the school to carry out work outside teaching time.
MSPACE	There is enough space to hold meetings between staff or with parents.
TCOMP	There are functioning computers to help me complete work outside teaching time.
SROOM	The staff room is a comfortable area for teaching staff.
	3rd Item Grouping: Comfort – classroom temperature and air quality
CAIRCIRL	The classrooms have good air circulation (*i.e.* I can breathe easily, it is not stuffy or too breezy):
CLTHERM	The temperature in the classroom is comfortable.
CLVENTCR	I can control ventilation and temperature in the classroom (*i.e.* you can open and close windows; switch on fans or air conditioners).

Table 3 Contd.

List of Variables created from the Principal's Questionnaire (4th, 5th, 6th, 7th and 8th Item Groupings)

Variable	Descriptive Statement/Item
	4th Item Grouping: Noise in the teaching spaces that are currently used.
CLNECHO	Sound echoes too much in the classroom.
CLVOICE	(When students are quiet) I have to raise my voice to ensure that students hear me at the back of the classroom.
CLNOUT	Noise from outside the classroom does not disrupt student learning.
	5th Item Grouping: Light quality and quantity in the teaching spaces that are currently used.
CLIGHT	The classroom has good lighting (*i.e.* it is not too dark or too bright; there is no glare), so that I can teach and see students and their work without difficulty:
CLIGCTR	I can control lighting in the classroom (*i.e.* you can turn the lights on and off, open and close windows to control natural light):
	6th Item Grouping: Schools' visual appearance.
SCHEXT	The *outside* of the school building is welcoming and attractive.
SCHINT	The *inside* of the school building is welcoming and attractive.
SCHSYM	The school building conveys to the community the importance of learning.
	7th Item Grouping: Safety and Security in school.
SCHSAFE	I feel safe in the school.
SCHGRDS	I feel safe in the school grounds.
TEACSTOR	There are secure lockers in which I can keep my belongings.
	8th Item Grouping: School maintenance.
CLCLEAN	Classrooms are clean.
CLEANBG	The school building and grounds generally are clean.
CLMNT	Classrooms are well maintained (*i.e.* wall paint and floor coverings are in good condition, windows and doors function correctly and the ceiling does not leak).
SCHMNT	The school buildings and grounds are well maintained (*i.e.* wall paint and floor coverings are in good condition, windows and doors function correctly and the ceiling does not leak)
TEACHRM	The toilet spaces for staff are clean and functional .

3.7 **The Facility Inspection Tool (FIT)**

FIT Analysis Tool was adapted from The Facility Inspection Tool (FIT) taken from the *Facility Inspection Tool Guidebook* (CASH: California's Coalition for Adequate School Housing, 2008). Excerpts on furniture, acoustics, accessibility provisions from the *International Pilot study on the Evaluation of Quality in Educational Spaces (EQES) User Manual Final Version*© OECD, (OECD/CELE, 2009, pp. 40-42) were added to the tool. The tool was used to assess the physical condition of school spaces, furniture and equipment by identifying the deficiencies in each area of the physical facility that was inspected. For the complete FIT Tool refer to the Appendix B.

Inspection Procedure

All school inspections were conducted by the researcher during the month of January, 2011. Inspections were arranged with the principals, who were responsible for informing the staff members of the pending inspection. The researcher was allowed to view the school spaces while in use, generally observations were made of one randomly chosen classroom per grade (six per school), after which the staff spaces were inspected. This was followed by other support spaces such as: restrooms, kitchens, play areas. Figures: 6, 7, 8, 9, 10, 11, 12, 13 show the typical facility element assessed during the school visits. All the photos show Jamaican primary schools from internet sources (no photo records were taken of the study sample).

The FIT Analysis Tool covered: ventilation systems, doors and windows, furniture and equipment, storage, lighting, acoustics, potable water, restroom in all areas, sewer, fire safety, gates and fences, structural damage, play areas and grounds, accessibility and overall cleanliness. The inspections on average took approximately two hours to complete. The inspection consisted of visual checks for deficiencies in all internal surfaces (walls, ceilings and floors). The state of repair for the windows, doors and furniture was also noted (along with their quality and suitability). Systems such as ventilation, lighting and acoustics were observed for their condition and adequacy for purpose (missing or malfunctioning elements counted). Safety hazards were also recorded for each area observed.

Figure 6. Assessment of the external façade - included windows, doors, steps, walkways, wall surfaces, eaves, lighting and signage. Photo adapted from "Primary school needs facelift" by Christopher Thomas. Retrieved from http://jamaica-gleaner.com/gleaner/20110813/news/news9.html

Figure 7. Assessment of inside the classrooms included – furniture (desk and chairs), ventilation blocks or windows, lighting, storage, classroom separation and all internal surfaces (walls, ceilings and floors). Photo adapted from photo titled "St. Paul Primary School 5" by Negril Education Environment Trust. Retrieved from http://neetja.com/articles/NEET

Figure 8. Assessment of computer rooms or labs included - furniture (desk and chairs), equipment available, ventilation, windows, lighting, storage, and internal surfaces (walls, ceilings and floors). Photo adapted from "Bellefield Primary Uses Creative Methods to Improve Performance" by Dave Lindo. Retrieved from http://jamaica-gleaner.com/gleaner/20120225/news/news3.html

Figure 9. Assessment of administrative spaces (or libraries) included – furniture, equipment, storage, lighting ventilation and internal surfaces (walls, ceilings and floors). Photo adapted from "Jamaican Parents Take Action" by Laura de Reynal. Retrieved from http://www.olpcnews.com/countries/Jamaica/jamaican_parents_take_action.html

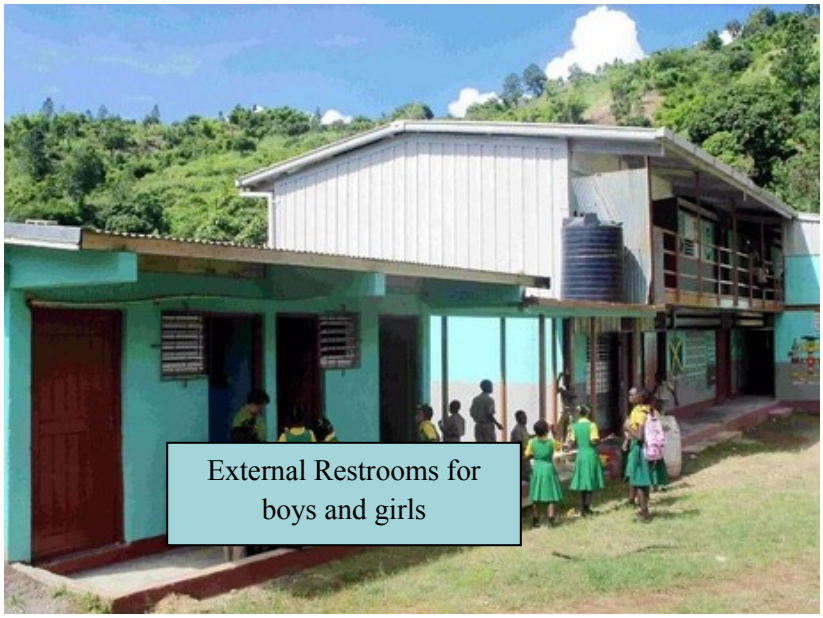


Figure 10. Assessment of teacher and student restrooms included – functional units, windows, door general hygiene and ventilation. Photo adapted from "Peace Corps volunteers get life enriching experience" by Carole Sand. Retrieved from http://jamaica-gleaner.com/gleaner/20110323/news/news7.html

Figure 11. Assessment of external drinking water taps included – functional units and general hygiene. Photo adapted from "Elderslie School Water Projects-Phase 2" by Water Charity. Retrieved from http://appropriateprojects.com/node/125

Figure 12. Assessment of primary school kitchens included - ventilation system, windows, lighting, storage (especially of food and gas cylinders), and internal surfaces (walls, ceilings and floors). Photo adapted from "Big Like Me: On not being body shamed in Jamaica. Retrieved from http://www.xojane.com/issues/big-me-not-being-body-shamed-jamaica

Figure 13. Assessment of the school grounds including: quadrangles or courtyards, parking areas, play grounds and athletic fields – landscaping, equipment, cleanliness and safety hazards. Photo adapted from "Trench Town Primary get a facelift" by Anastasia Cunningham. Retrieved from http://jamaica-gleaner.com/gleaner/20110701/lead/lead93.html

The deficiencies were tabulated in the FIT Analysis Tool and the number and type of deficiencies was noted for each separate area inspected. The sum of building systems that was in place and in good condition was calculated for each school area inspected. Then the average percentage of the areas without deficiencies was calculated for each school (FIT score). Schools were rated based on their scores: Poor–(0 - 66.99%), Fair (67 – 84.99%), Good (85 – 97.99%) and Exemplary (98 – 100%).

No weighting factor was used on the values obtained from the calculations. The average percentage FIT score was used to create the variables: **OBJRATE – FIT Scores** (percentage), a continuous variable use to test for association and **FITRATE** a nominal variable used to describe school conditions as poor, fair, good or exemplary.

Secondary Data

Grade Six Achievement Test Score Data

GSAT results for 2006 to 2010 were obtained for all primary schools from the Ministry of Education, Jamaica. The results encompassed the schools' average scores in Mathematics, Science, Social Studies, Language Arts and Composition. National averages for each subject were also obtained. Only scores for 2009 and 2010 were used for analysis as this time period corresponded to the other data collected. This school scores were assumed to represent school overall performance during the period covered by the questionnaire responses.

3.9.2. Other Secondary Data

School locales (**LOCALE**) were used to identify the geographic location of the schools and included the following categories: urban, rural and remote. The capacity status (**CAP09** and **CAP10**) was used to describe the enrollment levels at school in 2009 and 2010; schools were identified as being at/below or above official enrollment capacity. Input data for these variables were taken from the school profiles available to the public via the Ministry of Education website.

3.8 **Analysis Procedures**

Exploratory analysis was performed on all collected data using descriptive statistics. Descriptive statistics were also calculated for all other data types. The inter-item correlations and the internal consistency reliability were calculated for the Principals' Questionnaire. This was followed by hypothesis testing using Nonparametric Test for Bivariate Correlation - Spearman's Rho (r) to test for association between selected variables from the Principals' Questionnaire and GSAT scores (2009 and 2010), and the FIT scores and the GSAT scores (2009 and 2010).

The analyses results for both years were compared for consistency. The correlations for the schools' overall scores and those for girls and boys (separately) were also calculated and compared. The significance of the correlations was noted, starting at the 0.05 level in one-tailed tests. All statistical analyses were conducted using IBM SPSS Version 19.0 Software.

3.8.1. Assumptions:

1. Principals' Questionnaire data would reflect school quality perceptions for 2009 and 2010. This is based on the fact that background information revealed that most school had not undergone any major changes in infrastructure during the period 2008 to 2010.
2. Principals' Questionnaire data (Likert Scale) could be converted into scores that represented rating of the school facilities in question.
3. Inspection data obtained in January 2011 would be applicable for 2009 and 2010 as no major schools improvement occurred during this period
4. The small sample was assumed to be a non-normal and therefore nonparametric statistics were used to test the hypotheses.

4 Results

4.1 Descriptive analysis

4.1.1. Exploratory Analysis of the Education Facility Analysis Questionnaire Data and Secondary Data from the Ministry of Education, Jamaica

The small sample included schools from 10 of the 14 parishes and all three locale types: 4 urban, 6 remote and 8 rural. All schools were co-ed, mostly government owned (15) and church owned (3). Schools from all five MOE classifications (enrollment size) were represented by the sample. Therefore the sample included schools with enrollment levels representing: Class I $\leq$ 250, Class II = 251- 500, Class III = 501 – 850, Class IV = 851 – 1200 and Class V > 1200. The mean sample enrollment for 2009 was 514 students (Std. Dev. = 393 and N =15).

The enrollment data was also compared with the data on school capacity. It showed that several schools were over the design capacity for total students per year. A cross tabulation (Table 4) of capacity status and locale showed that most urban and rural schools were over capacity, while most remote schools were at or below design capacity. This trend may represent a general population shift from remote/rural areas to urban areas for better education and economic opportunities. Additionally, it may indicate the urban schools are generally overcrowded.

The socioeconomic backgrounds of the communities were described as lower middle class (60%), Lower Class (30%) and Middle Class (10%). A few schools reported that they were located in problems areas, such as schools were in flood zones (33.3%) or schools were near a source of pollution (14.3%). In general, other members of the community used the schools at least once per month by for adult education, vocational training, recreational activities, or meetings. Most schools were also were also listed as emergency shelters.

Table 4

Number of School in Different Locales and their Capacity Status for 2009 and 2010

School Student Capacity	Urban	Rural	Remote	Total
		Year 2009		
At or under full capacity	1	2	5	8
Over full capacity	3	6	1	10
Total	4	8	6	18
		Year 2010		
At or under full capacity	1	2	4	7
Over full capacity	3	6	2	11
Total	4	8	6	18

Inside the schools the teaching Spaces included: classrooms, computer labs or resource centers and libraries or reading rooms. (No additional teaching spaces were identified). The floor area of typical classrooms was 400 sq.ft. Schools reported having athletic spaces (76.92%) but only 53.38% of those reported having athletic equipment for use. All schools utilized natural ventilation and daylight through open windows and doors (or via roof panels for some).

Most schools had management spaces: 92.3% of the schools reported having administrative areas for staff only one school (7.69%) reported having none. All schools had support facilities such as school kitchens. Social spaces were limited, only 36.36% of schools reported having social spaces such playgrounds, student rooms or auditoriums. While only 27.27% reported have equipment for these areas.

The principals were responsible for building management in 73.3% of the schools. Central, regional and local government authorities were responsible for allocating resources for the physical facilities. Schools reported that government funding accounted for 20% to 100% of total school funding.

Many schools had completed at least one major repair in the last five years (Table 5) but had no major improvements (new classroom blocks or other capital works). Most reported spending 30% or less on school maintenance.

Table 5

Distribution of Schools with Major Repairs in the Last Five years (2005 – 2009)

No. of repairs	Frequency	Percentage
0	3	21.4
1	5	35.7
2	3	21.4
3	2	14.3
5	1	7.2
Total	14	100

4.2 Findings from the Principal's Questionnaire: Item Analysis

Table 6 shows the distribution of responses to the statements or items on the Principal's Questionnaire. Most participants responded to all items and responses were distributed over the range of the answer scale. One school did not complete this questionnaire (N = 17). The complete questionnaire results are included in the Appendix C (showing all the item statements).

Firstly, the principals' perception of the general suitability of the teaching space was mixed. The responses were divided over the total range of agreement or disagreement in all but a few items. More than half of the principals indicated that the classroom size was adequate for the number of student in class (58.8%) but that the variety of spaces available was inadequate (52.9%). The results show that some teachers were ambivalent about the suitability of the layout for new teaching methods (23.5%); this could

be linked to the fact that the classroom furniture was inflexible (41.2%). Two important points to note for all teaching spaces were that most schools did not have enough computers for students (70.6%) and did not have any provisions for special needs students (over 70%).

The schools administrative spaces were generally adequate (47.1%) for many principals, but the staffrooms in particular were not as comfortable as desired (47% disagreement). The reviews were mostly positive (58.8%) for the provision of computers for administrative use, in comparison to the negative perceptions (70.6%) about the provision of student computers. Though there were some mixed feelings about parent teacher meeting spaces (29.4%), many principals felt that the spaces were adequate (41.2%).

Perception of thermal comfort in the classroom was more positive than negative. The air circulation and classroom temperature were perceived to be quite comfortable (over 50%), though many principals were somewhat ambivalent (23.5% to 29.4%). This was possibly linked to the fact that a significant percentage (58.8%) indicated that the classrooms lacked any mechanism to control ventilation or temperature. The responses show that even though class conditions are generally comfortable, it was not possible to adjust the thermal conditions when necessary (as is often the case in tropical countries relying solely on natural ventilation to improve thermal comfort of occupants).

The acoustical environment of the classroom was pleasing to most principals, under normal conditions (that is when the room was quiet). This was illustrated by the fact that many (52.9%) reported that they had no problems with echoes (reverberation) or required voice amplification (82.3%) during quiet times. The responses to the problem of noise disruption from outside the class were more mixed, 47.1% felt that external noise was not a problem, while 41.1% found it to be significant issue. This implied that most acoustical problems were associated with noise from outside the classroom and that it affected some schools more than others.

Table 6

Distribution of Response Results from Principal's Questionnaire

#	Variable	Strongly Disagree %	Disagree %	Mostly Agree %	Agree %	Strongly Agree %	*Not Appl. %	Total %
	1st Item Grouping: General suitability of teaching spaces that are currently used.							
1	Classroom Space adequacy	29.4	5.9	5.9	29.4	29.4	0	100
2	Furniture Flexibility	11.8	29.4	17.6	17.6	23.5	0	100
3	Space Variety	23.5	29.4	17.6	23.5	5.9	0	100
4	Classroom Layout	5.9	23.5	23.5	29.4	11.8	5.9	100
5	Display Areas	0	0	23.5	47.1	23.5	5.9	100
6	Storage Space	11.8	17.6	23.5	29.4	11.8	5.9	100
7	Teaching Space	0	17.6	17.6	41.2	17.6	5.9	100
8	Student Computers	35.3	35.3	11.8	11.8	5.9	0	100
9	Equipment Ready	5.9	11.8	23.5	29.4	17.6	11.8	100
10	School - Special Needs Accessibility	52.9	17.6	5.9	17.6	5.9	0	100
11	Class - Special Needs Accessibility	41.2	29.4	11.8	5.9	5.9	5.9	100
12	Special Needs equipment	58.8	35.3	5.9	0	0	0	100
	2nd Item Grouping: Suitability of spaces available for teaching staff in the school							
13	Administrative Space Adequacy	17.6	17.6	17.6	41.2	5.9	0	100
14	Meeting Space	17.6	11.8	29.4	35.3	5.9	0	100
15	Computers for Teachers	5.9	11.8	23.5	35.3	23.5	0	100
16	Staffroom Suitability	29.4	17.6	23.5	17.6	5.9	5.9	100
	3rd Item Grouping: Comfort – classroom temperature and air quality							
17	Classroom Air Circulation	5.9	0	23.5	52.9	17.6	0	100
18	Classroom Temperature	0	17.6	29.4	41.2	11.8	0	100

19	Classroom Ventilation Control	17.6	41.2	11.8	23.5	5.9	0	100

Table 6 Continued

Distribution of Response Results from Principal's Questionnaire

#	Variable	Strongly Disagree %	Disagree %	Mostly Agree %	Agree %	Strongly Agree %	*Not Appl. %	Total %
		4th Item Grouping: Noise in the teaching spaces that are currently used.						
20	Classroom Echoes	23.5	29.4	11.8	17.6	11.8	5.9	100
21	Teaching Voice Amplification	52.9	29.4	0	17.6	0	0	100
22	Noise Outside the Classroom	17.6	23.5	5.9	41.2	5.9	5.9	100
		5th Item Grouping: Light quality and quantity in the teaching spaces that are currently used.						
23	Classroom Lighting	0	0	29.4	23.5	41.2	5.9	100
24	Classroom Lighting Control	0	5.9	17.6	35.3	35.3	5.9	100
		6th Item Grouping: Schools' visual appearance.						
25	Exterior Attractiveness	0	17.6	11.8	23.5	47.1	0	100
26	Interior Attractiveness	0	5.9	41.2	29.4	23.5	0	100
27	School Symbolism	0	5.9	11.8	47.1	23.5	11.8	100
		7th Item Grouping: Safety and Security in school.						
28	Safety Inside School buildings	11.8	23.5	11.8	29.4	17.6	5.9	100
29	Safety on School Grounds	17.6	23.5	17.6	17.6	17.6	5.9	100
30	Secure Storage for Teachers	11.8	17.6	11.8	41.2	0	17.6	100
		8th Item Grouping: School maintenance.						
31	Classroom Cleanliness	0	0	29.4	52.9	17.6	0	100
32	School Cleanliness	0	5.9	17.6	41.2	35.3	0	100
33	Classroom Maintenance	5.9	17.6	29.4	17.6	23.5	5.9	100
34	School Maintenance	5.9	23.5	35.3	17.6	17.6	0	100
35	Teacher Restroom Upkeep	0	11.8	35.3	41.2	11.8	0	100

*Not Applicable OR no response

The principals were generally positive about the classroom lighting and the attractiveness of the schools (interior and exterior appearance). This was also reflected in their response to items relating to school cleanliness, 76.5% thought the school and the grounds were generally clean. In contradiction to this, many had mixed views on how well the schools were maintained as far as the condition of walls, floors, ceilings, windows and doors were concern. This could indicate that there is a surface level approach to upkeep with general lack maintenance of major building elements in some schools.

The principals' perception of school safety and security was mixed. Safety inside the school buildings (47%) was higher than safety outside (35.2% agreement on the school grounds). This implied that there may safety controls within the buildings but a lack of security for the grounds. This could be associated with a lack of security personnel, proper perimeter protection or general control over community accessibility to the grounds.

4.2.1. Inter-Item Correlation Analysis

Correlational analysis revealed that the questionnaire had a strong internal consistency, with a Cronbach Alpha of 0.888. It was assumed that highly positive correlations were 0.7 and above and that highly negative were -0.7 and below. The complete inter-item correlation table is available in the Appendix D. The analysis revealed the following high intra-grouping correlations:

- From the 1st Grouping: Items 1, 2, 3 and 4 were highly positively correlated to each other; while items 10 and 11 were highly correlated to each other.
- From the 2nd Grouping: No highly correlated items were in this grouping.
- From the 3rd Grouping: No highly correlated items were in this grouping
- From the 4th Grouping: Items 20 and 21 were highly positively correlated.
- From the 5th Grouping: No highly correlated items were in this grouping
- From the 6th Grouping: No highly correlated items were in this grouping
- From the 7th Grouping: Items 28 and 29 were highly positively correlated.

- From the 8th Grouping: Items 31 and 32 were highly positively correlated to each other; while Items 33 and 34 were highly correlated to each other.

Notable inter-grouping correlations were:

- Item 6 and 30 were highly correlated to each other.
- Item 8 was highly negatively correlated to Items 28 and 29.
- Item 13 was highly positively correlated to Items 2, 3 and 4
- Item 16 was highly positively correlated to Items 33 and 34
- Item 19 was highly positively correlated to Items 20 and 24.

The strong intra- correlations for the teaching space items (space adequacy; furniture flexibility; space variety and classroom layout) show that the principals' perception of different classroom variables was linked. This illustrates that the suitability of the teaching space is associated with the interplay of size of the classroom, the ability of the teacher to arrange the furniture to fit the layout necessary for the teaching methods and variety of spaces available to the teacher if the given classroom cannot accommodate the teacher/student needs. The correlations between accessibility for special needs students in the classroom and in the school general reflect the strong negative response to both items. Again this shows that in general there are no accommodations for such students in most primary schools.

The association between classroom echoes and the need for voice amplification reflects the fact that the natural acoustical environment is linked to both these variables. Therefore the classroom acoustical design may be adequate for times when the room is quiet and no voice amplification is necessary. Since classrooms are not normally quiet then noise may still be an issue, especially where no acoustical buffers are in place.

Items pairs measuring the same environmental factors were also highly correlated. This included pairs such as: safety inside and outside buildings; classroom cleanliness and school cleanliness; and classroom maintenance and general school maintenance. Since these item pairs were measuring the same

factors but at different facility levels, each item response was strongly linked to the other. This trend was also true for the intra-group item pair correlation of teaching space storage and storage for teachers.

The most notable inter- group item correlations were the strongly negative correlations between student computers and school safety (inside and outside buildings). This implied that the schools that were better equipped with computers were more likely to feel unsafe. This may reflect the fact that these schools did not have adequate storage for these items or were just generally lacking in the security that was necessary for the school facilities.

4.3 General Findings from School Inspections (FIT): Description of School Facilities based on Observations

4.3.1. School Spaces

Each schools visited had at least one classroom per grade except where multigrade classrooms were present. Only four multigrade classrooms were assessed in the classrooms visited (98 classrooms: approximately 6 assessed per school). Other classrooms were separated from each other by solid concrete walls, single ply board panels or movable blackboards. Other rooms used for teaching included the library/reading room and the computer room. Where these spaces were not enough the open school yard was used as a break out area.

4.3.2. General School Design

The school design is based on quadrangular arrangement of building blocks around a paved or grassed courtyard. Each building block was one to three stories high and usually faced each other; allowing for easier monitoring of activities. Buildings were typically made of reinforced concrete, although older buildings may be constructed with a variety of materials. Roofs were either concrete slabs or corrugated steel. Smaller schools were usually a one story scaled down version of larger schools.

Classrooms were back to back with covered exterior corridors. Every school had at least one classroom per grade, except in the case of multigrade classes. The principal's office and staffroom were usually close together in a block. Other offices included those for vice principals administrative assistants

and guidance counselors. Figure 14 shows the typical layout of the school around the quadrangle or courtyard.

Libraries and computer rooms were normally inside a classroom block but two schools have utilized temporary buildings for computer rooms. Kitchens and snack shops were either beside classrooms or in smaller buildings (two rooms) separate from the classrooms. Most schools had no separate dining area for students; meals were taken in the classrooms. Restrooms were typically at the end of a block and located on the ground floors only.

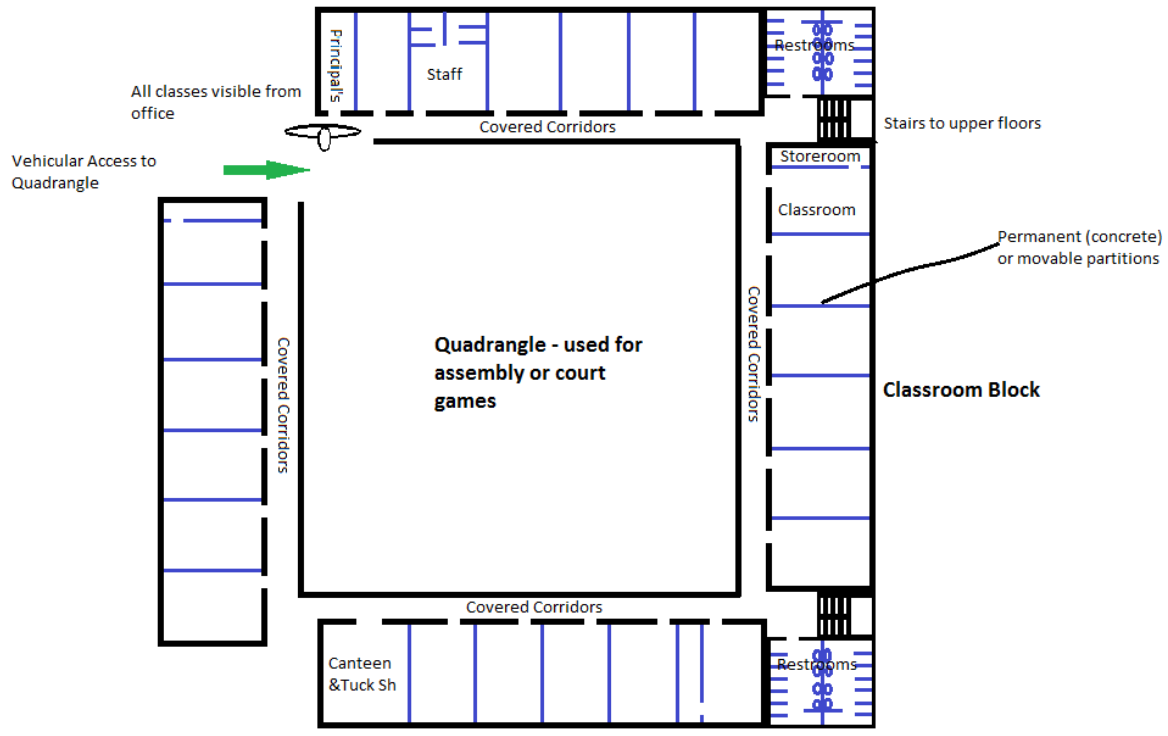


Figure 14. Sketch showing the layout of a typical medium to large size primary school. A modification to this design resulted in U-shape or L-shaped arrangement where only three or two class blocks were present.

4.3.3. Description of Building Systems

Ventilation

All areas utilized natural ventilation except for some administrative areas and computer rooms that had wall AC units. Ventilation block, open windows and doors allowed for adequate air flow. Ventilation was sometimes aided by ceiling fans for the whole classroom or standing fans for teachers. Classroom designs allowed for cross ventilation, although this was sometimes limited by the blackboards used to divide rooms meant to be occupied by only one class.

Windows and Doors

Windows, where present were made from aluminum louvers, most were in good condition but some were missing louvers or had damaged locking mechanisms. Windows generally ran the length of the side walls and were of varying heights. Doors were wooden and of varying widths. In a few schools open grillwork was substituted for doors and windows but more frequently ventilation blocks were substituted for windows, this meant that classrooms were open to the outside all the time. When ventilation blocks were used in libraries they were clearly unsuitable for the storage of books.

Interior Surfaces

These were painted concrete walls (lighter colors at the top of the wall below which dark colors were used). Walls were generally in good condition but some ventilation blocks were dusty. Ceilings were painted white or left on painted (ply board brown); many classrooms had no ceiling and the corrugated roofing was exposed in these areas. Floors were typically gray concrete, smooth finished and in good condition.

Furniture

Classroom furniture were typically the heavy wooden, double desk-seat units. These seated two to three students. Some desk tops had visible termite damage or the surfaces were pitted with age. Other desks were made of ply board that was visibly delaminating. Some classes had individual desks and

chairs (metal) and some Grade 1's had height appropriate tables and chairs that allowed for group work. Teachers' desks and chairs were made of wood and metal, some of the units had damaged tops and drawers. The generally condition and suitability of furniture in each school was mixed.

Storage

Classroom storage was often limited to one wooden-lockable cabinet. Excess books were stored on top of tables and old desks at the side or back of the classrooms. Open shelving was present in some classes, but books and posters (teaching aids) stored in the open where often dusty (dirt blown in due openings used for natural ventilation). General storage rooms were available in some schools and these were under stairs or adjacent to the principals' offices. One critical safety hazard noted in some schools was the storage of large butane tanks in kitchen located in classroom blocks.

Lighting

Natural and artificial lighting was used in all spaces. Skylights were made from translucent corrugated roofing sheets were observed in some schools. Light from these skylights often reduced the need for artificial lighting but many were not maintained and moss growth often made them less effective. Fluorescent lamps were used throughout and the lighting appeared to be adequate even though many classes had ballasts with missing lamps.

Acoustics

No visible acoustic treatment was observed in any of the school areas. Rooms separated by concrete walls had some noise buffer, but the open windows and doors allowed for outside noise intrusion. Classrooms separated by blackboards were also affected by sounds from adjacent classrooms.

Potable Water

Schools had potable piped water, with the exception of one school whose back up water tank was not connected to the school pipes. Drinking taps were available in the school yards; schools depending on their size had 4-16 taps. Vandalism was clearly a problem as many schools had damaged or missing taps

or had to resort to locked grillwork to protect them. All drinking areas were clean and free from moss growth on fixtures.

Restrooms

Separate restrooms were provided for girls and boys. Some toilets were in good condition while others were not functional or had seats and covers missing. All restrooms were cleaned everyday but many had floors that were wet and messy by lunchtime. This resulted in some facilities having a strong and offensive odor. Teacher and administrative staff had restrooms in their offices or share toilets in the staffrooms, most of these were in good condition. Where shower stalls were present many had missing fixtures.

Fire Safety

Most schools had at least one fire extinguisher in the kitchen along with another in the principal's office or the computer room. Only one school had a visible fire alarm. All outer areas of the school yard had vehicular access, but some inner quadrangles or courtyard had limited vehicular access. No fire exits signs were observed.

Gates and Fences

A few schools had locked gates with a guard at the entry point to monitor students and visitors. Other schools had front gates that were open during the daytime to all vehicular and pedestrian traffic. Fences were made from chain link, barbed wire or concrete walls. Many fences were damaged and allowed for intrusion from the side and back perimeters.

Structural Elements

Most schools were free from any structural damage to beams and columns. One exception is a school that had rafters that were damaged by termites. Another school had extensive concrete spalling (concrete flaking off with the rebar exposed) at the roof slab. This structural damage was visible in all the top floor classrooms inspected.

Play Areas

Excluding sports fields, only one school had a designated play area fitted with play equipment. Play occurred all over the school grounds including: classrooms, fields, paved netball courts, quadrangle, the parking lots and the driveways. In many schools trip hazards such as open drains and rocky/uneven grounds were observed. No outdoor seating was available in these areas.

General School Grounds

Schools grounds were generally very clean. The school yards in rural and remote areas were usually unpaved with large open areas (some with overgrown vegetation). Urban school yards were smaller and usually paved. Very little formal landscaping has been done in most schools, so unpaved areas tend to be quite uneven. Many schools had no athletics field even though adequate space is available in the yard.

Only two schools provided wheelchair ramps. Most schools had classrooms that were only accessible by climbing (even those located on the ground floor). None of the schools had any specific accommodation for Special Needs students.

4.4 Facility Inspection Ratings

Based on the assessment of the facilities, the schools were rated as either Poor (14) or Fair (3). No school was rated as Good or Exemplary, their overall FIT scores were too low (highest possible score was 100%). This means that there were sufficient deficiencies in each of the school spaces inspected to produce low average ratings. The mean score was 56.45% (Std. dev. = 11.28%). The lowest score was 35.94% and the highest was 71.43%. Rating assessments were based on the data from the 17 schools visited only and scores were calculated based this data alone. Figure 15 shows the distribution of the FIT scores for the schools. In addition Table 7 shows the average score of each facility element or system along with the descriptions of the related condition during the school assessment. The condition of the

interior surfaces, furniture, acoustics, fire safety system and play areas were a largely responsible for the low scores.

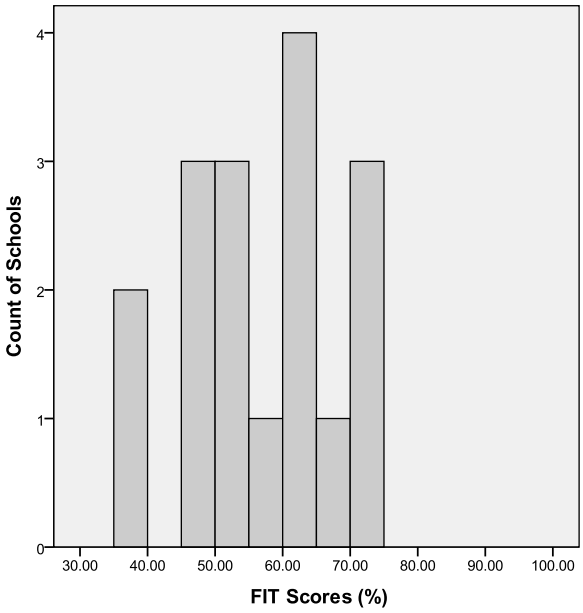


Figure 15. Histogram showing distribution of FIT Scores for the schools inspected. Two schools scored under 40%; six school score between 45% and 55%; five school scored between 55% and 65%; and four schools above 65%.

As the methodologies were different a comparison of the results from the building systems or elements inspection (Table 7) to the principals' perception (Table 6) showed a only few commonalities as one gave the objective condition of the all spaces (as is) and the other provided information on the suitability of some of the spaces (as measure against a subjective ideal). Major differences between the two results were also due to the differences in the variables, the Principals' Questionnaire results showed their view of the adequacy of the size and flexibility of school spaces; there were no comparable variables to measure this in the FIT inspection tool. The questionnaire results also gave the subjective measurement of the suitability of classrooms for teaching and teacher movement, school attractiveness, computer equipment availability and the readiness of the spaces of equipment use, while the FIT inspection tool results were limited to objectively illustrating the physical deficiencies in the condition of

the spaces and did not extend to the number of computers available to each student nor the measurement of aesthetics or spacial comfort.

Commonalities were found for maintenance, cleanliness, ventilation, acoustics and safety. The principals' responses illustrated that classroom and school maintenance levels were mixed, and according to the inspections the schools were in an overall Fair to Poor condition, while both indicated that the schools were very clean. The natural ventilation systems were given high scores during the inspections (cool month of January) and the principals' indicated that overall the air circulation and temperature was okay even though the systems had very little means to adjust/control ventilation rates when required to do so (hot months). Both instruments revealed that the acoustic conditions were challenging and a lack of noise controls/buffers was noted for both. In addition to these common findings, both the principals and the researcher found that safety and security provisions to be mixed (storage, playgrounds, gates and fences) and agreed that most facilities had absolutely no provisions for special needs students in school.

Table 7

Average condition scores and description of the related conditions

Building System or Elements	Average Score (%)	Standard Dev.	Description of Conditions (during assessment)
Ventilation System	97.12	5.40	Natural ventilation allowed for good ventilation of spaces (No high temperatures, odor nor stuffiness). Little use mechanical of ventilation (fans & AC)
Windows and doors	87.81	23.94	Where applicable windows and doors mostly free from defects except for damaged locks
Interior Surfaces – walls/ floors/ ceilings	35.60	20.47	Mixed: few good, holes present in others or some water damage or dust from ventilation blocks.
Furniture	37.36	28.50	Mixed: some good others with damaged desk tops or seats with no back support; termite issues etc.
Storage Available	22.70	27.60	Inadequate in most spaces. Inappropriate storage of gas tanks in kitchens potential fire hazard.
Lighting System	88.27	14.62	Artificial lighting mostly adequate. Few missing bulbs.
Acoustics	0	0	Concrete surfaces may help reduce noise transmission but no other means of sound control seen. Also ventilation openings and blackboard separations help to exacerbate noise problems.
Potable Water	91.18	26.43	Available and systems functional in most schools.
Restrooms	63.73	27.80	Functional and fairly clean in most schools but with many damaged elements.
Sewer	100	0	System functional where applicable. No odors or leaks observed.
Fire Safety System	44.12	42.87	Approximately half conform to local standards: at least two extinguishers on school grounds.
Gates and Fences	50	50	Mixed: some with damaged gates and perimeter fencing (security issues)
Structural Damage	70.59	47.0	Most structurally sound. Only one school with extreme damage to ceilings/floors with exposed rusting rebar
Play Areas	17.64	39.30	Most with safety hazards and not well equipped (uneven grounds, unsecured equipment)
School Grounds	58.82	50.73	Grounds generally clean and only few schools with storm water drainage problems.
Accessibility	0	0	Most do not provide for special needs students
Cleanliness	98.78	3.51	Overall schools are clean: free from refuse and graffiti; restroom and kitchens cleaned daily.

4.5 Distribution Grade Six Achievement Test Scores

Table 8

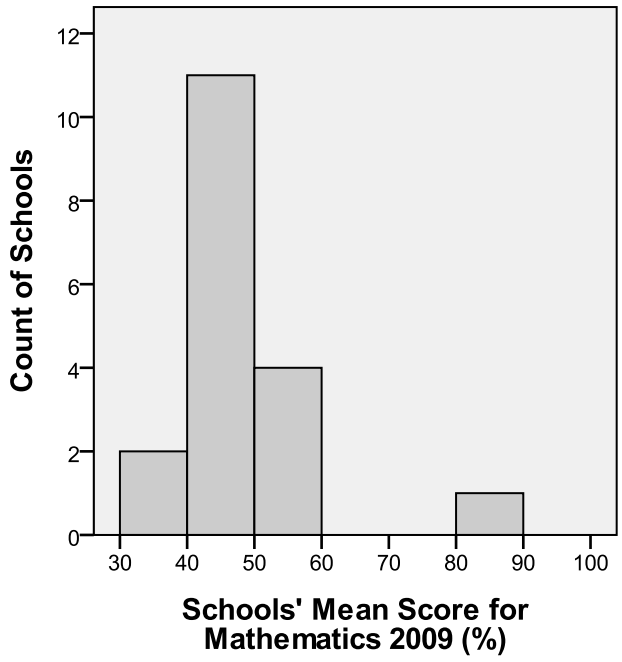
National Average GSAT Scores for Primary Schools (All Subjects)

GSAT Subjects	Average Scores					
	2009			2010		
	Overall	Girls	Boys	Overall	Girls	Boys
Mathematics	53	57	49	57	61	52
Science	53	56	50	60	63	56
Social Studies	53	56	50	58	62	54
Language Arts	57	62	51	58	63	53
Composition	7	8	7	8	9	7

Composition scored from 1- 12

Table 8 shows the general GSAT scoring trends at the national level; scores for 2010 were higher than those for 2009 and the girls outperformed boys in all subjects (this was also true for the sample, N=18). The data from the scores (schools' mean scores, girls' mean scores and boys' mean scores) were used in the hypotheses testing.

Figures: 16, 17, 18, 19, and 20 show the distribution of the schools' overall GSAT scores for the sample. As seen in the national trends, the sample means for all subjects were greater for 2010 than for 2009. The distributions were assumed to be non-normal. The distributions showed that in general only about 30% of the sample scored above the national average, while the total sample means were below the national average. One school scored well above the others in 2009 for Mathematics, Social Studies and Language Arts, this performance gap was not present in the 2010 distributions.



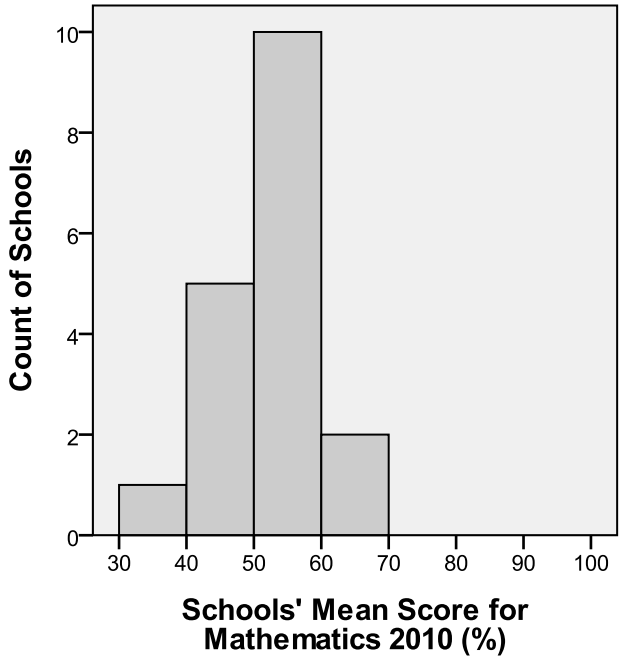
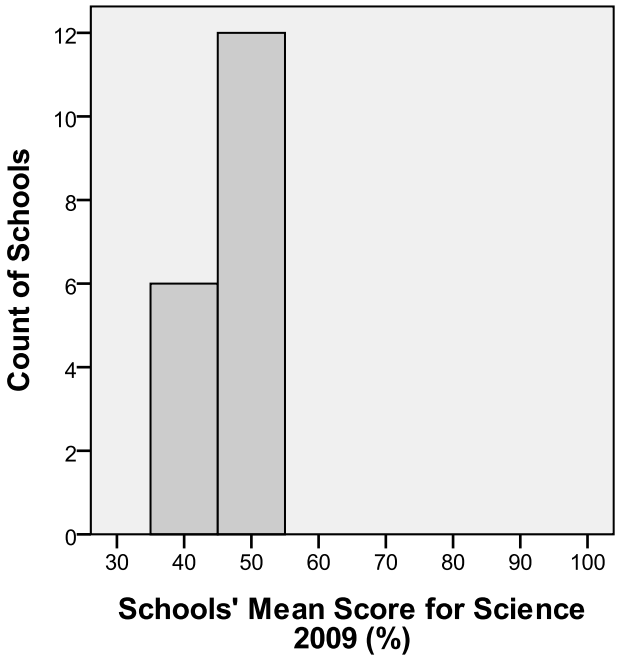


Figure 16. Histograms showing the Distribution of the Schools' Mean Scores for Mathematics (2009 and 2010). The mean score for the sample (N=18) for 2009 was 47.5% (Std. dev. = 9.3%) and for 2010 the mean was 51.5% (Std. dev. = 8.0%).



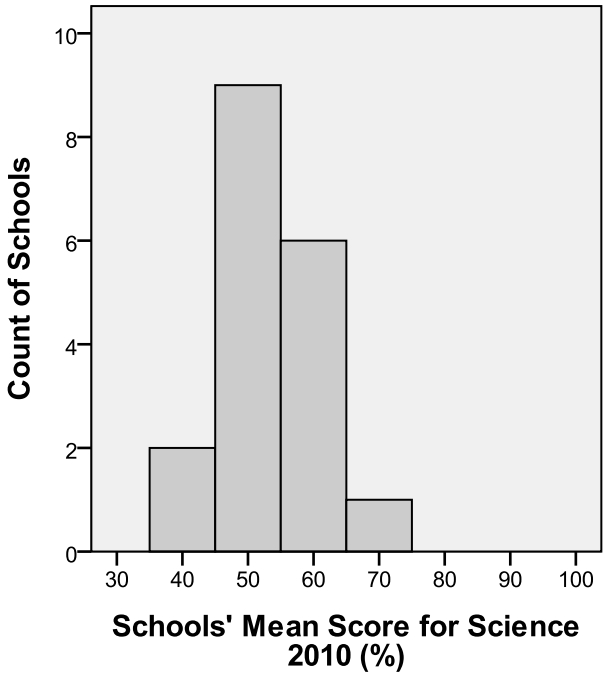


Figure 17. Histograms showing the Distribution of the Schools' Mean Scores for Science (2009 and 2010). The mean score for the sample (N=18) for 2009 was 47.4% (Std. dev. = 4.7%) and for 2010 the mean was 52.9% (Std. dev. = 6.7%).

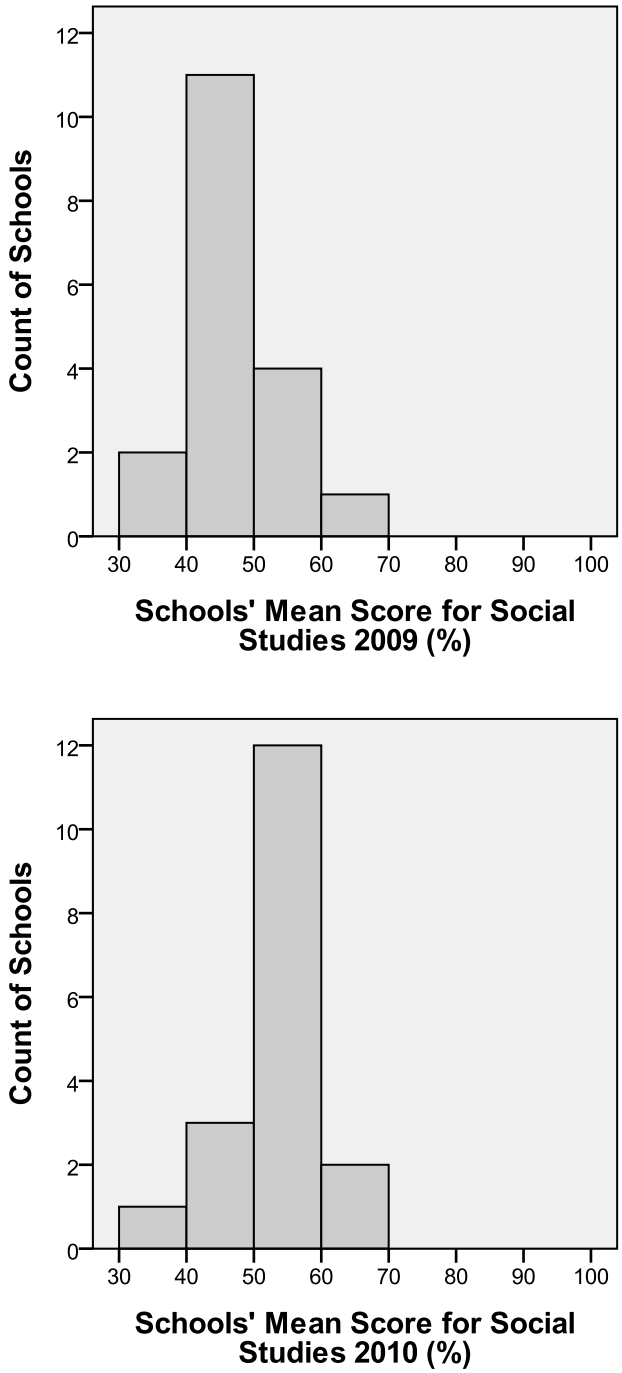


Figure 18. Histograms showing the Distribution of the Schools' Mean Scores for Social Studies (2009 and 2010). The mean score for the sample (N=18) for 2009 was 46.7% (Std. dev. = 7.7%) and for 2010 the mean was 51.28% (Std. dev. = 7.0%).

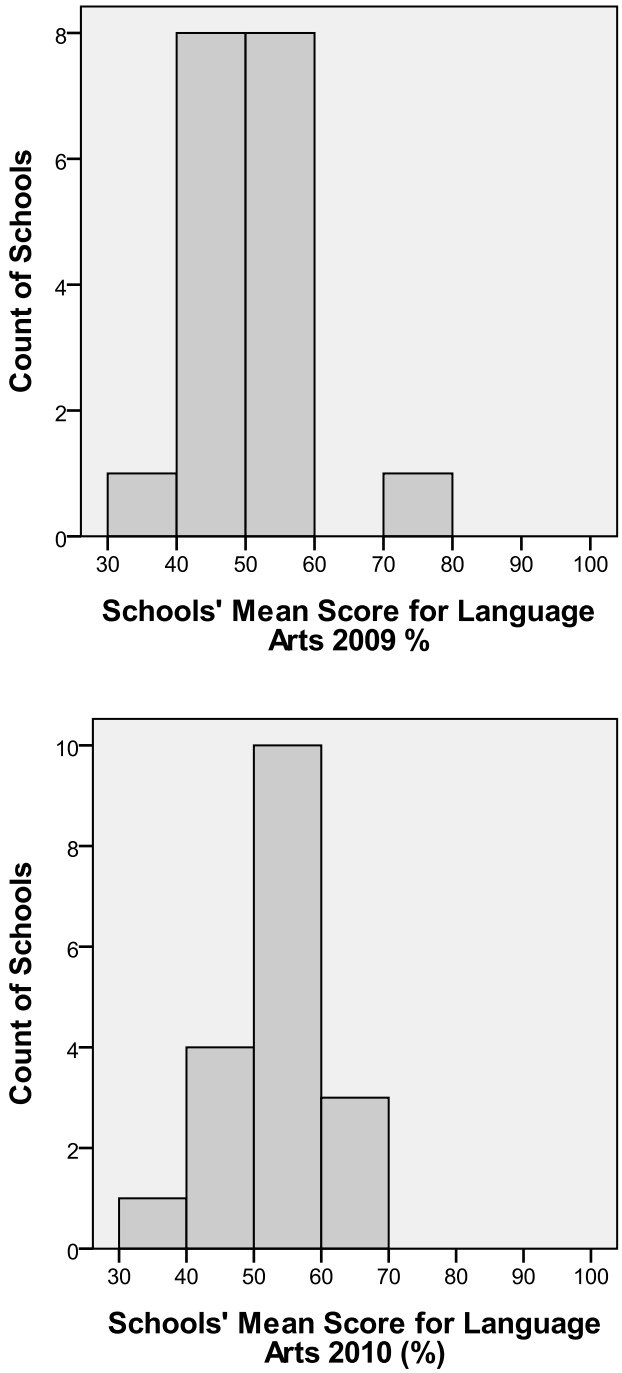


Figure 19. Histograms showing the Distribution of the Schools' Mean Scores for Language Arts (2009 and 2010). The mean score for the sample (N=18) for 2009 was 51.00% (Std. dev. = 7.7%) and for 2010 the mean was 52.02% (Std. dev. = 7.4%).

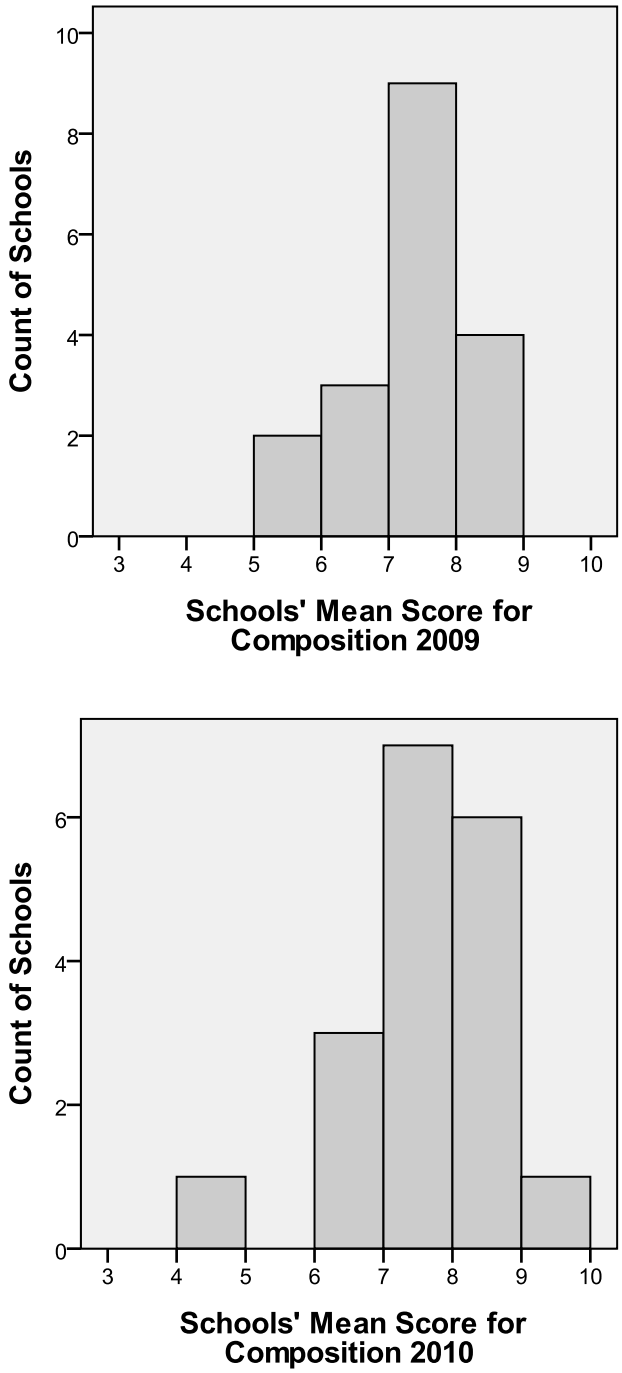


Figure 20. Histograms showing the Distribution of the Schools' Mean Scores for Composition (2009 and 2010). The mean Math score for the sample (N=18) for 2009 was 6.8 (Std. dev. = 0.9%) and for 2010 the mean was 7.1 (Std. dev. = 1.1).

4.6 Findings from Correlational Analyses or Tests for Association for Hypothesis 1 and Hypothesis 2

Tables 9, 10, 11, 12 and 13 show the summarized tabulations of the correlations between both the selected variables from the Principal's Questionnaire (principals' perception), the FIT Scores (school condition); and the GSAT Mathematics, Science, Social Studies, Language Arts and Composition respectively. Only significant correlation values were included in the tables, corresponding p-values were also shown and the significance was noted at the 0.05, 0.01 and 0.001 levels (for the complete correlation analyses results refer to Appendix E). Both positive and negative correlations were shown for 2009 and 2010 – for the association with the schools' overall scores, and then for the girls' and boys' scores respectively. There were no significant correlations between the schools' condition (FIT scores) and Science and Language Arts for either 2009 or 2010, therefore no results for the second hypothesis was included in Table 10 and Table 12.

Therefore, correlations were found that confirmed the first hypothesis (differences in the principals' perception of school facilities quality are associated with differences in the schools' GSAT Scores for all subjects for 2009 and 2010). This included correlations between the principals' perception of several school facility elements and all GSAT subjects for 2009 and 2010. The greatest numbers of correlations were for school safety (buildings and grounds), classroom ventilation control, classroom echoes, and noise outside classroom. They were significantly associated with the schools' performance Mathematics and Social Studies; and to a lesser degree the performances in Science, Language Arts and Composition. These correlations for the schools' overall performance GSAT was mirrored by the correlations for boys' performance in most cases.

The second hypothesis was also confirmed (differences in the condition of the schools' physical facilities are associated with differences in the schools' GSAT Scores for all subjects for 2009 and 2010). But this was only for boys' performances in Mathematics (2009) and Composition (2010); and for the performances in Social Studies (schools overall scores, boys and girls scores, 2009).This implies that the

school physical condition, as indicated by the overall ratings, may not be as significantly correlated to the GSAT performances as the individual facility elements measured by the principals' perception.

Table 9

Summary of Significant Correlations between Principals' Response Variables and Schools' Performance in Mathematics (2009 and 2010) and between FIT Scores and Schools' Performance in Mathematics (2009 and 2010)

	GSAT Mathematics for 2009					
	Schools' Scores		Girls' Scores		Boys' Scores	
Variables	r	p-value	r	p-value	r	p-value
Safety Inside School buildings	0.720	0.001*			0.593	0.008*
Safety on School Grounds	0.542	0.015			0.599	0.007
Student Computers	-0.468	0.029				
Computers for Teachers			0.449	0.035		
Classroom Ventilation Ctrl.	0.448	0.036				
Noise Outside the Classroom	0.514	0.021			0.661	0.003*
Interior Attractiveness					0.471	0.028
	GSAT Mathematics for 2010					
Classroom Ventilation Ctrl.	0.424	0.045			0.439	0.039
Noise Outside the Classroom					0.536	0.016
Interior Attractiveness	0.532	0.014	0.596	0.006*	0.416	0.048
Classroom Echoes	0.464	0.035			0.460	0.036
School Cleanliness			0.420	0.047		
Display Areas					0.510	0.022
FIT Scores					0.414	0.049

Note. All correlations significant at the 0.05 level ($p < .05$, one-tailed)
*$p < 0.01$, one-tailed
Where variables are missing no significant correlations were found.

Table 10

Summary of Significant Correlations between Principals' Response Variables and Schools' Performance in Science (2009 and 2010) and between FIT Scores and Schools' Performance in Science (2009 and 2010)

	GSAT Science for 2009					
	Schools' Scores		Girls' Scores		Boys' Scores	
Variables	r	p-value	r	p-value	r	p-value
Safety Inside School buildings	0.651	0.003			0.546	0.014
Safety on School Grounds	0.458	0.037			0.561	0.012
Student Computers	-0.429	0.043			-0.428	0.043
Classroom Ventilation Ctrl.	0.556	0.010			0.460	0.032
Noise Outside the Classroom	0.565	0.011			0.752	0.000**
	GSAT Science for 2010					
Classroom Space adequacy					-0.436	0.040
Meeting Space	-0.430	0.042			-0.529	0.015
Classroom Temperature			0.420	0.047		
Classroom Ventilation Ctrl.	0.527	0.015			0.606	0.005*
Classroom Echoes	0.613	0.006	0.464	0.035	0.596	0.007

Note. All correlations significant at the 0.05 level ($p < .05$, one-tailed)

*$p < 0.01$, one-tailed

**$p < 0.001$, one-tailed

Where variables are missing no significant correlations were found.

Table 11

Summary of Significant Correlations between Principals' Response Variables and Schools' Performance in Social Studies (2009 and 2010) and between FIT Scores and Schools' Performance in Social Studies (2009 and 2010)

GSAT Social Studies for 2009						
	Schools' Scores		Girls' Scores		Boys' Scores	
Variables	r	p-value	r	p-value	r	p-value
Safety Inside School buildings	0.697	0.001	0.512	0.021	0.581	0.009
Safety on School Grounds	0.575	0.010			0.594	0.008
Computers for Teachers			0.425	0.045		
Classroom Ventilation Ctrl.	0.642	0.003*	0.624	0.004*	0.500	0.021
Classroom Echoes	0.454	0.039				
Noise Outside the Classroom	0.648	0.003*			0.710	0.001*
FIT Scores	0.525	0.015	0.455	0.033	0.445	0.037
GSAT Social Studies for 2010						
Meeting Space					-0.431	0.042
Classroom Air Circulation			0.431	0.042		
Classroom Temperature			0.452	0.034		
Classroom Ventilation Ctrl.	0.491	0.023				
Classroom Echoes	0.516	0.020	0.441	0.043		
Noise Outside the Classroom					0.571	0.010
Display Areas					0.433	0.047
Interior Attractiveness	0.433	0.041	0.475	0.027		
School Cleanliness			0.421	0.046		

Note. All correlations significant at the 0.05 level ($p < .05$, one-tailed)

*$p < 0.01$, one-tailed. Where variables are missing no significant correlations were found.

Table 12

Summary of Significant Correlations between Principals' Response Variables and Schools' Performance in Language Arts (2009 and 2010) and between FIT Scores and Schools' Performance in Language Arts (2009 and 2010)

	GSAT Language Arts for 2009					
	Schools' Scores		Girls' Scores		Boys' Scores	
Variables	r	p-value	r	p-value	r	p-value
Safety Inside School buildings	0.698	0.001			0.608	0.006
Safety on School Grounds	0.542	0.015			0.628	0.005
Computers for Teachers	0.420	0.047	0.569	0.009*		
Classroom Ventilation Control	0.538	0.013			0.415	0.049
Noise Outside the Classroom	0.593	0.008*			0.708	0.001*
Display Areas					0.432	0.047
	GSAT Language Arts for 2010					
Classroom Layout			0.442	0.043		
Teaching Space			0.437	0.045		
Classroom Ventilation Control					0.425	0.044
Noise Outside the Classroom	0.442	0.043			0.563	0.012
Interior Attractiveness	0.420	0.047	0.437	0.040		

Note. All correlations significant at the 0.05 level ($p < .05$, one-tailed)
*$p < 0.01$, one-tailed
Where variables are missing no significant correlations were found.

Table 13
Summary of Significant Correlations between Principals' Response Variables and Schools' Performance in Composition (2009 and 2010) and between FIT Scores and Schools' Performance in Composition (2009 and 2010)

	GSAT Composition for 2009					
	Schools' Scores		Girls' Scores		Boys' Scores	
Variables	r	p-value	r	p-value	r	p-value
Computers for Teachers			0.419	0.047		
Classroom Layout	0.444	0.043			0.487	0.028
Classroom Temperature			0.503	0.020		
Classroom Ventilation Control			0.415	0.049		
Noise Outside the Classroom					0.556	0.013
Classroom Maintenance			0.541	0.015		
	GSAT Composition for 2010					
Display Areas					0.485	0.026
Classroom Echoes	0.485	0.029				
Classroom Ventilation Control	0.432	0.042			0.430	0.042
FIT Scores					0.455	0.033

Note. All correlations significant at the 0.05 level ($p < .05$, one-tailed)
Where variables are missing no significant correlations were found.

4.7 School Rankings

Table 14 shows the ranking of the schools based on the prioritized significant variables (strength and number of correlations – Tables 9 to 13). The Ranking of 1 was the highest and the Ranking 14 the lowest. Many of the top performing schools and students were also in higher quality facilities (Principals' coded ratings: 5 or 4) and spaces that were in better condition than others (FIT scores: 60 to 70), as revealed by the correlations and Table 14 (that is, when these facilities are compared to those receiving

lower ratings). Therefore, the prioritized variables listed here (ventilation control, noise outside the classroom, classroom echoes, attractiveness of the school interior) not only reflected the students' overall performance but also the overall school conditions.

Table 15 shows the ranking of the schools by way of their average performances in Social Studies and Mathematics (GSAT subjects with the greatest number of significant correlations). The Ranking 1 was the highest and the Ranking 18 the lowest. The results showed that only two schools from the sample performed above the national average, these included: a remote school from the smallest size classification and rural school from the largest size classification. Three school performed at the national average level (two were large from the urban locale and the other medium from the rural locale). The rest of the sample all performed below average, with the lowest performers all coming from small schools located in rural or remote locales.

Table 16 showed that locales and sizes are not equally represented by the final sample. Therefore this made it difficult to compare performance across the two classifications. The sample had more small to medium sized schools located in rural and remote areas. The results were mixed as their performances were mostly below the national average but as shown in Table 15, the two top performers were also from these locales.

Table 14

School Ranking according to the most significant variables from the Principals' Questionnaire results and compared to FIT Scores

School Ranking	Classroom Ventilation Control	Noise Outside the Classroom	Safety inside School Buildings	Classroom Echoes	Attractiveness of Interior	FIT Scores
1	5	5	5	4	5	70.67
2	4	4	4	5	3	64.71
3	4	3	1	4	3	71.41
4	4	2	5	5	4	61.13
5	3	4	5	5	5	66.66
6	3	2	4	4	3	54.49
7	2	4	4	4	3	63.72
8	2	4	4	2	4	61.58
9	2	4	3	3	3	35.94
10	2	2	2	2	2	46.34
11	2	1	3	5	5	57.11
12	2	1	2	1	4	47.96
13	1	2	4	2	3	50.82
14	1	1	1	3	3	52.35

Notes: N= 14, schools omitted due to missing values. Ranking of schools based on coded values (5 the highest and 1 the lowest)in prioritized list of variables starting with Classroom Ventilation Control, then Noise outside the Classroom, Safety inside school buildings, Classroom Echoes, Interior Attractiveness and FIT Scores)

Table 15

School Ranking according to their averages in Social Studies and Mathematics and compared with Ministry of Education school size and locale classifications.

School Rank	Performance compared to National Average	School Size	School Locale
1	Above	I	Remote
2	Above	V	Rural
3	Average	V	Urban
4	Average	V	Urban
5	Average	III	Remote
6	Below	I	Rural
7	Below	III	Rural
8	Below	IV	Rural
9	Below	III	Rural
10	Below	III	Rural
11	Below	IV	Urban
12	Below	II	Remote
13	Below	III	Urban
14	Below	II	Rural
15	Below	I	Remote
16	Below	I	Remote
17	Below	I	Rural
18	Below	I	Remote

Notes: N= 18, Ranking (1 the highest and 18the lowest) GSAT subjects with the greatest number of significant correlations. School SIZE classification or enrollment levels: Class I $\leq$ 250, Class II = 251- 500, Class III = 501 – 850, Class IV = 851 – 1200 and Class V > 1200

Table 16

Cross tabulations of school performances in Social Studies and Mathematics compared with Ministry of Education school size and locale classifications.

School Performance	School Size					Total	School Locale			Total
	I	II	III	IV	V		Urban	Rural	Remote	
Above Average	1	0	0	0	1	2	0	1	1	2
Average	0	0	1	0	2	3	2	0	1	3
Below Average	5	2	4	2	0	13	2	7	4	13
Total	6	2	5	2	3	18	4	8	6	18

5 Discussion

As sample is small and non-representative all discussions reflect the characteristics of the current sample only. The exploratory analysis of the data from the questionnaires and the school facility assessment revealed that the primary schools had all the basic amenities in place and were architecturally quite similar. The school facilities also had the same types of deficiencies in the following areas: grounds landscaping, classroom acoustical treatment, restroom maintenance, gate and fencing, fire safety system and accessibility structures. Therefore, given these general deficiencies in the infrastructure, most schools received a Poor Rating from the FIT school assessment tool. This indicated that although the basic elements of a school were present, there were sufficient inadequacies in the condition of the facilities to affect their suitability for all teaching, learning and social activities.

The exploration of the GSAT data revealed there were general trends at the national level. The most obvious was that the girls always outperformed the boys (on average). There was also an improvement in GSAT performance in 2010 over that in 2009 for all subjects (1% - 7% score increase). These improvements were spread across all five subjects for both girls and boys (except for boys' Composition). The average scores in the schools examined in this study (aggregated from the girls' and boys' scores) also followed this trend and with the same margin of improvement.

Similarly, the schools from the study sample followed the national trends and had higher scores for most subjects in 2010. As indicated in the background information on the schools, there were no major changes to the physical facilities that could account for any changes in GSAT scores between the two years. Therefore the changes in GSAT results may be due to a lurking variable, possible associated with the level of difficulty of the exams from one year to another and this may be responsible for the increased scores observed in 2010.

In addition, although the ranking of the schools purely of GSAT scores, from highest to lowest scores remained generally the same, the margin of difference between the scores changed for some

schools (not specifically stated in the results). This fact may have accounted for some of the inconsistencies in the results from the hypothesis testing (correlational analyses) from the two consecutive years. Additionally ranking based on the schools' performance in Social Studies and Mathematics alone revealed that smallest schools (Class I) tended to fall within the lowest performance rankings, although it is not possible to declare any major trend as neither the school sizes nor the locales were equally represented by the small sample.

The study found significant correlations for both hypotheses; even though many correlations were inconsistent (i.e. the exact value and strength of each correlation were not the same from year to year). The first hypothesis sought to identify correlations between the Principal's questionnaire responses and GSAT subjects. The results the sample showed that statistically, the different GSAT subject scores were significantly correlated to the following variables from the questionnaire: school safety, availability of computers for students and teachers, classroom ventilation controls, classroom air circulation and temperature, meeting space for staff and parents, classroom layout and space for teacher movement, attractiveness of school interiors, internal classroom acoustics and external noise, and school upkeep (cleanliness and maintenance).

The second hypothesis sought to identify correlations between facility condition rating (FIT scores) and GSAT scores. School facility condition was significantly correlated to three GSAT in the two year period assessed. The findings from each hypothesis are discussed below: (Refer to the Results Tables 9, 10, 11, 12 and 13 for the all significant Spearman's rho and the p-values)

5.1 Significant Findings

Hypothesis 1: School Safety (Safety Inside the School Buildings and Safety on the School Grounds: SCHSAFE and SCHGRDS)

The results indicated that school safety was positively correlated to the schools' overall scores in Mathematics, Science, Social Studies and Language Arts for 2009; the highest correlation for safety inside buildings was with the schools' performance in Mathematics ($r = 0.720$; $p < 0.01$). The highest correlation for safety on the grounds (outside) was with the schools' performance in Social Studies ($r = 0.579$; $p < 0.05$). Only the girls' performance in Social Studies (2009) was linked to safety (inside school; $r = 0.512$; $p < 0.05$).

The boys' scores in Mathematics, Science, Social Studies and Language Arts were positively correlated to school safety (inside and outside) for 2009. The highest correlation for the boys being that for Language Arts (inside buildings: $r = 0.0.608$; $p < 0.01$ and outside: $r = 0.628$; $p < 0.01$). No significant associations were found between GSAT subjects and school safety in 2010. Neither were there any significant correlations between safety and performances in Composition for either 2009 or 2010.

Therefore, this study indicated that safety in primary schools may be linked to the students' overall academic performance in 2009. In fact, violence is problem for many Jamaican schools and resulted in the creation of "the Safe Schools Programme" to reduce the number of incidences (PIOJ, 2010, p.22.19). In addition to violence, many primary schools experienced vandalism which often went unchecked owing to the limited facility protection at the perimeter (damaged gates and fences) or from the lack of security guards. Violence and vandalism could possibly interrupt normal teaching and learning activities in the within schools.

Leonard (2001) indicated that interruptions reduced planned teaching time and also had the potential to affect the students' learning quality. In Jamaica the interruptions were not limited to violence

and vandalism but also included unplanned classroom visits from parents and other community members (as observed during school assessments), especially where there were no controls at the entry/exits points to the school grounds. Therefore, the association between safety and GSAT performance for this sample may to support other studies that suggest that, safe and secure facilities provided the best education climate for teachers and students and were linked to better school performance (Lockheed and Harris, 2005; PIOJ, 2010).

Hypothesis 1: Availability of Computers for Students (Student Computers: ACOMPU)

This is one of the significant negative correlations found in the correlational analyses. The availability of computers for students was negatively correlated to the schools' overall performance in Mathematics and Science, and to boys' scores in Science (2009). No significant correlations were found for girls' scores in 2009. Also no significant correlations were found for the schools, boys or girls in 2010.

These somewhat unexpected negative results for students' computer use may be linked to the fact that, most principals from the sample reported that computers were not enough for students to use. Therefore answers were skewed towards the negative. The findings may also indicate a lurking variable associated with computers availability and usage.

Hypothesis 1: Availability of Computers for Teachers (Computers for Teachers: TCOMP)

The availability of computers for teachers was positively linked to schools' overall performance in Language Arts for 2009. It was also associated with girls' scores for Mathematics, Social Studies, Language Arts and Composition for the same year; there were no significant correlations between teachers' computers and boys' scores for 2009. All correlations were weak to moderate ($r < 0.700$) and no significant correlations were found for 2010.

The availability of computers for teachers therefore appear to be more positively associated with the schools' or the students' performance than the availability of computers for students, at least for 2009. This may be due to the fact that schools with more computers for teachers allowed for improved lesson preparations (as was indicated in the questionnaire).

Hypothesis 1: Classroom Ventilation Control (CLVENTR)

Ventilation control was positively correlated to schools' overall scores in Mathematics, Science, Social Studies and Language Arts for 2009. This result was repeated for 2010 except for the performance in Language Arts which was replaced by the association with the scores in Composition. All listed correlations were significant (but weak to moderate), the highest being the correlation to Social Studies for 2009 ($r = 0.642$; $p < 0.01$).

Boys' scores in Science, Social Studies and Language Arts were significantly correlated to ventilation control in 2009. The Boys' performance in Mathematics, Science, Language Arts and Composition were significantly correlated to ventilation control in 2010. The highest correlation was with Science in 2010 ($r = 0.606$; $p < 0.01$). Girls' scores in Social Studies and Composition were significantly correlated to ventilation control in 2009, but no correlations for girls were found in 2010.

The primary schools' lack of control over ventilation rates may have be reflecting the use of ventilation blocks instead of operable windows, and also by the unplanned use of space (blackboard partitions) that possibly reduced cross-ventilation by blocking airflow in some classes. The fact that the classrooms operated under tropical conditions of high heat and humidity indicated that a lack of ventilation control may sometimes be create environments unsuitable for learning.

Therefore, this study showed that for some primary schools' total reliance on natural ventilation may have affected some students' performance. When designed properly, natural ventilation systems have many benefits, but without the aid of ventilation controls to adjust to changing user needs, occupant

comfort and performance may be compromised (Griffiths and Eftekhari, 2008 and Wargocki, Wyon and Fanger (2000); Butera, 1998). The association between ventilation control and GSAT performance has therefore confirmed the theory that, thermal discomfort was may be linked to poor academic performance (Hwang, Lin, Chen and Kuo, 2009; Dapi, Rocklov, Nguefack-Tsague, Tetanye and Kjellstrom, 2010; NEI, 2010).

Hypothesis 1: Classroom Air Circulation (CAIRCIRL) and Classroom Temperature (CLTHERM)

Surprisingly, these variables were only correlated to the performance of girls (not to the schools' or boys' performance) in contrast to the number of significant correlation attributed to ventilation control. In 2010, air circulation had a weak correlation to girls' Social Studies ($r = 0.431$; $p < 0.05$) only. While classroom temperature was moderately associated with girls' Composition scores in 2009 ($r = 0.503$; $p < 0.05$) and weakly linked to girls scores in Science and Social Studies in 2010.

These results indicated that for this sample there was a stronger link between the indoor thermal environment and the academic performances of girls (as compared to the performance of boys). The findings for air circulation, classroom temperature and ventilation control may be compared to those from other tropical studies in, which theorized that girls (wearing restrictive schools uniforms) may be more affected by thermal discomfort in the classroom than boys (Hwang, Lin, Chen and Kuo, 2009; Kwok and Chun, 2003; Dapi, Rocklov, Nguefack-Tsague, Tetanye and Kjellstrom, 2010).

Hypothesis 1: Availability of Adequate Meeting Space for Staff and Parents (Meeting Space: MSPACE)

This was the second variable with an unexpected negative correlation to GSAT scores. In 2010, availability of adequate meeting space had a weak negative correlation to the schools' overall performance in Science scores ($r = - 0.430$; $p < 0.05$) and a moderately negative correlation to boys' Science scores ($r = - 0.529$; $p < 0.05$). There were no other significant correlations to meeting space.

Therefore this contradictory result showed that schools with an inadequate amount of parent-teacher meeting space appeared to perform better at Science than other school. This finding may be due to the fact that meeting space availability was not directly linked to quality of classroom spaces and therefore not associated directly with teaching or learning quality. There may also be the possibility of a lurking variable associated with school space and student performance that could explain better these unexpected results.

Hypothesis 1: Adequacy of Classroom Teaching Space for Movement (Teaching Space: TEACHSPA)

Classroom space for teacher movement was weakly ($r = 0.437$; $p < 0.05$) but significantly positive correlated to girls' performance in Language Arts (2010). There were no correlations with schools' overall scores or with boys' scores. There were no significant correlations for 2009. Therefore, this study implied that, limited teaching space was associated with lower academic achievement in girls.

The lack adequate classroom space for instruction could be a reflection of the fact that many schools (over 50%) had enrollment levels that were above the designed capacity. Spaces intended to hold one class were sometimes occupied by two and three classes. Davies (1999) also indicated that large classroom furniture did not allow for the movement of teachers and the NEI, (2010) implied that cramped classroom spaces were associated with lower learning quality. Hence the results appeared to support the fact that classrooms without adequate teaching space were linked to lower teaching quality and possibly reduced academic performance for some primary school students (James, 1977).

Hypothesis 1: Attractiveness of the Schools' Interior (Interior Attractiveness: SCHINT)

The attractiveness of the school interior spaces was associated with both the schools' overall performance and the girls' performance of in Mathematics, Social Studies and Language Arts for 2010. It was also correlated to the boys' performance in Mathematics in 2009 and in 2010. There were no significant correlations to the girls or the schools' overall performance in 2009. Therefore, primary

schools with relatively unattractive interiors were linked to lower performances in many GSAT subjects (2010).

The overall quality of the primary schools' interior surfaces was mixed: walls were generally clean and well painted but most floors and ceilings were undecorated and utilitarian (with damaged areas). In some cases newer schools had old and worn furniture; and classrooms were often filled with dusty books and old teaching aids (owing to limited storage facilities). These conditions may have helped to create poorer learning climate and weaker academic performances, as indicated by other school studies: PIOJ (1987); Lockheed and Harris (2005); NEI, 2010; Uline and Tschannen-Moran (2008).

Hypothesis 1: Internal Classroom Acoustics (Classroom Echoes: CLNECHO)

The classroom echoes variable (internal sound control of reverberations) was significantly correlated to the schools' overall scores in Mathematics, Science, Social Studies and Composition for 2010. There were no significant correlations for Language Arts. The strongest correlation was for the schools' performance in Science ($r = 0.613$; $p < 0.01$). The boys' performance (2010) in Mathematics, Science and Composition was weak to moderately, correlated to classroom echoes; while the girls' performances in Science and Social studies were only weakly correlated to classroom echoes. There was only one significant correlation in 2009 and this was for the schools' overall performance in Social Studies.

Classrooms with poor acoustical designs are often associated with reduced teaching and learning quality (Crandell and Smaldino, 2000). Poor design is often associated with longer reverberation times (echoes) and this sometimes interfere with the sound teachers voice (Knecht et al., 2002). Since there was an overall lack of acoustical treatment in all the primary school classrooms to reduce echoes, hence, variations in acoustical quality were likely dependent on classroom dimensions (size) and on the construction of the wall (concrete, black board, open grillwork or open ventilation blocks).

Therefore, the results indicated that these differences in the acoustical quality of the materials used on classroom surfaces were correlated to difference in schools' performances in GSAT. These findings are also in agreement with those of Zannin et al. (2007) who found that acoustically untreated classrooms were a source of internal noise. Addition, they imply that the echoes in the crowded Jamaican classrooms that Lockheed et al. (2005) referred to, may affect the learning process and consequently the students' academic achievement.

Hypothesis 1: Noise from Outside the Classroom (Noise Outside the Classroom: or CLNOUT)

Noise from outside the classroom (external noise) had some of strongest correlations to GSAT subjects. Noise was linked to both the schools' and the boys' GSAT performance in 2009 and 2010. There were no significant correlations with the girls' GSAT scores. External noise was correlated to the schools' overall scores in Mathematics, Science, Social Studies and Language Arts (in 2009). There was one significant correlation to the schools' overall performance in 2010 and this was in Language Arts. All the schools' correlations were moderate; the highest was for Social Studies ($r = 0.648$; $p < 0.01$).

The correlations between external noise and boys' performance were the strongest correlation found in the entire study. External noise was linked to boys' performance in all GSAT subjects in 2009: Mathematics ($r = 0.661$; $p < 0.01$), Science ($r = 0.752$; $p < 0.001$), Social Studies ($r = 0.710$; $p < 0.01$), Language Arts ($r = 0.708$; $p < 0.01$) and Composition ($r = 0.556$; $p < 0.05$). The results for Mathematics, Social Studies and Language Arts were repeated for 2010, but with weaker correlations.

These results showed that noise outside the classroom was strongly linked to the performance of boys in GSAT and in turn to the schools' overall GSAT performance (which is an aggregation of the scores for boys and girls). This indicated that boys in schools with low quality acoustical environments (more disruptions from external noise) had consistently lower scores on average than boys in schools with

better acoustical environment (less noise intrusion). The results also showed that performance of boys had a much stronger correlation to external noise than the performance of girls.

Observations from the school facility assessments also revealed many incidences when loud noise from outside the classroom could be clearly heard inside the class, this included noises from the following sources: principals using the public address system to call errant students after lunch time, teachers shouting down the corridors to control unmanned classes, recitation in neighbouring classrooms- especially those separated by black boards, movement of the large heavy furniture pieces during class time, shouting during physical education classes held in the quadrangle, playing at recess while other classes were in session and banging of pots and pans where schools kitchens were located besides classrooms.

This study also confirmed anecdotal reports of noise being a problem in many Jamaican classrooms (James, 1977; Miller, 1989; Davies, 1999; Evans 2001; Lambert and Jackson, 2000; NEI, 2010). It was apparent from these studies that the lack of an acoustical buffer system was a serious deficiency in the design of Jamaican primary schools. Additionally, the openness of the naturally ventilated classrooms meant that many classrooms were always vulnerable to outside noise intrusion (through ventilation blocks etc.). The findings were therefore, also a confirmation of the prioritization of ventilation needs over the acoustical requirements of the learning environment in the tropics (Kruger and Zannin, 2004).

Classrooms with high background noise level made it difficult for students to understand the teachers' speech; this limited learning quality and had a measurable effect on students' academic performance (Shield and Dockrell, 2008). The continual exposure to noise also affected the cognitive development of children (Lercher, Evans and Meis, 2003). Especially relevant was the negative effect of noise on Reading Ability (Language Arts) which potentially affected students' performance in all other subjects (Evans and Maxwell, 1997; Hygge, 2001; Lewis, 2001). Therefore, it was not surprising that

primary school classrooms that lacked acoustical protection from external noise created very poor learning environments, and were consistently associated with the lower performance in Language Arts.

Hypothesis 1: Overall School Cleanliness (School Cleanliness: CLEANBG)

The cleanliness of the school buildings and grounds was only correlated to the girls' scores in Mathematics ($r = 0.420$; $p < 0.05$) and Social Studies ($r = 0.421$; $p< 0.05$) for 2010. This indicates that girls may be more sensitive to poor school conditions, as there were no other significant correlations with school cleanliness. Moreover, this was supported by the NEI (2010) reports which stated that some primary schools were potential health hazards; and the school assessments which found that some learning areas were contaminated by dust via the permanently open ventilation blocks. Therefore it is possible that the school conditions may be linked to the health and performance of some students as indicated by other studies (WHO, 2004).

Hypothesis 1: Classroom Maintenance (CLMNT)

Classroom maintenance was only correlated to the girls' score in Composition ($r= 0.541$; $p < 0.05$) for 2009. There were no other significant correlations. Similar to school the correlations with school cleanliness, this result may indicate that the girls' performance was linked to poor classroom conditions. Therefore, the results confirm the findings of other studies, that school spaces that were not well maintained were associated low academic achievement (Schneider, 2002; Sheets, 2011; Earthman, et al., 1995; Lewis, 2001; Branham 2004; Stevenson, 2001).

Hypothesis 1: Display Areas (TSDISPLA)

The availability of display areas for student work was only linked to the boys' performance. In 2009, there was one significant correlation to the boys' score in Language Arts ($r = 0.432$; $p < 0.05$). Display areas were correlated to boys' Mathematics, Social Studies and Composition for 2010; the

highest correlation was with Mathematics ($r = 0.510$; $p < 0.05$). It is possible that schools that provided display areas do so to boost morale. The GSAT data clearly shows that boys underperform girls; therefore the display areas may indicate that schools that make special effort to motivate students through their facility design may improve student performance. In addition, the results seem confirm that facility quality is linked to student morale, which in turn is associated with academic achievement (Green et al., 2005).

Hypothesis 1: Classroom Layout (CLAYOUT)

The classroom layout was correlated to the schools' and the boys' Composition scores in 2009. The correlations were weak but positive. In 2010, the layout was associated with the girls' performance in Language Arts; this correlation was also weak ($r = 0.442$; $p < 0.05$). The results indicated that classroom layout may influence students' GSAT performance. James (1977) stated that the Jamaica classroom layout was inflexible and this could affect teaching quality; Miller (1997) implied that the classroom design has not changed since that study. Consequently, the findings show that some layouts may be impeding the learning process; this was also potentially exacerbated by the crowded conditions in many rural and urban schools.

Hypothesis 1: Adequate Classroom Space (Classroom Space Adequacy: TSPACE)

This was third variable with a negative correlation to GSAT performance. The only significant correlation to class space was for the boys' performance in Science, 2010; the correlation was weak ($r = -0.436$; $p < 0.05$). This was the second space variable (first was MSPACE) to indicate schools with larger rooms tended to underperform schools with small spaces. These findings seemed to show that larger classrooms do not necessarily lead to better student performance or that another lurking variable associated with room size/occupancy levels was present.

Hypothesis 2: Facility Rating (FIT Scores) Association with GSAT Performances

The results from the testing for the second hypothesis showed that the FIT school facility rating scores were weakly or moderately correlated to some GSAT subjects for 2009 and 2010. Facility scores were correlated to the schools' overall scores in Social Studies in 2009, this was the highest correlation for the second hypothesis ($r = 0.525$; $p < 0.05$). It was also correlated to the girls' and the boys' scores for Social Studies for that year. Facility rating scores were correlated to the boys' performance in Mathematics and Composition in 2010. Therefore, these findings showed that the primary schools' condition was significantly correlated to differences in students' performance and agreed with similar studies in the United Stated and the United Kingdom. (DfEE, 2001; Ibrahim, 2010; Sheets, 2011).

Since, the overall low facility ratings from the school assessments were due to general deficiencies in the acoustical system, fire safety system, playgrounds and accessibility provisions of the schools (etc). Variations in facility scores were therefore dependent on differences in the quality of the classroom surfaces, furniture, windows and doors, lighting and storage space. These factors created unsuitable conditions in the classrooms and disparities in the quality of the school facilities. These differences in quality were possible linked to varying levels of student comfort which was associated with significant differences in Social Studies scores (at least for 2009 when both girls' and boys' scores were correlated). This finding agreed with those of Lewis (2001), whose results also showed that facility condition scores were significantly linked to students' performance in Social Studies.

In addition, there seemed to be a stronger link between the boys performance and the condition of the physical, since the Mathematics and Composition correlations were only associated with the boys' scores. These findings also corroborated with those from the Principals questionnaire, which produced more correlates for the performance of boys than the performance girls, especially for ventilation control and these two subjects, in 2010. Hence, there is a potential link to ventilation control through the deficiencies in windows and doors which has lead to differences in the performance of boys.

5.2 Conclusions

The comparison of the results in the itemized FIT scores (Table 7, Table 14 and Appendix F) with the results of the principals' questionnaires therefore indicated that differences in the school rankings can be compared not only the differences in school condition but to the students' GSAT performance. Consequently, the results showed that both the principals' perception of different physical elements of the school facilities and the facility condition rating were correlated to the schools' (students') performance in different GSAT subjects. Most notable were the significant correlations between the following variables: classroom ventilation control, internal and external noise (lack of acoustical control) and GSAT Mathematics, Science, Social Studies and Language Arts. The results also indicated that links between school facilities and boys' scores were stronger than the association with girls' scores.

In addition, the condition of the school facilities was also correlated to schools' or students' performance in the examinations. These correlations corresponded to differences in the condition of the classroom surfaces, furniture, windows and doors, lighting, play areas and storage availability. Although all schools had basic infrastructure in place, there was a generally deficient in the acoustical systems, fire safety systems, accessibility structures and social spaces (playgrounds etc.). Most importantly, these deficiencies also were linked to the schools' academic performance.

The aim of this study was to examine the links between the quality of the physical facility of Jamaican primary schools and the schools' academic achievements. In addition, it was hoped that the findings of the study would provide new insight into how deficiencies in the physical facility of some primary schools could potentially affect the teaching and learning activities in the classrooms. This information was considered relevant, as initially very little published research was available on the relationship between the Jamaican primary school facilities and students' performance. Furthermore, since primary schools were judged on the basis of their students' overall performance in GSAT, then the

findings would be valuable to those who seek to improve the students' performance and hope to create a better school environment for teachers and students.

Therefore, since the data from the sample of 18 primary schools were used to answer the research questions**: Are differences in the principals' perception of quality of the physical facilities of Jamaican primary schools associated with differences in GSAT scores for the schools/students? Are differences in the condition of Jamaican primary school facilities associated with differences in GSAT scores for the schools/students?** The study was successful in achieving its' goal, because in the final analysis of the results, the researcher could clearly state the following:

1. The principals' perception of selected areas in the primary school facilities was significantly correlated to the schools' (students') performance in specific GSAT subjects.
2. The differences in the overall condition of the school facilities were also significantly correlated to differences in the schools' (students') performance in specific GSAT subjects.

The following conclusions were derived (as sample is small and non-representative all conclusions noted reflects the characteristics of the current sample only):

1. Both classroom ventilation control and intrusion of external noise into the classroom were consistently and strongly correlated to GSAT scores. Observations of school conditions suggested a strong link between lack of ventilation control (reliance on natural ventilation only) and lack of noise control (openings in wall allow for noise intrusion) in the classroom.
2. Internal noise, external noise and the lack of proper acoustical treatments in primary school classrooms were correlated to the lower overall performance of schools and specifically to the lower performance of boys.
3. School safety perception was positively associated with schools' overall performance in GSAT.

4. Attractive school interiors were correlated to higher GSAT scores for both girls and boys. But the perception of cleanliness and maintenance of school spaces was only positively correlated to girls' scores.
5. There was general lack of adequate number of computers for students suggested that they currently play no significant role in the academic achievements of primary school students, while availability of computers for teachers may be correlated to enhanced student performance.
6. Poor air circulation and uncomfortable temperatures in the classroom were more likely to be associated with the underperformance of girls than boys. The layout of the classroom and adequate classroom space for teacher movement was also linked to the performance of girls.
7. Availability of adequate meeting space for teachers enhanced their performance and that of their students. Adequate space for parent/teacher meeting may be linked to lurking variable that is negatively correlated to performance.
8. Schools that provided display areas for students may also have boys with higher GSAT scores.
9. The schools' overall condition was associated with the schools' performance in Social Studies.

5.3 Summary of study findings

The study supported most of the anecdotal information available on Jamaican primary schools facilities, especially as far as safety, capacity and noise were concern. Firstly, in this study school safety issues were linked to incidences of violence and vandalism which could potentially interrupted teaching and learning activities. These interruptions could eventually lead to lower academic achievement.

Secondly, although the school capacity variables were not fully explored, the results indicated that they played significant role in the students' achievements. The lack of classroom space for teacher movement was associated with the underperformance of girls and may be linked to overcrowded classrooms. In fact,

the enrollment data showed that at least half of the sample was over their official school capacity during the study period.

Thirdly, the study showed that noise and the lack of proper acoustical treatments in primary school classrooms were correlated to the lower overall performance of schools and specifically the lower performance of boys. This is most significant, as given that the lack of noise control and the reported effect of noise on the cognitive development of children; this could possible provide an explanation as to why boys were more likely to underperform than girls.

In addition, the study also provided new information on the role that other environmental conditions played in the classrooms. It showed that, poor air circulation and high temperatures were more likely to be associated with the underperformance of girls and that, the total reliance on natural ventilation without ventilation control, could have helped to create unhealthy classroom conditions. Furthermore, the school design that allowed for the natural ventilation of the classroom was also linked to the serious problem of noise in the schools experienced. Open windows and door and wall perforated by ventilation blocks allowed external noise to intrude on classroom activities.

Finally, unattractive school interiors were correlated to lower student performance. This was also supported by the school facility assessments in which most schools were given only a poor or fair condition rating. Since the schools' attractiveness and condition was associated with their design and their upkeep, the researcher can only conclude that serious deficiencies exist in the quality of the Jamaican primary school facilities. These deficiencies should be addressed, not only to improve the conditions for teachers and students, but also to improve their performance.

5.4 Recommendations

Recommendations for improvements to the Jamaican primary school facilities include the following:

1. Ministry of Education's Primary School Building Standards document should contain clear, quantifiable objectives for school facilities as they relate to physical environmental factors such as classroom air quality, classroom temperature, classroom ventilation rates, sound levels (or background noise levels), classroom furniture ergonomics (and anthropometric compatibility), fire safety, special needs accessibility, play area safety, classroom seated space and space for movement, structural soundness, aesthetics and overall facility management and maintenance. Standard should aim for high facility quality in all existing primary schools (not only newly constructed schools).
2. Jamaican school designers should consider ventilation controls in the design of natural ventilation systems or at a minimum use operable windows that are oriented to reduce sun glares and maximize airflow (when necessary).Where improvement of air circulation and reduction of classroom temperature is required then operable windows or fans should be installed. Total reliance on ventilation blocks (breather blocks) should be reconsidered, especially where they block daylight, are difficult to maintain and allow for dust and noise intrusion. School designers should also consider how the different systems will interact (e.g. acoustics and ventilation).
3. The Ministry of Education should revisit the standard primary school building design to first address ventilation and acoustical controls, and the provision of spaces that are of adequate size and variety to match the changing needs of the schools (curricular, special needs, social and administrative), especially in urban areas. Where this is not possible, more flexible classroom furniture should be used. This should include furniture that allows for easy rearrangement and allows both teachers and students to move about the classroom. All schools should consider providing access to the school facilities for users who have special needs.

4. Generally the conditions in all primary schools should be improved, but special areas of concern include the following: fire safety, playgrounds and storage of all material and equipment. Schools should be provided with more fire extinguishers and alarms. Proper playgrounds should be created (away from driveways and parking areas) and child safe equipment installed. Book and teaching aids storage should be improved in both the classrooms and libraries; storage of gas tanks in kitchens that are located beside classrooms should be avoided completely. Any improvement to the restrooms, grounds landscaping and increasing social spaces (dining areas) would enhance all primary school facilities.
5. In the short-term, principals should consider creating a Quiet School Program, that encourages all school facility users (teachers, students and visitors) to reduce the noise levels in schools. In the long-term schools should consider providing acoustical treatment in all classrooms, but especially in those that are close to known noise sources like kitchens and play areas.
6. All schools should have a school safety program that addresses the safety problems that affect individual schools. Install or repair all gates and fences where necessary, if possible include security personnel at the gate to control visitor access and reduce the interruptions from unwanted visitors during the school day.
7. Increase the numbers of computers available for student use and implement maintenance plans to keep them functional.

5.6 Limitations of the Study

Limitations:

- The small sample may not be representative of all primary schools and non-parametric statistical methods were used to analyze the data may not be as robust as other statistical methods.
- Though attempts were made to control for shift schools (by excluding them) and reduce bias for parish and locale types. The study did not attempt to control for many of the potentially lurking

variables identified in the literature, other than by those that were eliminated by the random selection of the sample.

- All school were visited in January during the cool season and therefore classroom temperature under natural ventilation conditions may have been lower than in other seasons (e.g. dry season or late summer)
- Missing Data from each participant was excluded in the analyses on a case by case basis.
- Study could not examine changes to school over the intended five year period as some schools were reclassified during the period.
- The number of schools with multi-grade classes or several classes sharing one room was unknowns prior to the start of the study and could not be controlled for during sample selection.

5.7 Recommendations for future studies on Jamaican schools:

1. A similar study with a larger, representative sample of primary schools should be carried out. It should include instruments that capture the students' opinions on their schools facilities. The study should control for variables such as school size, attendance, poverty levels and teacher quality. The research should also prioritized variables identified as significant to student performance such as: ventilation, acoustics (internal/external), school safety and aesthetics. The mixed method study that includes some qualitative site assessment while school is in use is recommended. The tools/instruments used should be able to measure local school conditions accurately as facilities available may differ significantly from those found in more developed countries.
2. An investigation into the noise levels experienced in schools and its' effect on all occupants. Also include the effects of noise and language acquisition in Jamaican children (especially for children

who speak Jamaican Patois at home before learning Jamaican Standard English Language in school). The effect of over-crowding and differences classroom density should be controlled for.

3. Examination of the suitability of the standard school design for educational activities and for health and safety, especially where thermal comfort inside the classroom is concerned and the role of the condition of student restrooms on the health of school age children.
4. An anthropometric study that encompass the measurement of the local school population and compare the data to the furniture provided in school.
5. A case study that examines best practices in the maintenance and management of school facilities.

APPENDICES

APPENDIX A

Facility Analysis Tool (Board Members' Questionnaire) and the Principals' Questionnaire Or Teaching Staff Representative Questionnaire were adapted from the ORGANIZATION FOR ECONOMIC COOPERATION AND DEVELOPMENT (OECD) Centre for Effective Learning Environments (CELE, formerly PEB)
International Pilot study on the Evaluation of Quality in Educational paces (EQES)
User Manual© **OECD**
Final Version, May 2009

Source: http://www.oecd.org/edu/facilities/evaluatingquality

FACILITY ANALYSIS TOOL
EDUCATIONAL FACILITY ANALYSIS

<u>This questionnaire is to be completed for each school.</u>

Basic information

Research number of school: # (To be provided by researcher)

Proposed Respondent: School Board Representative

Date of questionnaire completion:

Instructions

This questionnaire requests information about the following aspects of the school spaces:

1. School location.

2. School demographics.

3. Ownership, financing and management of the school estate.

4. Community use of school.

5. Activities at the school.

6. School site.

7. Construction and maintenance of the school.

8. Spaces and places in the school.

9. School safety and security.

- ***Please complete as many questions as possible****. If you do not know an answer precisely, your best estimate will be adequate for the purposes of the study.*

- *The questionnaire should take approximately* ***two hours*** *to complete.*

The completed questionnaire will be used in a study about the quality of the school learning environment.

- *Please send the completed questionnaire to email* address *(where applicable).*

1. School location

1.1 Which of the following best describes the community in which your school is located?

(Please tick only one box.)

☐ A village or rural area

☐ A small town

☐ A town

☐ A city

1.2. Please describe in the box below, urban setting of the school, for example socio-economic background of surrounding community, nature and condition of housing, availability and proximity of basic amenities to the school (*e.g.* water and electricity, healthcare centre, police station, fire brigade, recreational area) and incidences of violence and graffiti at or near the school.

2. School demographics

2.1. As at September, 2009, what was the total school enrolment (number of students)?

(Please write a number in each row. Write 0 (zero) if there are none.)

a) Number of boys:

b) Number of girls:

2.2. Which grade levels and corresponding age ranges are found in your school?

(Please tick one box in each row, and write the age range in numerals.)

a) Grade 1: Yes ☐ No ☐ Age range: years.

b) Grade 2: Yes ☐ No ☐ Age range: years.

c) Grade 3: Yes ☐ No ☐ Age range: years.

d) Grade 4: Yes ☐ No ☐ Age range: years.

e) Grade 5: Yes ☐ No ☐ Age range: years.

f) Grade 6: Yes ☐ No ☐ Age range: years.

g) Other : Yes ☐ No ☐ Age range: years.

2.4. Is the legal student capacity of the school? If Yes what is that limit?

2.5. Will there be a significant <u>increase</u> or <u>decrease</u> in the projected school-age population in the area in which the school is located over the next five years?

2.6. How many teaching staff is there at your school?

A full-time teacher is employed at least 90% of the time as a teacher for the full school year. All other teaching staff should be considered part-time. Please include teacher's aides.

(Please write a number in each space provided. Write 0 (zero) if there is none.)

Full-time teaching staff:

Part-time teaching staff:

2.7. How many non-teaching staff is there at your school?

(Please write a number in each space provided. Write 0 (zero) if there is none.)

Full-time non-teaching staff:

Part-time non-teaching staff:

2.8. How many students with special needs are enrolled at the school?

3. Ownership, financing and management of the school estate

3.1. Is your school a public or a private school?

(Please tick only one box.)

☐ A public school

*(This is a school **managed** directly or indirectly by a public education authority, government agency, or governing board appointed by government or elected by public franchise.)*

☐ A private school

*(This is a school **managed** directly or indirectly by a non-government organization; e.g. a church, trade union, business, or other private institution.)*

3.2. About what percentage of your total funding for a typical school year comes from the following sources?

(Please write a number (%) in each row. Write 0 (zero) if no funding comes from that source.)

a) %: Government (includes departments, local, regional, state and national)

b) %: Student fees or school charges paid by parents

c) %: Benefactors, donations, bequests, sponsorships, parent fund raising

d) %: Other

Total 100%

3.3. Which body is primarily responsible for allocating resources related to operational issues, such as maintenance of school buildings, minor repairs and rental of school spaces?

(Please tick only one box.)

☐ Central Government

☐ Regional authorities

☐ Local authorities or government

☐ School, school board or committee

☐ Not applicable

3.4. Which body is primarily responsible for the <u>management of these resources</u> related to operational issues, such as maintenance of school buildings, minor repairs and rental of school spaces?

☐ Central government

☐ Regional authorities

☐ Local authorities or government

☐ School, school board or committee

☐ Not applicable

3.5. Approximately what percentage of the school budget is spent on maintenance of school buildings, minor repairs and rental of school spaces? %

Maintenance costs comprise the total spending on maintenance, including any spending on either ongoing or deferred maintenance. It *excludes* maintenance on furniture and equipment.

3.6. Who at the school is responsible for managing the school building?

3.7. Were public-private partnerships used in the construction, maintenance or everyday operation of the school?
Yes ☐ No ☐

If "Yes", please describe *in three or four sentences below* the objective and nature of the partnership.

3.8. In what year was the school last evaluated?

Please describe in three or four sentences below the outcomes of this evaluation and any facilities-related recommendations.

<u>4. Community use of school</u>

4.1. How frequently is the school used by the community?

(Please tick only one box.)

☐ Every day

☐ At least once per week

☐ At least once month

☐ Less than once per month

☐ Never

4.2. For what purpose is the school used by the community?

(Please tick only one box.)

☐ Adult education courses

☐ Vocational training courses

☐ Recreational activities

☐ Community meetings

☐ Other: *Please describe*.

4.3. Is the community involved in assisting with school maintenance or providing the school with additional materials or equipment? Yes ☐ No ☐

If "Yes", please describe *in two sentences below* the nature and extent of this community support.

5. Activities at the school

5.1. Please indicate the full name of the programs offered at your school and there duration per year.

• Name of Program 1:

• Name of Program 2:

• Name of Program 3:

• Name of Program 4:

6. School site

6.1. Is the school site located:

In a floodable zone? Yes ☐ No ☐

Near a pollutant source that may impact on the school site (*e.g.* chemicals factory, or major motor vehicle roadway)? Yes ☐ No ☐

Near any other high-risk area? Yes ☐ No ☐

6.2. What is the total site acreage?

"total site area": Example size of school property- building and grounds

6.3. What is the gross floor area?

"gross floor area": Example sum of all floors

7. Construction and maintenance of the site

7.1. In what year was the main school building originally constructed?

7.2. In what year(s) were major building renovations undertaken; and what was the nature of this work?

(In the table below, please indicate the year and type of buildings or additions.)

Year	Type of new buildings or additions

7.3. What major repairs and maintenance have been undertaken at the school in the last five years?

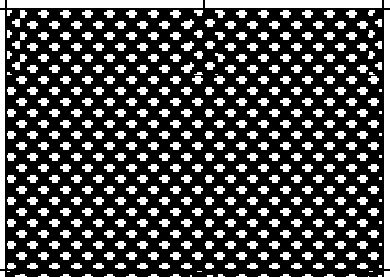
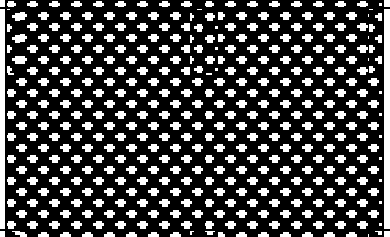
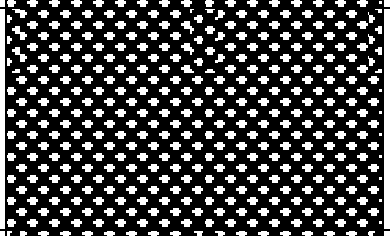
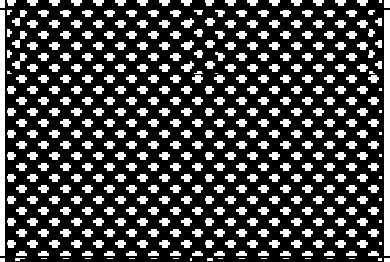
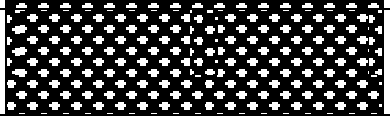
(In the table below, please indicate the year and major repairs and maintenance completed in the last 5 years.)

Year	Type of major repairs and maintenance

8. Spaces and places in the school

8.1. Please complete the following table on the number, size, equipment, layout and use of space in each subject area at the school:

Type of space	Number of spaces	Approximate number of students using space per week	Subject(s) taught in space	Equipment available	Layout of space(s)	Approximate area (m2)
Teaching spaces: classrooms						
Teaching spaces: science/computer laboratory						
Teaching spaces: special education room						
Teaching spaces: library and resource centre						
Teaching spaces:						

Other (please specify)						
Teaching spaces: Other (please specify)						
Teaching spaces: Other (please specify)						
Athletic spaces, indoor and outdoor						
Management spaces, including areas for administration and teaching staff.						
School support facilities, including kitchen, and infirmary						
Social spaces, including playgrounds, student room and auditorium.						
Circulation spaces, including corridors and lobby.						
Other (please specify)						

8.2. Are there any <u>architectural drawings of the school and grounds</u> on site?

<u>9. Environmental sustainability</u>

9.1. How much water is consumed in the school year? litres

9.2. How much electricity is consumed in the school year? kWh

9.3. Does your school produce its own energy (*i.e. through photovoltaic panels, solar panels, and wind turbines*)? Yes ☐ No ☐

If "Yes", please describe *in one or two sentences below* the nature of these practices, how much is produced and how energy production is monitored.

9.4. Which water saving practices are used at your school (*e.g. rainwater collection, low flow toilets, taps with timers, etc.*)? Yes ☐ No ☐

If "Yes", please describe *in one or two sentences below the nature of these practices*.

9.5. Is recycling practiced at your school (*i.e.* separation of paper, glass, plastic, etc.)? Yes ☐ No ☐

If "Yes", please describe *in one or two sentences below* the nature of these practices.

9.6. Are there any other waste reduction practices at the school? Yes ☐ No ☐

If "Yes", please describe *in one or two sentences below the nature of these practices*.

9.7. Are there examples of sustainable design and construction at the school (*e.g. use of passive thermal design, renewable construction materials, natural ventilation)***?** Yes ☐ No ☐

If "Yes", please provide *in one or two sentences examples.*

9.8. How are the principles of environmental sustainability integrated into the curriculum?

9.9. How is the school (grounds, building) used for demonstration or instruction?

10. School safety and security

10.1. Is there vandalism or property damage at the school?

Yes ☐ No ☐

If "Yes", please describe *a few examples of such incidences below to illustrate the nature and scale of the problem*.

10.2. Is there a high incidence of theft at the school?

Yes ☐ No ☐

If "Yes", please describe *a few examples of such incidences below to illustrate the nature and scale of the problem*.

10.3. Is there a plan showing emergency exits in each classroom?

Yes ☐ No ☐

10.4. Are fire extinguishers located near each classroom?

Yes ☐ No ☐

10.5. Is there a functioning fire alarm in the school?

Yes ☐ No ☐

THANK YOU FOR COMPLETING THE QUESTIONNAIRE. Please save/print and submit questionnaire.

PRINICIPAL OR TEACHING STAFF REPRESENTATIVE QUESTIONNAIRE

Basic information :

Please provide the following information about your school.
Research Number of School: # (To be provided by researcher)
Proposed Respondent: Principal or Principal Appointed Teaching Representative
Date of completion:

Instructions:

This questionnaire requests information about the following aspects of the spaces and places in which you work, and the school spaces in general:

1. Teaching and teaching staff' spaces
2. Comfort.
3. School's appearance.
4. Safety and security.
5. Maintenance.

- *The Principal or Teaching staff representative is requested to complete **ALL** questions.*
- *Where applicable please indicate in the scale from 1 through to 5, the degree to which you agree or disagree with the each statement.*
- *Answer scale: Strongly disagree – 1*
  Disagree – 2
  Mostly Agree – 3
  Agree – 4
  Strongly Agree – 5

- *If a question is not applicable, please tick "Not applicable".*
- *Please **tick** one box for each question.*
- *The questionnaire should take about **1hour** to complete.*
- ***The completed questionnaire will be used in a study about the quality of the school learning environment.***
- *Please send the completed questionnaire to email address (where applicable).*

1. Teaching and teaching staff' spaces

1.1. Teaching spaces

1.1.1. Please list the space(s) that are currently use for teaching *(e.g. regular classrooms, computer laboratory, science laboratory, library, and gymnasium or sports spaces)*.

1.1.2. How much do you agree or disagree with the following statements about <u>the teaching space(s) that are currently used</u>?

a) The spaces in general are large enough to accommodate the number of students being taught.

1– Strongly Disagree ☐
2 – Disagree ☐
3 – Mostly Agree ☐
4 – Agree ☐
5 – Strongly Agree ☐
Not Applicable ☐

Comments/explanations:

b) Furniture can be easily moved and arranged to accommodate different learning activities
(*e.g.* activities in large or small groups; seating arrangements in circles, rows or groups).

1– Strongly Disagree ☐
2 – Disagree ☐
3 – Mostly Agree ☐
4 – Agree ☐
5 – Strongly Agree ☐
Not Applicable ☐

Comments/explanations:

c) There are different areas for students to pursue different learning activities
(*e.g.* quiet space for individual study or reading; space for computer work; space for group work).

1– Strongly Disagree ☐
2 – Disagree ☐

3 – Mostly Agree ☐
4 – Agree ☐
5 – Strongly Agree ☐
Not Applicable ☐

Comments/explanations:

d) The physical layout of the classroom allows for new methods and teaching practices.

1– Strongly Disagree ☐
2 – Disagree ☐
3 – Mostly Agree ☐
4 – Agree ☐
5 – Strongly Agree ☐
Not Applicable ☐

Comments/explanations:

e) There are areas where students' work can be displayed (*e.g.* wall boards).

1– Strongly Disagree ☐
2 – Disagree ☐
3 – Mostly Agree ☐
4 – Agree ☐
5 – Strongly Agree ☐
Not Applicable ☐

Comments/explanations:

f) There is enough storage space for teaching materials and students' work.

1– Strongly Disagree ☐
2 – Disagree ☐
3 – Mostly Agree ☐
4 – Agree ☐
5 – Strongly Agree ☐
Not Applicable ☐

Comments/explanations:

g) There is enough space for me to work at my desk or move around when teaching.

1– Strongly Disagree ☐
2 – Disagree ☐
3 – Mostly Agree ☐
4 – Agree ☐
5 – Strongly Agree ☐
Not Applicable ☐

Comments/explanations:

h) Students have adequate access to functioning computers (with Internet).

1– Strongly Disagree ☐
2 – Disagree ☐
3 – Mostly Agree ☐
4 – Agree ☐
5 – Strongly Agree ☐
Not Applicable ☐

Comments/explanations:

i) I can use electronic equipment - such as video projector, DVDs and projection screens.

1– Strongly Disagree ☐
2 – Disagree ☐
3 – Mostly Agree ☐
4 – Agree ☐
5 – Strongly Agree ☐
Not Applicable ☐

Comments/explanations:

j) The school is accessible for students with special needs.

1– Strongly Disagree ☐
2 – Disagree ☐
3 – Mostly Agree ☐
4 – Agree ☐
5 – Strongly Agree ☐
Not Applicable ☐

Comments/explanations:

k) Classrooms are accessible for students with special needs.

1– Strongly Disagree ☐
2 – Disagree ☐
3 – Mostly Agree ☐
4 – Agree ☐
5 – Strongly Agree ☐
Not Applicable ☐

Comments/explanations:

l) Classrooms are equipped for students with special needs.

1– Strongly Disagree ☐
2 – Disagree ☐
3 – Mostly Agree ☐
4 – Agree ☐
5 – Strongly Agree ☐
Not Applicable ☐

Comments/explanations:

1.2. Spaces for teaching staff

1.2.1. Please list the spaces that <u>are currently used</u> in the school for completing work outside teaching time, such as for lesson preparation, marking, administrative work, staff meetings, etc.

1.2.2. How much do you agree or disagree with the following statements about the spaces available for teaching staff in the school?

a) There is enough space in the school to carry out work outside teaching time.

1– Strongly Disagree ☐
2 – Disagree ☐

3 – Mostly Agree ☐
4 – Agree ☐
5 – Strongly Agree ☐
Not Applicable ☐

Comments/explanations:

b) There is enough space to hold meetings between staff or with parents.

1– Strongly Disagree ☐
2 – Disagree ☐
3 – Mostly Agree ☐
4 – Agree ☐
5 – Strongly Agree ☐
Not Applicable ☐

Comments/explanations:

c) There are functioning computers to help me complete work outside teaching time.

1– Strongly Disagree ☐
2 – Disagree ☐
3 – Mostly Agree ☐
4 – Agree ☐
5 – Strongly Agree ☐
Not Applicable ☐

Comments/explanations:

d) The staff room is a comfortable area for teaching staff.

1– Strongly Disagree ☐
2 – Disagree ☐
3 – Mostly Agree ☐
4 – Agree ☐
5 – Strongly Agree ☐
Not Applicable ☐

Comments/explanations:

2. Comfort

2.1. How much do you agree or disagree with the following statements about the <u>temperature</u> and <u>air quality</u> in the <u>teaching space(s) that are currently used</u>?

a) The classrooms have good air circulation (*i.e.* I can breathe easily, it is not stuffy or too breezy).

1– Strongly Disagree ☐
2 – Disagree ☐
3 – Mostly Agree ☐
4 – Agree ☐
5 – Strongly Agree ☐
Not Applicable ☐

Comments/explanations:

b) The temperature in the classroom is comfortable:

1– Strongly Disagree ☐
2 – Disagree ☐
3 – Mostly Agree ☐
4 – Agree ☐
5 – Strongly Agree ☐
Not Applicable ☐
Comments/explanations:
c) I can control ventilation and temperature in the classroom (*i.e*. you can open and close windows; switch on fans or air conditioners).

1– Strongly Disagree ☐
2 – Disagree ☐
3 – Mostly Agree ☐
4 – Agree ☐
5 – Strongly Agree ☐
Not Applicable ☐

Comments/explanations:

2.2. How much do you agree or disagree with the following statements about <u>noise</u> in the <u>teaching space(s) that are currently used</u>?

a) Sound echoes too much in the classroom.

1– Strongly Disagree ☐
2 – Disagree ☐
3 – Mostly Agree ☐

4 – Agree ☐
5 – Strongly Agree ☐
Not Applicable ☐

Comments/explanations:

b) (When students are quiet) I have to raise my voice to ensure that students hear me at the back of the classroom.

1– Strongly Disagree ☐
2 – Disagree ☐
3 – Mostly Agree ☐
4 – Agree ☐
5 – Strongly Agree ☐
Not Applicable ☐

Comments/explanations:

c) Noise from outside the classroom does not disrupt student learning.

1– Strongly Disagree ☐
2 – Disagree ☐
3 – Mostly Agree ☐
4 – Agree ☐
5 – Strongly Agree ☐
Not Applicable ☐

Comments/explanations:

2.3. How much do you agree or disagree with the following statements about <u>light</u> in the <u>teaching space(s) that are currently used</u>?

a) The classroom has good lighting (*i.e.* it is not too dark or too bright; there is no glare), so that I can teach and see students and their work without difficulty.

1– Strongly Disagree ☐
2 – Disagree ☐
3 – Mostly Agree ☐
4 – Agree ☐
5 – Strongly Agree ☐
Not Applicable ☐

Comments/explanations:

b) I can control lighting in the classroom (*i.e.* you can turn the lights on and off, open and close windows to control natural light).

1– Strongly Disagree ☐
2 – Disagree ☐
3 – Mostly Agree ☐
4 – Agree ☐
5 – Strongly Agree ☐
Not Applicable ☐

Comments/explanations:

3. School's appearance

3.1. How much do you agree or disagree with the following statements about the visual appearance of the school?

a) The *outside* of the school building is welcoming and attractive.

1– Strongly Disagree ☐
2 – Disagree ☐
3 – Mostly Agree ☐
4 – Agree ☐
5 – Strongly Agree ☐
Not Applicable ☐

Comments/explanations:

b) The *inside* of the school building is welcoming and attractive.

1– Strongly Disagree ☐
2 – Disagree ☐
3 – Mostly Agree ☐
4 – Agree ☐
5 – Strongly Agree ☐
Not Applicable ☐

Comments/explanations:

c) The school building conveys to the community the importance of learning.

1– Strongly Disagree ☐
2 – Disagree ☐
3 – Mostly Agree ☐
4 – Agree ☐
5 – Strongly Agree ☐
Not Applicable ☐

Comments/explanations:

4. Safety and security

4.1. How much do you agree or disagree with the following statements about the safety and security of your school?

a) I feel safe in the school.

1– Strongly Disagree ☐
2 – Disagree ☐
3 – Mostly Agree ☐
4 – Agree ☐
5 – Strongly Agree ☐
Not Applicable ☐

Comments/explanations:

b) I feel safe in the school grounds.

1– Strongly Disagree ☐
2 – Disagree ☐
3 – Mostly Agree ☐
4 – Agree ☐
5 – Strongly Agree ☐
Not Applicable ☐

Comments/explanations:

c) There are secure lockers in which I can keep my belongings.

1– Strongly Disagree ☐
2 – Disagree ☐
3 – Mostly Agree ☐
4 – Agree ☐
5 – Strongly Agree ☐
Not Applicable ☐

Comments/explanations:

5. Maintenance

5.1. How much do you agree or disagree with the following statements about the maintenance of your school?

a) Classrooms are clean.

1– Strongly Disagree ☐
2 – Disagree ☐
3 – Mostly Agree ☐
4 – Agree ☐
5 – Strongly Agree ☐
Not Applicable ☐

Comments/explanations:

b) The school building and grounds generally are clean.

1– Strongly Disagree ☐
2 – Disagree ☐
3 – Mostly Agree ☐
4 – Agree ☐
5 – Strongly Agree ☐
Not Applicable ☐

Comments/explanations:

c) Classrooms are well maintained (*i.e.* wall paint and floor coverings are in good condition, windows and doors function correctly and the ceiling does not leak).

1– Strongly Disagree ☐
2 – Disagree ☐
3 – Mostly Agree ☐
4 – Agree ☐
5 – Strongly Agree ☐
Not Applicable ☐

Comments/explanations:

d) The school buildings and grounds are well maintained (*i.e.* wall paint and floor coverings are in good condition, windows and doors function correctly and the ceiling does not leak).

1– Strongly Disagree ☐
2 – Disagree ☐
3 – Mostly Agree ☐
4 – Agree ☐
5 – Strongly Agree ☐
Not Applicable ☐

Comments/explanations:

e) The toilet spaces for staff are clean and functional.

1– Strongly Disagree ☐
2 – Disagree ☐
3 – Mostly Agree ☐
4 – Agree ☐
5 – Strongly Agree ☐
Not Applicable ☐

Comments/explanations:

6. Comments

If you have any additional information about your school environment, please write them here. If they refer to one of the questions above, please cite the question number. If your comments relate to a particular room, please indicate the room number or name.

THANK YOU FOR COMPLETING THE QUESTIONNAIRE. Please save/print and submit questionnaire.

APPENDIX B

The Facility Inspection Tool is adapted from *Facility Inspection Tool Guidebook* by California's Coalition for Adequate School Housing, 2008. Retrieved from: http://www.cashnet.org/resource-material/FITGuidebook.pdf

FACILITY INSPECTION TOOL (FIT):

GENERAL INFORMATION

The Facility Inspection Tool (FIT) will be used to determine if a school facility is in "good repair") and to rate the facility on the under 4 categories: exemplary, good, fair and poor. The tool was designed to identify areas of a school site that are in need of repair based upon a visual inspection of the site.

USER INSTRUCTIONS

The FIT is comprised of three parts as follows:

Part I, Good Repair Standard outlines the school facility systems and components that should be considered in the inspection of a school facility to ensure it is maintained in a manner that assures it is clean, safe and functional. Each of the sections in the Good Repair Standard provides a description of a minimum standard of good repair for various school facility categories. Each section also provides examples of clean, safe and functional conditions. The list of examples is not exhaustive. If an evaluator notes a condition that is not mentioned in the examples but constitutes a deficiency, the evaluator can note such deficiency in the applicable category as "other."Some of the conditions cited in the Good Repair Standard represent items that are critical to the health and safety of pupils and staff. Any deficiencies in these items require immediate attention and, if left unmitigated, could cause severe and immediate injury, illness or death of the occupants. They constitute extreme deficiencies and indicate that the particular building system evaluated failed to meet the standard of good repair at that school site.

These critical conditions are identified with underlined text followed by an (X) on the Good Repair Standard. If the underlined statement is not true, then there is an extreme deficiency (to be marked as an "X" on the Evaluation Detail) resulting in a "poor" rating for the applicable category. It is important to note that the list of extreme deficiencies noted in the Good Repair Standard is not exhaustive. Any other deficiency not included in the criteria but meeting the definition above can be noted by the evaluator and generate a poor rating.

Part II, Evaluation Detail is a site inspection template to be used to evaluate the areas of a school on a category by category basis. The design of the inspection template allows for the determination of the scope of conditions across campus. In evaluating each area or space, the user should review each of the categories identified in the Good Repair Standard and make a determination of whether a particular area is in good repair. Once the determination is made, it should be recorded on the Evaluation Detail, as follows:

Part III includes the Category Totals and Ranking, the Overall Rating, and a section for Comments and Rating Explanation. Once the inspector completes the site inspection, he or she must total the number of areas evaluated. The inspector must also count all of the spaces deemed in good repair, deficient, extremely deficient, or not applicable under each of the 15 sections. Next, the evaluator must determine the condition of each category by taking the ratio of the number of areas deemed in good repair to the number of areas being evaluated (after subtracting non-applicable spaces from the total number of areas evaluated). If any of the categories received a rating of extreme deficiency, the ratio (i.e., the percentage of good repair) for that section should default to zero.

Next, the overall school site score is determined by computing the average percentage rating of the all the categories (i.e. the total of all percentages divided by sum of categories). Finally, the rater should determine the overall School Rating by applying the Percentage Range in the table provided.

PART I: GOOD REPAIR STANDARD
(X): If underlined statement is not true, then this is an extreme deficiency (marked as an "X") on the Evaluation
Detail resulting in a "poor" rating for the applicable category.

Ventilation Systems
Ventilation and air conditioning systems (HVAC) as applicable are functional and unobstructed. Examples include but are not limited to the following:

a. <u>The HVAC system is operable where applicable.(X)</u>
b. The facilities are ventilated (via mechanical or natural ventilation).
c. The ventilation units are unobstructed and vents and grills are without evidence of excessive dirt or dust.
d. There appears to be an adequate air supply to all classrooms, work spaces, and facilities (i.e. no strong odor is present, air is not stuffy).
e. Interior temperatures appear to be maintained within normally accepted ranges.
f. The ventilation units are not generating any excessive noise or vibrations.
g. Other

Windows/Doors (Interior and Exterior)
Conditions that pose a safety and/or security risk are not evident. Examples include but are not limited to the following:

✓	No Deficiency - Good Repair: Insert a check mark if all statements in the Good Repair Standard are true, and there is no indication of a deficiency in the specific category.
D	Deficiency: Mark "D" if one or more statement(s) in the Good Repair Standard for the specific category is not true, or if there is other clear evidence of the need for repair.
x	Extreme Deficiency: Indicate "X" if the area has a deficiency that is considered an "Extreme Deficiency" in the Good Repair Standard or there is a condition that qualifies as an extreme deficiency but is not noted in the Good Repair Standard.
NA	Not Applicable: If the Good Repair Standard category (building system or component) does not exist in the area evaluated, mark "NA".

a. <u>There is no exposed broken glass accessible to pupils and staff. (X)</u>
b. <u>Exterior doors and gates are functioning and do not pose a security risk. (X)</u>
c. Windows are intact and free of cracks.
d. Windows are functional and open, close, and lock as designed, unless there is a valid reason they should not function as designed.
e. Doors are intact.
f. Doors are functional and open, close, and lock as designed, unless there is a valid reason they should not function as designed.

Interior Surfaces (Floors, Ceilings, Walls, and Window Casings)
Interior surfaces appear to be clean, safe, and functional. Examples include but are not limited to the following:

a. Walls are free of hazards from tears and holes.
b. Flooring is free of hazards from torn carpeting, missing floor tiles, holes.

c. Ceiling is free of hazards from missing ceiling tiles and holes.
d. There is no evidence of water damage (e.g. no condensation, dampness, staining, warping, peeling, mineral deposits, etc.)
e. Paint is not peeling, chipping, or cracking.
f. Other

Furniture and Equipment (Source: OECD/CELE 2009)
Examples include but are not limited to the following:

a. Furniture is ergonomically appropriate and suitable for the users' activities.
b. Furniture is in good repair and maintenance program is in place.
c. Other

Storage (Interior and Exterior)
Examples include but are not limited to the following:

a. Adequate storage is provides for staff and students.
b. Secured storage is provided for technical equipment.
c. Hazardous chemicals, chemical waste, and flammable materials are stored properly (e.g. locked and labeled properly). (X)
d. There are no holes in the walls, floors, or ceilings of storage rooms.
e. Other

Lighting System (Interior and Exterior)
Lighting appears to be adequate and working properly, including exterior lights. Examples include but are not limited to the following:

a. Lighting appears to be adequate.
b. Lighting is not flickering.
c. There is no unusual hum or noise from the light fixtures.
d. The facility demonstrates effective and efficient use of daylighting. **(Source: OECD/CELE 2009)**
e. Other

Acoustics (Source: OECD/CELE 2009)
User comfort examples include but are not limited to the following:

a. Level of internal and external noise does not appear to hinder the learning process.
b. There appears to be systems in place for noise control.
c. Other

Potable Water (Inside and Outside)
Drinking fountains and other fixtures appear to be accessible and functioning as intended. Examples include but are not limited to the following:

a. Drinking fountains are accessible.
b. Water pressure is adequate.
c. A leak is not evident.
d. There is no moss, mold, or excessive staining on the fixtures.
e. The water is clear and without unusual taste or odor.
f. Other

Restrooms
Restrooms in the vicinity of the area being evaluated appear to be accessible during school hours, clean and functional. The examples include but are not limited to the following:

a. Restrooms are maintained and cleaned regularly.
b. Restrooms are fully operational.
c. Restrooms are stocked with toilet paper, soap, and paper towels.
d. Restrooms are open during school hours.
e. Other

Sewer
Sewer line stoppage is not evident. Examples include but are not limited to the following:

a. There are no obvious signs of flooding caused by sewer line back-up in the facilities or on the school grounds. (X)
b. The sanitary system controls odors as designed.
c. Other

Fire Safety
The fire equipment and emergency systems appear to be functioning properly. Examples include but are not limited to the following:

a. The fire sprinklers appear to be in working order (e.g., there are no missing or damaged sprinkler heads). (X)
b. Emergency alarms appear to be functional. (X)
c. Emergency exit signs function as designed, exits are unobstructed. (X)
d. Fire extinguishers are current and placed in all required areas.
e. Fire alarms pull stations are clearly visible.
f. Other

Gates and Fences
Conditions that pose a safety and/or security risk are not evident. Examples include but are not limited to the following:

a. Gates and fences appear to be functional.
b. Gates and fences are intact and free of holes and other conditions that could present a safety hazard to pupils, staff, or others.
c. Other

Structural Damage
There does not appear to be structural damage that has created or could create hazardous or uninhabitable conditions.

a. Examples include but are not limited to the following:
b. Severe cracks are not evident. (X)
c. Ceilings & floors are not sloping or sagging beyond their intended design. (X)
d. Posts, beams, supports for portable classrooms, ramps, and other structural building members appear to be intact, secure and functional as designed.(X)
e. There is no visible evidence of severe cracks, dry rot, mold, or damage that undermines the structural components. (X)
f. *Roof systems appear to be functioning properly. Examples include but are not limited to the following:* Roofs, gutters, roof drains, and down spouts are free of visible damage.
g. Roofs, gutters, roof drains, and down spouts are intact.
h. Other:

Play areas
The playground equipment in the vicinity of the area being evaluated appears to be clean, safe, and functional. Examples include but are not limited to the following:

a. Significant cracks, trip hazards, holes and deterioration are not found.
b. Open "S" hooks, protruding bolt ends, and sharp points/edges are not found in the playground equipment.
c. Seating, tables, and equipment are functional and free of significant cracks.

School Grounds
School grounds in the vicinity of the area being evaluated appear to be clean, safe, and functional. Examples include but are not limited to the following:

a. There are no signs of drainage problems, such as flooded areas, eroded soil, water damage to asphalt, or clogged storm drain inlets.
b. Other

Accessibility (Source: OECD/CELE 2009)
Accessibility to all: The facility makes provision for user with special needs. Examples include but are not limited to the following:

a. The facility makes provision for students and staff with special needs, including persons with disabilities. (X)
b. The facility is accessible for pedestrians, bicycles, goods vehicles, private care, public transport and safety services.
c. Wayfinding: The facility's structure is easy to understand for its occupants and offers sufficient points of recognition.

Overall Cleanliness

School grounds, buildings, common areas, and individual rooms appear to have been cleaned regularly. Examples include but are not limited to the following:

a. Area(s) evaluated is free of accumulated refuse, dirt, and grime.
b. Area(s) evaluated is free of unabated graffiti.
c. Restrooms, drinking fountains, and food preparation or serving areas appear to have been cleaned each day that school is in session.
d. Surfaces (including floors, ceilings, walls, window casings, HVAC grills) appear to be free of mildew, mold odor and visible mold.
e. *Pest or vermin infestation are not evident. Examples include but are not limited to the following:* There is no evidence of a major pest or vermin infestation. (X)
f. Rodent droppings or insect skins are not evident.
g. Odor caused by a pest or vermin infestation is not evident.
h. There are no live rodents observed.
i. Other

Sample Facility Assessment Sheet# 1 **School Research ID:**

AREA/LOCATION.	VENT./AC	**WINDOWS/DOORS**	INTERIOR SURFACES	FURN./EQUIP.	STORAGE	LIGHT. SYSTEM	ACOUSTICS	POTABLE WATER	REST-ROOMS	SEWER	FIRE SAFETY	GATES& FENCES	STRUCTURAL DAMAGES	PLAY AREAS	GROUNDS	ACCESSI-BILITY	CLEANLINESS
E.g. Class #1	✓	✓	D	D	✓	✓	D	NA	NA	NA	D	NA	✓	NA	NA	D	✓
OTHER/COMMENTS:				Desk tops damaged													
Class #2																	
OTHER/COMMENTS:																	
OTHER/COMMENTS:																	
OTHER/COMMENTS:																	
OTHER/COMMENTS:																	
OTHER/COMMENTS:																	

FIT Ratings/Scores Calculations

CATEGORY TOTALS AND RANKING (Calculations)

TOTAL No. OF AREAS	CATEGORY TOTALS	VENT./ AC	WINDOWS/ DOORS	INTERIOR SURFACES	FURN./ EQUIP.	STORAGE	LIGHT. SYSTEM	ACOUSTICS	POTABLE WATER	REST-ROOMS	SEWER	FIRE SAFETY	GATES& FENCES	STRUCTURAL DAMAGES	PLAY AREAS	GROUNDS	ACCESSI-BILITY	CLEAN.
EVALUATED ↓	NO. OF "✓"s																	
	NO. OF "D"s																	
	NO. OF "X"s																	
	NO. OF "NA"s																	
Percentage of System in good repair equals NO. OF "✓"s divided by (Total Areas minus "NA"s																		
Rank (Circle one)																		
Good : 85% to 100%		GOOD	GOOD	GOOD	GOOD	GOOD	GOOD	GOOD	GOOD	GOOD	GOOD	GOOD	GOOD	GOOD	GOOD	GOOD	GOOD	GOOD
Fair : 67% to 84.99%		FAIR	FAIR	FAIR	FAIR	FAIR	FAIR	FAIR	FAIR	FAIR	FAIR	FAIR	FAIR	FAIR	FAIR	FAIR	FAIR	FAIR
Poor : 0% to 66.99%		POOR	POOR	POOR	POOR	POOR	POOR	POOR	POOR	POOR	POOR	POOR	POOR	POOR	POOR	POOR	POOR	POOR

NOTES:

Overall Rating :
Average Percentage of Categories Above equals:
School Rating: (Circle One)
EXEMPLORY GOOD FAIR POOR

Overall Rating:	Average Percentage Range	Description
EXEMPLORY	98% to 100%	School facility in good repair, deficiencies noted but not considered significant.
GOOD	85% to 97.99%	School facility in good repair, deficiencies noted but may be as a result of normal wear and tear and/or being mitigated
FAIR	67% to 84.99%	School facility not in good repair, some deficiencies may be critical and repair or additional maintenance required in several areas.
POOR	0% to 66.99%	School facility in poor condition, deficiencies appear in most areas. Major repair and maintenance required throughout property.

COMMENTS/EXPLANATIONS:

APPENDIX C

Principal Questionnaire Results

#	How much do you agree or disagree with the Statements:* VARABLE NAME	Strongly Disagree %	Disagree %	Mostly Agree %	Agree %	Strongly Agree %	*Not Appl. %	Total %
1	The spaces in general are large enough to accommodate the number of students being taught: **TSPACE**	29.4	5.9	5.9	29.4	29.4	0	100
2	Furniture can be easily moved and arranged to accommodate different learning activities: **TFURN**	11.8	29.4	17.6	17.6	23.5	0	100
3	There are different areas for students to pursue different learning activities: **TSPACEV**	23.5	29.4	17.6	23.5	5.9	0	100
4	The physical layout of the classroom allows for new methods and teaching practices: **CLAYOUT**	5.9	23.5	23.5	29.4	11.8	5.9	100
5	There are areas where students' work can be displayed: **TSDISPLA**	0	0	23.5	47.1	23.5	5.9	100
6	There is enough storage space for teaching materials and students' work: **TLSTOR**	11.8	17.6	23.5	29.4	11.8	5.9	100
7	There is enough space for me to work at my desk or move around when teaching: **TEACHSPA**	0	17.6	17.6	41.2	17.6	5.9	100

8	Students have adequate access to functioning computers (with Internet):**ACOMPU**	35.3	35.3	11.8	11.8	5.9	0	100
9	I can use electronic equipment - such as video projector, DVDs and projection screens: **EQUIPRED**	5.9	11.8	23.5	29.4	17.6	11.8	100
10	The school is accessible for students with special needs: **SCSPEC**	52.9	17.6	5.9	17.6	5.9	0	100
11	Classrooms are accessible for students with special needs: **CLSPEC**	41.2	29.4	11.8	5.9	5.9	5.9	100
12	Classrooms are equipped for students with special needs: **CLSEQUIP**	58.8	35.3	5.9	0	0	0	100
13	There is enough space in the school to carry out work outside teaching time: **ADMSPACE**	17.6	17.6	17.6	41.2	5.9	0	100
14	There is enough space to hold meetings between staff or with parents: **MSPACE**	17.6	11.8	29.4	35.3	5.9	0	100
15	There are functioning computers to help me complete work outside teaching time: **TCOMP**	5.9	11.8	23.5	35.3	23.5	0	100
16	The staff room is a comfortable area for teaching staff: **SROOM**	29.4	17.6	23.5	17.6	5.9	5.9	100
17	The classrooms have good air circulation: **CAIRCIRL**	5.9	0	23.5	52.9	17.6	0	100

18	The temperature in the classroom is comfortable: **CLTHERM**	0	17.6	29.4	41.2	11.8	0	100
19	I can control ventilation and temperature in the classroom: **CLVENTCR**	17.6	41.2	11.8	23.5	5.9	0	100
20	Sound echoes too much in the classroom: **CLNECHO**	23.5	29.4	11.8	17.6	11.8	5.9	100
21	(When students are quiet) I have to raise my voice to ensure that students hear me at the back of the classroom: **CLVOICE**	52.9	29.4	0	17.6	0	0	100
22	Noise from outside the classroom does not disrupt student learning: **CLNOUT**	17.6	23.5	5.9	41.2	5.9	5.9	100
23	The classroom has good lighting, so that I can teach and see students and their work without difficulty: **CLIGHT**	0	0	29.4	23.5	41.2	5.9	100
24	I can control lighting in the classroom: **CLIGCTR**	0	5.9	17.6	35.3	35.3	5.9	100
25	The *outside* of the school building is welcoming and attractive: **SCHEXT**	0	17.6	11.8	23.5	47.1	0	100
26	The *inside* of the school building is welcoming and attractive: **SCHINT**	0	5.9	41.2	29.4	23.5	0	100
27	The school building conveys to the community the importance of learning: **SCHSYM**	0	5.9	11.8	47.1	23.5	11.8	100
28	I feel safe in the school: **SCHSAFE**	11.8	23.5	11.8	29.4	17.6	5.9	100

29	I feel safe in the school grounds: **SCHGRDS**	17.6	23.5	17.6	17.6	17.6	5.9	100
30	There are secure lockers in which I can keep my belongings: **TEACSTOR**	11.8	17.6	11.8	41.2	0	17.6	100
31	Classrooms are clean: **CLCLEAN**	0	0	29.4	52.9	17.6	0	100
32	The school building and grounds generally are clean: **CLEANBG**	0	5.9	17.6	41.2	35.3	0	100
33	Classrooms are well maintained: **CLMNT**	5.9	17.6	29.4	17.6	23.5	5.9	100
34	The school buildings and grounds are well maintained: **SCHMNT**	5.9	23.5	35.3	17.6	17.6	0	100
35	The toilet spaces for staff are clean and functional: T**EACHRM**	0	11.8	35.3	41.2	11.8	0	100

APPENDIX D

	TSPACE	TSFURN	TSPACEV	CLAYOUT	TSDISPLA	TLSTOR	TEACHSPA	ACOMPU	EQUIPRED	SCSPEC	CLSPEC	CL
TSPACE	1.000	0.901	0.806	0.925	0.520	0.275	0.841	0.113	0.481	0.568	0.300	
TSFURN	0.901	1.000	0.783	0.970	0.577	0.189	0.606	0.102	0.559	0.298	0.000	
TSPACEV	0.806	0.783	1.000	0.841	0.420	0.740	0.678	0.411	0.475	0.050	-0.050	
CLAYOUT	0.925	0.970	0.841	1.000	0.665	0.321	0.647	0.025	0.461	0.362	0.145	
TSDISPLA	0.520	0.577	0.420	0.665	1.000	0.191	0.070	-0.147	0.420	0.409	0.495	
TLSTOR	0.275	0.189	0.740	0.321	0.191	1.000	0.321	0.540	0.148	-0.296	-0.099	
TEACHSPA	0.841	0.606	0.678	0.647	0.070	0.321	1.000	0.149	0.108	0.524	0.235	
ACOMPU	0.113	0.102	0.411	0.025	-0.147	0.540	0.149	1.000	0.571	-0.411	-0.441	
EQUIPRED	0.481	0.559	0.475	0.461	0.420	0.148	0.108	0.571	1.000	0.050	-0.050	
SCSPEC	0.568	0.298	0.050	0.362	0.409	-0.296	0.524	-0.411	0.050	1.000	0.867	
CLSPEC	0.300	0.000	-0.050	0.145	0.495	-0.099	0.235	-0.441	-0.050	0.867	1.000	
CLSEQUIP	0.100	0.000	0.194	0.175	0.708	0.382	-0.175	-0.147	0.194	0.258	0.645	
ADMSPACE	0.685	0.808	0.763	0.741	0.130	0.356	0.632	0.403	0.341	-0.107	-0.455	
MSPACE	0.772	0.629	0.622	0.741	0.311	0.238	0.784	-0.367	-0.080	0.549	0.388	

Inter – Item Correlations Results

TCOMP	0.068	-0.098	0.285	0.119	0.283	0.649	0.214	-0.100	-0.482	0.073	0.336	0.481	-0.035
SROOM	0.600	0.385	0.258	0.397	0.167	0.000	0.747	0.079	-0.043	0.645	0.359	-0.222	0.415
CAIRCIRL	-0.147	-0.481	-0.043	-0.420	-0.611	0.255	0.257	0.216	-0.194	0.043	0.158	-0.028	-0.311
CLTHERM	0.320	0.144	0.710	0.315	0.167	0.955	0.420	0.354	0.032	-0.108	0.108	0.458	0.233
CLVENTCR	0.240	-0.096	0.043	-0.070	-0.167	0.127	0.560	0.334	-0.108	0.459	0.344	-0.167	0.069
CLNECHO	0.748	0.459	0.513	0.529	0.331	0.303	0.835	0.211	0.154	0.684	0.513	0.099	0.391
CLVOICE	0.821	0.696	0.525	0.697	0.427	0.115	0.781	0.160	0.253	0.610	0.298	-0.101	0.625
CLNOUT	0.477	0.344	0.385	0.445	0.828	0.303	0.139	0.117	0.564	0.513	0.684	0.828	-0.103
CLIGHT	0.380	0.000	0.194	0.175	0.125	0.191	0.560	-0.354	-0.258	0.710	0.796	0.417	-0.233
CLIGCTR	0.092	-0.283	0.148	-0.160	0.000	0.500	0.321	0.405	0.000	0.296	0.493	0.382	-0.238
SCHEXT	0.297	-0.086	0.307	0.083	-0.149	0.454	0.645	-0.070	-0.364	0.409	0.486	0.198	-0.046
SCHINT	0.600	0.577	0.710	0.560	0.167	0.382	0.420	0.354	0.710	0.043	-0.043	0.167	0.415
SCHSYM	-0.212	-0.416	-0.279	-0.370	-0.320	-0.183	-0.101	-0.283	-0.062	0.207	0.372	0.240	-0.623
SCHSAFE	0.012	0.090	-0.201	0.174	0.233	-0.356	-0.022	-0.917	-0.622	0.295	0.268	0.052	-0.097
SCHGRDS	0.163	0.196	-0.175	0.285	0.679	-0.389	-0.119	-0.801	-0.175	0.585	0.643	0.481	-0.282
TEACSTOR	0.075	0.180	0.622	0.283	0.130	0.832	0.022	0.275	0.060	-0.576	-0.361	0.311	0.323
CLCLEAN	0.085	0.000	0.548	0.149	-0.059	0.810	0.198	0.167	-0.091	-0.335	-0.091	0.354	0.110
CLEANBG	-0.264	-0.112	0.225	-0.081	-0.420	0.444	-0.108	0.068	-0.300	-0.750	-0.650	-0.194	0.221
CLMNT	0.240	0.144	0.194	0.175	-0.167	0.191	0.560	0.059	-0.484	0.108	-0.108	-0.458	0.493
SCHMNT	0.380	0.433	0.194	0.420	0.417	0.000	0.315	0.059	-0.032	0.258	0.043	-0.167	0.493
TEACHRM	-0.175	-0.316	-0.141	-0.307	-0.091	0.209	0.038	0.484	-0.141	-0.024	0.024	-0.091	-0.028

	MSPA	TCO	SROO	CAIRCI	CLTHER	CLVENT	CLNEC	CLVOI	CLNO	CLIG	CLIGC	SCHE

	CE	MP	M	RL	M	CR	HO	CE	UT	HT	TR	XT
TSPACE	0.772	0.068	0.600	-0.147	0.320	0.240	0.748	0.821	0.477	0.380	0.092	0.297
TSFURN	0.629	-0.098	0.385	-0.481	0.144	-0.096	0.459	0.696	0.344	0.000	-0.283	-0.086
TSPACEV	0.622	0.285	0.258	-0.043	0.710	0.043	0.513	0.525	0.385	0.194	0.148	0.307
CLAYOUT	0.741	0.119	0.397	-0.420	0.315	-0.070	0.529	0.697	0.445	0.175	-0.160	0.083
TSDISPLA	0.311	0.283	0.167	-0.611	0.167	-0.167	0.331	0.427	0.828	0.125	0.000	-0.149
TLSTOR	0.238	0.649	0.000	0.255	0.955	0.127	0.303	0.115	0.303	0.191	0.500	0.454
TEACHSPA	0.784	0.214	0.747	0.257	0.420	0.560	0.835	0.781	0.139	0.560	0.321	0.645
ACOMPU	-0.367	-0.100	0.079	0.216	0.354	0.334	0.211	0.160	0.117	-0.354	0.405	-0.070
EQUIPRED	-0.080	-0.482	-0.043	-0.194	0.032	-0.108	0.154	0.253	0.564	-0.258	0.000	-0.364
SCSPEC	0.549	0.073	0.645	0.043	-0.108	0.459	0.684	0.610	0.513	0.710	0.296	0.409
CLSPEC	0.388	0.336	0.359	0.158	0.108	0.344	0.513	0.298	0.684	0.796	0.493	0.486
CLSEQUIP	0.130	0.481	-0.222	-0.028	0.458	-0.167	0.099	-0.101	0.828	0.417	0.382	0.198
ADMSPACE	0.435	-0.035	0.415	-0.311	0.233	0.069	0.391	0.625	-0.103	-0.233	-0.238	-0.046
MSPACE	1.000	0.335	0.415	0.052	0.415	0.069	0.536	0.516	0.185	0.674	0.000	0.601
TCOMP	0.335	1.000	0.245	0.113	0.708	0.283	0.382	0.171	0.247	0.481	0.519	0.605
SROOM	0.415	0.245	1.000	-0.037	0.028	0.815	0.905	0.921	0.177	0.361	0.382	0.380
CAIRCIRL	0.052	0.113	-0.037	1.000	0.417	0.426	0.132	-0.251	-0.132	0.556	0.636	0.726
CLTHERM	0.415	0.708	0.028	0.417	1.000	0.167	0.364	0.101	0.331	0.458	0.573	0.668
CLVENTCR	0.069	0.283	0.815	0.426	0.167	1.000	0.795	0.603	0.132	0.417	0.764	0.545
CLNECHO	0.536	0.382	0.905	0.132	0.364	0.795	1.000	0.899	0.474	0.563	0.607	0.570
CLVOICE	0.516	0.171	0.921	-0.251	0.101	0.603	0.899	1.000	0.359	0.251	0.230	0.224

CLNOUT	0.185	0.247	0.177	-0.132	0.331	0.132	0.474	0.359	1.000	0.364	0.455	0.118
CLIGHT	0.674	0.481	0.361	0.556	0.458	0.417	0.563	0.251	0.364	1.000	0.573	0.891
CLIGCTR	0.000	0.519	0.382	0.636	0.573	0.764	0.607	0.230	0.455	0.573	1.000	0.681
SCHEXT	0.601	0.605	0.380	0.726	0.668	0.545	0.570	0.224	0.118	0.891	0.681	1.000
SCHINT	0.415	-0.283	-0.167	0.222	0.417	-0.222	0.132	0.101	0.331	0.167	0.000	0.149
SCHSYM	0.075	-0.218	-0.427	0.694	0.040	-0.133	-0.255	-0.531	0.032	0.520	0.183	0.381
SCHSAFE	0.468	0.282	0.069	-0.415	-0.233	-0.311	-0.103	0.031	-0.185	0.233	-0.475	0.046
SCHGRDS	0.335	0.192	0.113	-0.547	-0.283	-0.245	0.067	0.171	0.405	0.283	-0.259	-0.101
TEACSTOR	0.210	0.458	-0.432	0.052	0.778	-0.415	-0.185	-0.250	0.041	-0.052	0.000	0.169
CLCLEAN	0.367	0.520	-0.354	0.471	0.884	-0.196	-0.047	-0.284	0.047	0.354	0.270	0.560
CLEANBG	0.080	0.175	-0.559	0.194	0.420	-0.495	-0.513	-0.525	-0.564	-0.194	-0.296	0.096
CLMNT	0.311	0.481	0.750	-0.028	0.167	0.611	0.563	0.603	-0.331	0.125	0.191	0.371
SCHMNT	0.130	0.283	0.750	-0.611	-0.125	0.417	0.563	0.779	0.132	-0.167	0.000	-0.149
TEACHRM	-0.426	0.372	0.517	0.091	0.091	0.761	0.435	0.330	0.073	-0.091	0.627	0.108

	SCHINT	SCHSYM	SCHSAFE	SCHGRDS	TEACSTOR	CLCLEAN	CLEANBG	CLMNT	SCHMNT	TEACHRM
TSPACE	0.600	-0.212	0.012	0.163	0.075	0.085	-0.264	0.240	0.380	-0.175
TSFURN	0.577	-0.416	0.090	0.196	0.180	0.000	-0.112	0.144	0.433	-0.316
TSPACEV	0.710	-0.279	-0.201	-0.175	0.622	0.548	0.225	0.194	0.194	-0.141
CLAYOUT	0.560	-0.370	0.174	0.285	0.283	0.149	-0.081	0.175	0.420	-0.307
TSDISPLA	0.167	-0.320	0.233	0.679	0.130	-0.059	-0.420	-0.167	0.417	-0.091
TLSTOR	0.382	-0.183	-0.356	-0.389	0.832	0.810	0.444	0.191	0.000	0.209
TEACHSPA	0.420	-0.101	-0.022	-0.119	0.022	0.198	-0.108	0.560	0.315	0.038
ACOMPU	0.354	-0.283	-0.917	-0.801	0.275	0.167	0.068	0.059	0.059	0.484
EQUIPRED	0.710	-0.062	-0.622	-0.175	0.060	-0.091	-0.300	-0.484	-0.032	-0.141

SCSPEC	0.043	0.207	0.295	0.585	-0.576	-0.335	-0.750	0.108	0.258	-0.024
CLSPEC	-0.043	0.372	0.268	0.643	-0.361	-0.091	-0.650	-0.108	0.043	0.024
CLSEQUIP	0.167	0.240	0.052	0.481	0.311	0.354	-0.194	-0.458	-0.167	-0.091
ADMSPACE	0.415	-0.623	-0.097	-0.282	0.323	0.110	0.221	0.493	0.493	-0.028
MSPACE	0.415	0.075	0.468	0.335	0.210	0.367	0.080	0.311	0.130	-0.426
TCOMP	-0.283	-0.218	0.282	0.192	0.458	0.520	0.175	0.481	0.283	0.372
SROOM	-0.167	-0.427	0.069	0.113	-0.432	-0.354	-0.559	0.750	0.750	0.517
CAIRCIRL	0.222	0.694	-0.415	-0.547	0.052	0.471	0.194	-0.028	-0.611	0.091
CLTHERM	0.417	0.040	-0.233	-0.283	0.778	0.884	0.420	0.167	-0.125	0.091
CLVENTCR	-0.222	-0.133	-0.311	-0.245	-0.415	-0.196	-0.495	0.611	0.417	0.761
CLNECHO	0.132	-0.255	-0.103	0.067	-0.185	-0.047	-0.513	0.563	0.563	0.435
CLVOICE	0.101	-0.531	0.031	0.171	-0.250	-0.284	-0.525	0.603	0.779	0.330
CLNOUT	0.331	0.032	-0.185	0.405	0.041	0.047	-0.564	-0.331	0.132	0.073
CLIGHT	0.167	0.520	0.233	0.283	-0.052	0.354	-0.194	0.125	-0.167	-0.091
CLIGCTR	0.000	0.183	-0.475	-0.259	0.000	0.270	-0.296	0.191	0.000	0.627
SCHEXT	0.149	0.381	0.046	-0.101	0.169	0.560	0.096	0.371	-0.149	0.108
SCHINT	1.000	0.320	-0.415	-0.283	0.415	0.471	0.194	-0.417	-0.417	-0.548
SCHSYM	0.320	1.000	-0.075	-0.027	-0.100	0.283	0.062	-0.600	-0.881	-0.482
SCHSAFE	-0.415	-0.075	1.000	0.775	-0.097	-0.110	0.060	0.233	0.233	-0.369
SCHGRDS	-0.283	-0.027	0.775	1.000	-0.282	-0.320	-0.439	-0.113	0.283	-0.279
TEACSTOR	0.415	-0.100	-0.097	-0.282	1.000	0.880	0.783	-0.052	-0.233	-0.227
CLCLEAN	0.471	0.283	-0.110	-0.320	0.880	1.000	0.730	-0.059	-0.471	-0.258
CLEANBG	0.194	0.062	0.060	-0.439	0.783	0.730	1.000	0.032	-0.420	-0.354
CLMNT	-0.417	-0.600	0.233	-0.113	-0.052	-0.059	0.032	1.000	0.708	0.548
SCHMNT	-0.417	-0.881	0.233	0.283	-0.233	-0.471	-0.420	0.708	1.000	0.548
TEACHRM	-0.548	-0.482	-0.369	-0.279	-0.227	-0.258	-0.354	0.548	0.548	1.000

APPENDIX E

Hypothesis Test Results showing correlations with significance levels

VARIABLE		MATH9	GRL MATH9	BOY MATH9	SCIEN 9	GRL SCI9	BOY SCI9	SOCS T9	GRL SOCST9	BOY SOCST9	LAN ART9	GRL LAN9	BOY LAN9	COMP 9	GRL COMP9	BOY COMP9
TSPACE																
	r	-.019	.125	.036	-.095	.026	-.026	.054	-.014	.082	.045	.211	.046	.219	-.003	.315
	Sig.	.471	.316	.445	.359	.461	.461	.419	.479	.378	.432	.208	.431	.200	.496	.109
	N	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17
TFURN																
	r	.120	.015	.207	.038	-.122	.062	.175	-.035	.162	.087	-.001	.122	.204	-.132	.292
	Sig.	.323	.477	.213	.442	.320	.406	.251	.447	.267	.369	.498	.321	.216	.306	.128
	N	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17
TSPACEV																
	r	.112	.010	.106	.059	-.104	-.012	.175	.135	.121	.226	.161	.159	.258	.002	.300
	Sig.	.334	.485	.343	.410	.345	.482	.251	.303	.322	.192	.268	.270	.159	.497	.121
	N	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17
CLAYOUT																
	r	.148	-.065	.264	-.004	-.282	.048	.154	-.049	.201	.150	.009	.166	**.444***	.054	**.487***
	Sig.	.292	.405	.162	.494	.145	.430	.285	.428	.228	.290	.487	.269	.043	.421	.028
	N	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16
TSDISPLA																
	r	.240	-.269	.477	.010	-.368	.327	.222	-.135	.384	.202	-.279	**.432***	.165	-.144	.226
	Sig.	.185	.156	.031	.486	.081	.108	.205	.310	.071	.227	.147	.047	.271	.297	.200
	N	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16
CLVOICE																
	r	-.211	.056	-.219	-.306	-.026	-.200	-.119	-.102	-.108	-.285	-.174	-.224	-.166	.339	-.133
	Sig.	.208	.416	.199	.116	.461	.220	.324	.324	.340	.134	.253	.193	.263	.091	.306
	N	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17

CLNECHO															
r	.384	.111	.246	.393	.233	.325	**.454***	.267	.344	.331	-.016	.298	.054	.174	.086
Sig.	.071	.341	.179	.066	.193	.109	.039	.159	.096	.105	.477	.131	.421	.259	.376
N	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16
SCHSAFE															
r	**.720****	.383	**.593****	**.651****	.261	**.546***	**.697****	**.512***	**.581****	**.698****	.333	**.608****	.193	-.023	.250
Sig.	.001	.072	.008	.003	.165	.014	.001	.021	.009	.001	.103	.006	.237	.466	.175
N	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16
SCHGRDS															
r	**.542***	.164	**.599****	**.458***	.028	**.561***	**.575***	.294	**.594****	**.542****	.138	**.628****	.252	-.153	.360
Sig.	.015	.272	.007	.037	.459	.012	.010	.135	.008	.015	.305	.005	.173	.286	.085
N	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16
CLCLEAN															
r	.066	.145	.107	-.046	.001	-.103	-.099	-.049	-.096	.096	.262	.047	.190	.370	.140
Sig.	.400	.289	.342	.430	.498	.347	.353	.426	.357	.357	.155	.428	.232	.072	.297
N	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17
CLEANBG															
r	.233	.248	.127	.103	.130	-.148	-.029	.090	-.138	.176	.282	.027	.109	.369	-.074
Sig.	.184	.169	.314	.347	.309	.286	.456	.365	.298	.250	.136	.458	.338	.073	.389
N	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17
CLMNT															
r	.040	.155	-.105	-.072	.031	-.232	.014	.226	-.077	.005	.085	-.130	.082	**.541***	-.032
Sig.	.441	.283	.350	.395	.454	.194	.480	.200	.389	.492	.377	.315	.381	.015	.453
N	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16
SCHMNT															
r	.055	.091	.028	-.043	-.059	-.043	.131	.212	.063	-.022	-.067	.037	-.099	.189	-.074
Sig.	.417	.364	.457	.435	.410	.436	.308	.208	.405	.467	.399	.444	.352	.234	.389
N	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17
TEACHSPA															

	r	.346	.405	.202	.208	.282	.118	.261	.211	.203	.292	.358	.119	.370	.241	.338
	Sig.	.095	.060	.227	.219	.145	.332	.164	.216	.225	.137	.087	.330	.079	.184	.100
	N	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16
ACOMPU																
	r	**-0.468 ***	-.326	-.390	**-.429 ***	-.309	**-.428 ***	-.282	-.131	-.273	-.244	-.117	-.240	-.012	.354	.026
	Sig	.029	.101	.061	.043	.114	.043	.137	.309	.144	.173	.327	.177	.482	.082	.461
	N	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17
ADMSPACE																
	r	-.124	.051	-.157	-.191	-.108	-.286	-.033	.085	-.164	-.099	.044	-.147	-.164	-.035	-.046
	Sig.	.317	.422	.274	.231	.339	.133	.449	.373	.265	.353	.434	.286	.265	.448	.431
	N	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17
MSPACE																
	r	-.105	-.024	-.264	-.025	.083	-.209	.015	.124	-.133	.033	.219	-.151	.106	.166	.163
	Sig.	.344	.464	.153	.462	.375	.210	.478	.317	.306	.450	.200	.282	.343	.263	.265
	N	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17
TCOMP																
	r	.318	**.449***	.152	.152	.254	.095	.242	**.425***	.180	**.420***	**.569 ****	.244	.072	**.419***	.065
	Sig.	.107	.035	.280	.281	.163	.358	.175	.045	.245	.047	.009	.173	.391	.047	.402
	N	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17
SROOM																
	r	.277	.189	.215	.259	-.046	.235	.391	.257	.326	.290	.185	.157	.305	.087	.427
	Sig.	.149	.241	.212	.167	.432	.191	.067	.168	.109	.138	.246	.281	.125	.374	.050
	N	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16
CAIRCIRL																
	r	.067	.008	.103	.116	-.042	.068	.055	-.005	.053	.116	.079	.067	.369	.396	.380
	Sig.	.399	.488	.347	.329	.437	.398	.418	.492	.420	.329	.382	.399	.073	.058	.066
	N	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17
CLTHERM																
	r	-.122	-.221	-.088	-.144	-.162	-.261	-.205	-.240	-.237	-.085	-.128	-.130	.062	**.503***	.020

Sig.	.321	.196	.369	.291	.267	.156	.215	.177	.179	.373	.312	.309	.407	.020	.470
N	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17
CLVENTCR															
r	**.448***	.273	.246	**.556***	.347	**.460***	**.642 ** **	**.624****	**.500***	**.538***	.308	**.415***	.252	**.415***	.270
Sig.	.036	.144	.170	.010	.086	.032	.003	.004	.021	.013	.114	.049	.164	.049	.148
N	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17
CLNOUT															
r	**.514***	.089	**.661****	**.565***	.044	**.752****	**.648 ****	.202	**.710****	**.593****	.155	**.703****	.380	-.148	**.556***
Sig.	.021	.372	.003	.011	.436	.000	.003	.226	.001	.008	.283	.001	.073	.292	.013
N	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16
CLIGHT															
r	.087	-.063	.059	.111	.006	.093	.123	.060	.099	.113	.029	.121	.260	.391	.263
Sig.	.375	.408	.414	.342	.492	.366	.325	.413	.357	.338	.457	.327	.165	.067	.162
N	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16
CLIGCTR															
r	-.154	-.064	-.150	-.009	-.028	.076	.027	.077	.011	-.033	.012	.003	-.058	.214	.157
Sig.	.285	.407	.289	.487	.459	.390	.461	.388	.484	.452	.483	.495	.415	.213	.281
N	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16
SCHEXT															
r	.218	.136	.041	.272	.220	.094	.194	.259	.014	.179	.135	.065	.011	.373	.021
Sig.	.200	.302	.438	.145	.198	.359	.227	.158	.478	.246	.302	.402	.483	.070	.469
N	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17
SCHINT															
r	.311	.084	**.471***	.194	-.016	.332	.226	.073	.294	.229	.018	.390	.310	.109	.266
Sig.	.112	.374	.028	.227	.476	.096	.192	.391	.126	.188	.473	.061	.113	.339	.151
N	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17
FIT SCORES/OBJRATE															
r	.296	.256	.222	.339	.181	.340	**.525***	**.455***	**.445***	.301	.118	.307	.307	.152	.368
Sig.	.125	.160	.196	.091	.243	.091	.015	.033	.037	.121	.326	.116	.115	.280	.073
N	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17

VARIABLE	MATH10	GRLMATH10	BOYMATH10	SCIEN10	GRLSCI10	BOYSCI10	SOCST10	GRLSOCST10	BOYSOCST10	LANART10	GRLLAN10	BOYLAN10	COMP10	GRLCOMP10	BOYCOMP10
TSPACE															
r	.088	.144	.009	-.239	-.166	**-.436***	-.079	-.022	-.130	.079	.260	-.056	-.027	.051	-.084
Sig.	.369	.291	.486	.178	.262	.040	.381	.467	.309	.381	.157	.415	.459	.423	.374
N	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17
TFURN															
r	.265	.276	.161	-.117	-.071	-.225	.015	.164	-.003	.146	.285	.041	-.016	-.021	.033
Sig.	.152	.142	.269	.327	.393	.192	.477	.264	.495	.288	.134	.438	.476	.469	.451
N	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17
TSPACEV															
r	.299	.249	.218	-.068	-.090	-.165	.107	-.027	.126	.327	.431	.230	.186	.169	.157
Sig.	.122	.168	.201	.397	.365	.263	.341	.459	.315	.100	.042	.188	.238	.259	.274
N	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17
CLAYOUT															
r	.309	.292	.243	-.112	-.065	-.148	.027	.170	.201	.331	**.442***	.274	.172	.055	.282
Sig.	.122	.136	.182	.340	.406	.292	.460	.265	.228	.105	.043	.152	.262	.420	.145
N	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16
TSDISPLA															
r	.336	.230	**.510***	.173	.029	.279	.279	.125	**.433***	.394	.317	.424	.381	.245	**.485***
Sig.	.102	.195	.022	.261	.458	.147	.148	.322	.047	.065	.116	.051	.073	.180	.029
N	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16
CLVOICE															
r	-.177	-.124	-.145	-.054	-.095	.088	-.167	.087	-.167	-.219	-.273	-.228	-.098	-.053	-.014
Sig.	.248	.317	.289	.418	.359	.368	.261	.370	.261	.199	.144	.190	.355	.420	.479
N	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17
CLNECHO															
r	**.464***	.370	**.460***	**.613****	**.464***	**.596****	**.516***	**.441***	.348	.397	.310	.309	**.485***	.418	.366
Sig.	.035	.079	.036	.006	.035	.007	.020	.043	.093	.064	.121	.122	.029	.054	.082

N	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16
SCHSAFE															
r	.308	.186	.305	.125	.030	.132	.192	.193	.203	.199	.127	.240	-.003	-.055	.221
Sig.	.123	.245	.126	.322	.456	.313	.238	.237	.225	.231	.319	.185	.495	.420	.206
N	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16
SCHGRDS															
r	.290	.181	.390	.087	-.045	.132	.221	.108	.356	.307	.202	.346	.090	-.073	.333
Sig.	.138	.251	.068	.374	.434	.313	.205	.346	.088	.124	.226	.095	.370	.393	.104
N	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16
CLCLEAN															
r	.201	.297	-.011	.050	.140	-.106	.107	.258	.053	.148	.246	.053	-.038	.150	-.043
Sig.	.219	.123	.484	.424	.297	.343	.341	.159	.420	.286	.170	.420	.442	.283	.434
N	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17
CLEANBG															
r	.318	**.420***	.026	.217	.304	-.013	.222	**.421***	-.024	.153	.239	-.001	-.012	.201	-.043
Sig.	.107	.047	.460	.201	.118	.480	.196	.046	.464	.279	.178	.499	.482	.220	.436
N	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17
CLMNT															
r	.162	.158	.062	.106	.053	.205	.065	.183	.077	.150	.083	.103	.100	.044	.235
Sig.	.274	.280	.410	.348	.423	.224	.405	.249	.389	.290	.380	.353	.356	.436	.191
N	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16
SCHMNT															
r	.138	.115	.141	.039	-.079	.256	.050	.107	.127	.083	-.039	.107	-.050	-.141	.188
Sig.	.299	.330	.295	.440	.381	.161	.424	.341	.313	.375	.440	.342	.425	.294	.234
N	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17
TEACHSPA															
r	.380	.357	.296	.012	.065	-.132	.120	.176	.117	.345	**.437***	.226	.243	.184	.192
Sig.	.073	.087	.133	.482	.405	.313	.329	.258	.333	.095	.045	.200	.182	.247	.238
N	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16

ACOMPU															
r	-.108	.025	-.215	.077	.108	.061	.045	.093	-.078	-.003	.123	-.065	.131	.292	-.010
Sig.	.340	.462	.203	.385	.340	.409	.432	.362	.383	.495	.318	.402	.308	.128	.485
N	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17
ADMSPACE															
r	.004	.058	-.165	-.283	-.225	-.309	-.215	-.066	-.318	-.144	.031	-.229	-.293	-.126	-.281
Sig.	.494	.413	.264	.135	.193	.114	.204	.401	.106	.291	.453	.189	.127	.315	.137
N	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17
MSPACE															
r	-.213	-.166	-.355	**-.430 ***	-.409	**-.529***	-.396	-.259	**-.431***	-.259	-.124	-.366	-.312	-.262	-.371
Sig.	.205	.263	.081	.042	.051	.015	.058	.158	.042	.157	.318	.074	.111	.155	.071
N	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17
TCOMP															
r	.076	-.032	.102	-.091	-.162	-.020	.011	-.170	.077	.122	.046	.198	.019	.184	.143
Sig.	.386	.452	.348	.364	.268	.470	.484	.258	.384	.321	.430	.224	.471	.240	.291
N	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17
SROOM															
r	.255	.285	.244	-.010	-.031	-.006	.040	.261	.135	.211	.268	.184	.076	-.251	.186
Sig.	.170	.143	.181	.486	.454	.491	.441	.165	.309	.216	.158	.248	.390	.175	.245
N	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16
CAIRCIRL															
r	.272	.388	.118	.286	.329	.209	.239	**.431***	.284	.307	.370	.244	.207	.048	.149
Sig.	.145	.062	.326	.133	.099	.211	.177	.042	.135	.115	.072	.173	.212	.427	.284
N	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17
CLTHERM															
r	.182	.266	-.029	.376	**.420***	.318	.236	**.452***	.157	.165	.212	.070	.199	.363	.079
Sig.	.242	.151	.457	.068	.047	.107	.181	.034	.274	.263	.207	.395	.222	.076	.382
N	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17
CLVENTCR															

	r	**.424***	.361	**.439***	**.527***	.349	**.606****	**.491***	.346	.387	.396	.247	**.425***	**.432***	.228	**.430***
	Sig.	.045	.078	.039	.015	.085	.005	.023	.087	.062	.058	.169	.044	.042	.189	.042
	N	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17
CLNOUT																
	r	.426	.285	**.536***	.301	.214	.349	.413	.234	**.571***	**.442***	.369	**.563***	.325	.195	.425
	Sig.	.050	.142	.016	.129	.213	.093	.056	.192	.010	.043	.080	.012	.110	.235	.050
	N	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16
CLIGHT																
	r	.136	.195	.028	.133	.069	.101	.099	.223	.122	.134	.106	.050	.071	-.109	.058
	Sig.	.307	.234	.458	.311	.400	.355	.358	.203	.327	.310	.347	.427	.397	.343	.415
	N	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16
CLIGCTR																
	r	-.083	-.069	-.032	.126	.048	.330	.030	-.058	.229	.056	-.018	.146	.021	-.114	-.008
	Sig.	.379	.400	.453	.321	.429	.106	.456	.416	.197	.418	.474	.294	.470	.337	.488
	N	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16
SCHEXT																
	r	.201	.253	.031	.230	.165	.236	.110	.277	.022	.045	.010	-.026	-.060	-.137	-.095
	Sig.	.220	.163	.453	.187	.263	.181	.338	.141	.466	.432	.484	.460	.410	.300	.359
	N	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17
SCHINT																
	r	**.532***	**.596****	**.416***	.340	.329	.247	**.433***	**.475***	.341	**.420***	**.437***	.334	.265	.173	.283
	Sig.	.014	.006	.048	.091	.099	.169	.041	.027	.090	.047	.040	.095	.152	.253	.136
	N	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17
FIT SCORES/OBJRATE																
	r	.395	.374	**.414***	.303	.216	.363	.391	.298	.333	.311	.252	.365	.271	.046	**.455***
	Sig.	.058	.069	.049	.118	.202	.076	.061	.123	.096	.112	.165	.075	.146	.430	.033
	N	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17

APPENDIX F

Ranked FIT Scores with itemized scores for each school assessed

FIT Scores	Vent.	Wind. & Door	Int. Sur	Furn.	Stor.	Light	Acoustics	Water	Rest-rooms	Sewer	Fire Safe.	Gates	Structural	Play Areas	Grounds	Access	Clean
71.43	100	100	75	14.28	25	100	0	100	50	100	50	100	100	100	100	0	100
71.41	100	100	25	25	75	88.88	0	100	100	100	100	0	100	100	100	0	100
70.67	100	87.5	37.5	37.5	0	88.88	0	100	50	100	100	100	100	100	100	0	100
66.66	100	100	77.77	55.55	0	100	0	100	50	100	50	100	100	0	100	0	100
64.71	100	100	25	75	37.5	62.5	0	100	100	100	100	100	0	0	100	0	100
63.72	100	100	25	25	33.33	100	0	100	50	100	50	100	100	0	100	0	100
61.58	85.71	42.85	14.28	100	0	87.5	0	100	66.66	100	0	100	100	0	100	0	100
61.13	100	100	14.28	14.28	25	85.71	0	100	100	100	0	100	100	0	100	0	100
57.11	100	87.5	37.5	33.33	75	87.5	0	100	50	100	100	0	0	0	100	0	100
54.49	100	100	50	37.5	0	88.8	0	100	50	100	0	0	100	0	100	0	100
52.35	100	100	50	40	0	100	0	100	100	100	0	0	100	0	0	0	100
50.82	100	100	14	0	0	100	0	100	50	100	0	100	100	0	0	0	100
47.96	87.5	100	25	75	0	88.88	0	100	50	100	100	0	0	0	0	0	88.88
46.34	88.88	100	22.22	66.66	70	90	0	50	50	100	0	50	0	0	0	0	100
45.31	100	25	25	25	0	100	0	100	100	NA	50	0	100	0	0	0	100
38.01	88.88	50	25	11.11	20	44.44	0	100	66.67	100	50	0	0	0	0	0	90
35.94	100	100	62.5	0	25	87.5	0	0	0	NA	0	0	100	0	0	0	100

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