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Impact of School Infrastructures on Students Learning and Performance: Case of Three Public Schools in a Developing Country

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Abstract

In several countries, low level of education is due to inadequate level of physical facilities. Physical facilities provide students with adequate atmosphere conducive to learning. Modern physical facilities are important and have positive effects on students learning and performance (Shami & Hussain, 2005). School facilities are a major factor in ensuring quality education. This is one of the criteria for measuring education's growth and development level. Recent studies conducted in the United Kingdom have shown the impact of infrastructure on learners' academic outcomes and explain 16% of the variation in primary school students' academic achievement (Teixeira et al., 2017). This study aimed to determine the impact of school infrastructure on student learning and achievement in three schools in the Kinshasa-Ngaliema education division. This study was the subject of quantitative research to analyze data collected from a questionnaire designed specifically for this study and based on the literature that addresses the impact of school facilities on student achievement. The target population (N = 108) was identified as teachers from three official secondary schools in the Kinshasa-Ngaliema education division. The accessible population was selected based on research interest, based on the non-probability sampling known as convenience sampling. The results of this study highlight several important observations that are critical to determining that school infrastructure has a serious impact on student learning and achievement. The results of this study suggest that continuous improvement of school infrastructure should be considered and recommended for all schools to optimize student achievement and teacher delivery.

Keywords

Schools Infrastructures, Students Learning, Student Performance

1. Introduction

1.1. Background to the Study

According to several studies on school facilities, we need to signify here that school facilities mean buildings housing classrooms, laboratories, dormitories, administrative, administrative facilities, athletic facilities, or related facilities operated in connection with a school. They are a major factor in ensuring quality education. This is one of the criteria for measuring education's growth and development level. Recent studies conducted in the United Kingdom have shown the impact of infrastructure on learners' educational outcomes and explain 16% of the variation in primary school students' academic achievement (Teixeira, Amoroso, & Gresham, 2017).

This analysis shows that the way school facilities are designed has an effect on learning processes based on three characteristics: They must be natural (e.g., light and air quality), stimulating (e.g., colors and complexity), and individualized (e.g., flexibility of learning spaces) (Teixeira, Amoroso, & Gresham, 2017).

The results of the Bullock (2007) studies show that there is a relationship between school facilities and student achievement in secondary schools. It also finds that students perform better in schools that have been recently new or renovated than in older schools.

A large school facility is more than a building kept in the best possible condition through routine maintenance, regular inspections, and other well-done preventative work. Rather, school facilities must create an ideal environment for academic success based on research findings that indicate that there is a direct impact on student learning.

1.2. Problem Statement

For some time, there has been a dramatic increase in student failures relative to success in our schools. These failures could certainly be due to the accentuation of the lack of school facilities or obsolete ones that do not promote good working conditions in general and apprenticeships in particular (Teixeira, Amoroso, & Gresham, 2017). We asked ourselves whether students' academic performance was really influenced by the novelty or age of school facilities and infrastructure. We need to mention that those three schools studied were aged more than fifty year old and they were not maintained appropriately.

1.3. Research Objective and Research Questions

The main objective of this study was to discover how school infrastructure impacts students' academic performance in three huge secondary schools in the commune of Ngaliéma.

To properly approach our subject, we asked ourselves these two questions that would guide all our reflections:

1) How would the condition of buildings and school infrastructure affect teaching and learning?

2) How would school facilities impact student achievement?

1.4. Importance of This Study

Our choice on this topic was to explore the importance of school facilities and infrastructure on student achievement. This is to reassure the education community of the learning capacity of students in each school.

To think about infrastructures is to evoke the direct relationship between learning processes and material or heritage resources. Each school, like an organization, owns the heritage or the material resources. These consist of the movable and immovable property of a school including school buildings, office furniture, desks, cabinets of the office and the master etc.

Through some pedagogues including Bullock, Clemmons, and Nutton, we would like to call on our education stakeholders to take the necessary measures for the proper maintenance or renovation of school infrastructure.

Thinking about infrastructure would challenge education authorities, school administrators, and parents to demand a school environment conducive to student learning. They should be concerned about the structural conditions of school facilities as well as the academic performance of students.

Our interest in this topic focuses on the importance of improving teaching and learning in a healthy environment and possibly increasing student achievement in all areas: cognitive, affective, and psychomotor.

1.5. Limitations

Due to the inability of the sample respondents to respond frankly, the results may not accurately reflect the views of all the school communities involved.

1.6. Delimitations

The instruments used only suggestions according to the Likert scale model to manage the data collected.

2. Literature Review

This chapter presents the concepts around which this research has developed. It provides a foundation for this work that can help the researcher find an anchor in the literature review on the impact of school infrastructure on student learning and achievement.

As this research aims to explore the impact of school infrastructure on student learning and achievement, this literature review focuses on the following:

1) School facilities and student performance;
2) State of school buildings and education;
3) Influence of school facilities on learning outcomes;
4) School facilities and deficits in the 21st century;
5) Impact of school facilities on students' academic performance;
6) School facilities and correlates of student success in the emotional and

psychomotor domains of learning.

2.1. Impact: School Facilities and Student Achievement

Jeff Clemmons (2014), Director of School Facilities Services for the Texas Association of School Boards in the United States of America said that if we want to continue to increase student scores in all areas, we must first be honest and recognize that we need to reduce disparities between schools in terms of the quality of the learning environment.

Karen Shwind (2014), president of the Texas School Nurses Organization said there's no doubt that facilities can impact student learning, especially when it comes to minimizing chronic absences related to conditions like asthma. According to Shwind, a healthy child will be your best learner. Environmental factors can lead—and think of those with respiratory problems, especially our asthmatic population and then those with anaphylaxis—to accumulations of absences. If children are not in school, they will not learn. Creating a healthy learning environment helps minimize absenteeism.

Gary Hutton (2014), general manager of operations for schools in the city of Spring, Texas, said that taking into account the performance of the school district, if we have high-performing facilities, children would stay in the classroom, and learn. If there is student attendance, learning and increased performance follow.

2.2. Condition of School Buildings and Education

Bullock's (2007) study: Relationships between School Building Conditions and Student Achievement at the Orientation Level in the State of Virginia, United States of America, is one of many studies that have found that student achievement is related to building conditions. Students perform better in newer or recently renovated buildings than in older buildings.

In 2014, the U.S. Department of Education recognized the impact of well-maintained facilities on learning and teaching. It has been found that when classrooms are too hot, too cold, overcrowded, dust-filled, or poorly ventilated, students and teachers suffer from physical and intellectual discomfort.

2.3. Influence of School Facilities on Learning Outcomes

With respect to school facilities, McGowen (2007) observed that school facilities are the essential elements that must be established and taken into account in order for the objectives of the school system to be achieved and that the availability of these facilities determines the quality of teaching and student achievement.

Indeed, school facilities influence pupils' results provided that the environment plays a dominant role in relation to the quality and use of resources. Environmental conditions that interfere with student achievement include:

1) Acoustics and noise;
2) Air quality;

3) Lighting;

4) The role of temperature;

5) Classroom size and space etc. (TASB, 2014).

1) *Acoustics and noise*

Loud noises are distracting and even stressful. Noise interferes with the ability of teachers to teach and students to learn. Common sources of these distractions are heating and ventilation levels, nearby classrooms, nearby facilities, aircraft flight paths, and road traffic. Research shows that classrooms that reduce outside noise have more engaged and performing students than those who live in noisier school environments.

Classroom noise is of particular concern for students with hearing loss or attention deficits. School buildings that can protect classrooms from external noise sources can improve student outcomes.

2) *Air quality*

Poor air quality contributes to absenteeism, especially among students with asthma. The increase in absences and difficulty concentrating during school may mean that measures of student achievement do not actually assess learning and rather a student's health and ability to concentrate.

Research undertaken by McGowen (2007) also indicates that some schools suffer from what has been dubbed "sick building syndrome," a set of symptoms that include lethargy, dry skin, and headaches. This syndrome affects absenteeism and the performance of students and teachers. In addition, poor indoor air quality means that these buildings contain more bacteria, viruses, allergens, and pollutants from office equipment, cleaning products, pesticides, flooring, paints, and adhesives that can all contribute to childhood diseases. A major moisture problem throughout the building creates mold problems. This situation involves many mechanisms of elimination.

According to Hutton (2014), an underestimated vector of indoor air quality is carpet. Whether it's the flu or COVID-19, or just allergens, kids bring these things in from outside, and they settle into the carpet and stir throughout the day.

3) *Lighting*

Research undertaken by McGowen (2007) shows that natural lighting boosts the morale of teachers and students. It also reduces off-task behavior and improves test scores. Environments with little natural light have been shown to produce less than desirable results.

According to Hutton (2014), many schools, especially those built in the 1980s and 1990s, were built as bunkers with little natural light coming in. School attendance by students was decreasing due to children being locked under fluorescent lights and not really seeing natural light all day.

According to Clemmons (2014), there is a study that shows that students most exposed to natural light progressed 20% faster in math and 26% faster in reading.

4) *Temperature control*

An environment that is too hot or too cold can be hard to concentrate when you are uncomfortable. Temperature affects your engagement levels and overall productivity, regardless of your age. Both teacher and student achievement are affected (TASB, 2014). According to the best analyses, the ideal temperature range for effective learning in reading and mathematics is between 20 and 24 degrees. Teachers know how to keep their rooms comfortable and ready to learn. For them to have the necessary fine-grained control, they must be able to adjust the temperature in their own class. If room-level control is not possible, schools should try to allow temperature control of small blocks of classrooms that receive similar amounts of sunlight and exposure to outdoor temperatures (TASB, 2014).

5) *Classroom size and space*

Classrooms with enough space to expand allow teachers to reconfigure seating arrangements and allow for varied teaching methods. They also create private study areas and smaller learning centers that reduce visual and hearing interruptions (TASB, 2014).

Overcrowding has always been linked to increased student aggression, decreased engagement, and lower levels of learning. Classrooms that offer flexibility and reconfiguration are associated with increased student engagement and learning (TASB, 2014).

As pedagogy changes, so does the layout of classrooms. A flexible space is important to ensure that students can work together, collaborate, and communicate effectively to achieve good performance (TASB, 2014). Clemmons (2014) stated that as education changes, so do our approaches to improving our school facilities.

2.4. School Facilities and the Challenge of the 21st Century

According to Clemmons (2014), school districts need to make careful assessments to determine when aging facilities need major renovation or replacement. An older facility that has been well-updated and maintained can still meet the needs of today's students.

A building that is dirty or has not been properly maintained could have a negative impact on student performance, regardless of the age of the school. As long as the building is maintained, clean, and has been renovated to create a comfortable 21st-century learning environment, it will provide us with the most conducive environment for the advancement of education (TASB, 2014).

According to Hutton (2014), from a district perspective, the goal is always to create an environment where teachers can teach to the best of their abilities and students can learn to the best of their abilities. Buildings should not get in the way of these things.

2.5. Impact of School Facilities on Pupils' Academic Performance

School facilities are a key factor in ensuring quality education. This is one of the criteria for measuring the level of growth and development of education.

The educational building program describes school facilities as the practice of coordinating the physical workplace with people and the work of the organization; it integrates the principles of school administration, architecture, and behavioral and engineering sciences. Student achievement can be measured in several ways, but the commonly used method is students' public exam scores, which are used to make judgments about schools and teachers. Student academic achievement is the final grade that students obtain after systematic and comprehensive measurement and assessment of each student in a school setting for the purpose of making a decision or judgment on their cognitive, affective, and psychomotor domains. The researcher considered the academic achievement of students, as a measure of the primary, secondary, or higher school certificate examination (Asaolu, 2003).

Bullock (2007) studied the relationship between school facilities and student achievement in senior high schools in the state of Virginia in the United States of America. The study examined the relationships between student academic performance and overall, structural and cosmetic construction conditions. It found that students perform better in schools that have been recently new or renovated than in older schools. The overall condition of the building, the grade age of the building, and the windows in the teaching areas were positively related to student achievement.

2.6. School Facilities and Correlates of Student Success in the Emotional and Psychomotor Domains of Learning

Based on the results of studies, it was recommended that schools maintain the pace of student achievement in emotional and psychomotor areas, while the government should improve the level of physical facilities in schools to improve student performance in these areas of learning.

However, a quick glance at secondary schools in recent times suggests that schools are not living up to expectations in producing quality education in all three areas of learning; that is, the cognitive, affective, and psychomotor domains. It seems that over the years, the school's focus has been on cognitive (academic performance) to the detriment of the other two domains (affective and psychomotor). Meanwhile, Bandele (2002) argued that the affective and psychomotor domains exert a great influence on the cognitive domain and allow the beneficiary of the education system to live a fulfilling life and contribute significantly to the development of society.

It has been observed that a major obstacle that affects secondary schools is the involvement of students in antisocial vices, thus rendering schools ineffective in the emotional field. The antisocial vices of students manifest themselves in the form of absence from school, tardiness at school, and insubordination to the school authority, among others. Nowadays, students seem lazy, dishonest, and always looking for shortcuts to success.

Personal experience has also shown that most young people leaving secondary

education do not have the technical skills required to function effectively in society. It seems that schools do not consider the importance of sport for the development of individuals and for nation-building. Sports activity (which is a very good indicator of the psychomotor field) is not just a routine or an annual fundraising activity for schools, but a very good avenue for the search for talent.

The ineffectiveness of schools in these two areas of learning (affective and psychomotor) has been attributed to a number of factors such as parenting, and societal and academic factors, but the academic factor appears to be important. The school factor considered in the study is school facilities. The availability of school physical facilities and the quality of the school learning environment was said to be powerful factors influencing student success in the emotional and psychomotor domains.

Personal visits to some schools showed that the school's physical facilities were not in good condition. In some cases, students sit on the floor to receive lessons. Many classrooms, laboratories, libraries, and playgrounds are in a terrible state of despair. Mutiu (1994) and Ahmed (2003) have shown that in most secondary schools in the country, teaching and learning take place in a less conducive environment, lacking basic materials.

Adeboyeje (1984), Adedeji (1998), and Ajayi (2002) presented positive relationships between school facilities and school efficiency. Hallack (1990) also noted that facilities were a major influencing factor in the school system. The author pointed out that the availability, relevance, and suitability of these facilities contribute to student success, while unattractive school buildings, crowded classrooms, unavailability of playgrounds and flower beds, and environments that lack aesthetic beauty can contribute to poor performance. Ahunanya and Ubabudu (2006) also reaffirmed the provision of adequate facilities for effective teaching and learning. It can be inferred from the literature that school facilities have a positive relationship with school effectiveness. These studies have revealed the relationship between school facilities and pupils' performance in the affective and psychomotor domains of learning.

3. Methodology

The purpose of this study is to determine the impact of school infrastructure on student learning and achievement in Kinshasa-Ngaliema education division. Two concerns were addressed:

1) How would the condition of buildings and school infrastructure affect teaching and learning?

2) How would school facilities impact student achievement?

3.1. Research Design

This study was quantitatively researched to analyze data collected from a questionnaire designed specifically for this study (Appendix 1). Surveys collect data using two basic methods, interviews and questionnaires, each with two options

for administration: remote or direct. The procedure allows for four different possible approaches to collecting data: personal interview, telephone interview, mail-in questionnaire, and directly administered questionnaire (Ary, Jacobs, & Razavieh, 1996). The researcher chose to use the directly administered questionnaire for its high response rate, which is usually one hundred percent. Other advantages of this method are the low cost and the fact that the researcher is present to provide assistance or answer respondents' questions. This type of survey is administered to a group of participants gathered at a designated location for specific purposes (Ary, Jacobs, & Razavied, 1996). This study focused on the impact of school infrastructure on student learning and achievement. The approach offered the highest possible participation rate of all four methods.

Quantitative analysis is used to describe and predict, corroborate and confirm, and experiment with hypotheses. It offers familiar variables, accepted guidelines, and an unchanged format, and is generally objective and independent of the environment. This is typically a large sample using standardized data collection and deductive analysis methods. The results were approached objectively, using figures, statistics, and summative data (Gall, Borg, & Gall, 1996; Leedy, & Ormrod, 2001).

3.2. Sample

The target population was identified as teachers from three official secondary schools in the Kinshasa-Ngaliema education division. The accessible population was selected based on research interest, based on the non-probability sampling known as convenience sampling. Despite the approbation of all three school principals, even though we explained that the survey was anonymous, most teachers were reluctant to take the survey. Those who accepted to take the survey reported to school auditoriums and took the survey.

We surveyed three schools, one school per day in the morning. In the first school, only 36 teachers showed up voluntarily for the survey. We decided to limit the number of teachers to survey to 36 based on first come first serve for the next two schools. The questionnaires were distributed to the teachers by the researcher. The available teachers came to answer the questionnaire under the supervision of the researcher. We chose to use data from the 108 participants (N = 108) that volunteered.

The researcher used the convenience sampling technique to circumvent the lack of accessibility to other schools as well as the availability and cooperation of some teachers.

3.3. Instrumentation

The data collection method in this study was the questionnaire (Appendix 1), which was validated before use by three teachers who did not participate in the survey (Gall, Borg, & Gall, 1996). The questionnaire was designed so that teach-

ers could understand and respond appropriately. In addition, the questionnaire was designed to encompass components of effective and research-based schools that led to higher student achievements. The questionnaire consisted of two parts. The first part concerns how teachers can help us determine the effectiveness of school infrastructure on teaching and learning; The second part helps us understand whether school facilities have an impact on student achievement.

To collect data useful for the evaluation of the research questions, the questionnaire used a Likert scale. The results of the Likert score, i.e., 1 to 5, revealed the relative importance of each component of each research question.

3.4. Data Collection

The researcher contacted school principals to obtain permission in advance to survey teachers using survey questionnaires (Appendix 1). The study was conducted in three schools. Sample N = 108 was obtained by voluntary participation. The researcher asked teachers to respond voluntarily and anonymously. The questionnaire was administered in the morning from 9:00 a.m. to 1:00 p.m. and supervised by the researcher. Responses to the questionnaire provided information on all research questions.

3.5. Data Analysis

This study aims to determine the impact of school infrastructure on teaching and learning and student achievement in the Kinshasa-Ngaliema education division. To answer the research questions, a questionnaire was administered to teachers (Appendix 1). Data were collected from the total sample of respondents. Descriptive statistics (i.e., standard means and deviations) were calculated for the survey items. Data were collected to answer the research questions. Means and standard deviations or standard deviations for each element of each research question were calculated. Data collected to answer the first research question (How would building conditions and school infrastructure affect teaching and learning) were pooled. Means and standard deviations or standard deviations were used to analyze the data. The averages for each survey question were arranged in descending order. To answer research question number two (How would school facilities impact student achievement) averages and standard deviations were used to analyze the data. The averages for each survey question were arranged in descending order.

3.6. Limitations

The study relied on the limited research available on the impact of school infrastructure on student teaching, learning, and achievement. One could only assume that the teachers surveyed understood all the questions or assertions very well.

A Likert-level assessment provided data that was considered valuable, but

responses in the middle of the range were difficult to interpret.

4. Presentation and Interpretations of Results

4.1. Presentation

4.1.1. First Research Question: How Would the Condition of Buildings and School Infrastructure Affect Teaching and Learning?

Surveyed teachers reported their responses to the first research question regarding the impact of school infrastructure on student learning and achievement using a Likert scale of 1 to 5 (1 not approved at all to 5 fully approved).

The responses to assertions 1 to 14 answered the first research question. The means and standard deviations of each element were computed. The ranked means and standard deviations for these statements 1 to 5 determined how consistent or not the teachers surveyed were in their answers.

Tables 1-3 below present descriptive statistics for the assertions surveyed according to descending means and standard deviations by item responding to assertions 1 to 14 for the first research question:

How would the condition of buildings and school infrastructure affect teaching and learning?

Results presented by order of magnitude of averages.

Analysis of the results from this table shows that assertions 1 to 11 average above 3. There is a strong adherence to assertions number 1, 2, and 5. On the other hand, the other assertions have quite disparate adhesion.

Analysis of the results from this table shows that assertions ranked numbers 1 to 10 have averages above 3. There is strong adherence for assertions ranked numbers 1 to 4. The other assertions are not very consistent.

Analysis of the results from this table shows that assertions ranked numbers 1 to 8 have average above 3. There is strong adherence for assertions ranked numbers 1, 2, 3, 4, 5, 6, and 8. The other assertions have quite disparate adhesions.

4.1.2. Second Research Question: How Would School Facilities Impact Student Achievement?

Analysis of the results from Table 4, School A shows that all assertions numbers 15, 16, 20, 18, 21, 22, and 24 obtain averages above 3. There is strong adherence for the first two assertions ranked in descending order (#15 and #16). All other assertions have notable inconsistencies.

The analysis of the results resulting from Table 5 shows that assertions numbers 15 and 16, obtain averages of 4 with total consistencies (0.00). They are ranked in the top two of all other assertions. However, it is noted that assertions number 19 (there is a well-equipped library in the school) has a low average (1.48) with a very high consistency (0.67); number 17 (classes have enough furniture for students) has a low average (1.25) with very high consistency (0.45), and number 22 (the school has sufficient recreational facilities) has a very low average (1.00) with maximum consistency.

Table 1. School A.

Ranks	Assertions Number	Assertions	Means	Standard Deviations
1	13	An inappropriate school environment does not allow teachers to teach and students to learn to the best of their abilities.	4.92	0.29
2	14	A dirty, poorly maintained, and unseemly building hinders teaching and learning and reduces student achievement.	4.58	0.90
3	8	Uncomfortable weather hampers teaching and learning.	3.83	1.27
4	9	Classrooms are large enough to allow for diverse teaching and learning.	3.75	1.14
5	3	Poor air quality contributes to absenteeism, especially among students with asthma.	3.75	0.97
6	11	School districts carefully assess school buildings to determine when aging facilities need major renovation or replacement.	3.67	1.30
7	12	A dirty or poorly maintained building creates an inappropriate teaching and learning environment.	3.67	1.31
8	10	Classrooms offer flexibility and reconfiguration for effective teaching and learning.	3.58	1.24
9	4	Poor air quality contributes to lethargy, dry skin, and headaches.	3.50	1.31
10	7	Temperatures that are too hot or too cold compromise the performance of teachers and students.	3.08	1.44
11	5	Natural lighting boosts the morale of teachers and students.	3.00	1.28
12	6	Lack of sufficient light can increase absences and decrease student achievement.	2.75	1.36
13	1	Noise interferes with teachers' ability to teach and students' ability to learn.	2.75	1.86
14	2	Classroom noise is of particular concern for students with hearing loss or attention deficits.	2.00	1.35

Table 2. Ecole B.

Ranks	Assertion Numbers	Assertions	Means	Standard Deviation
1	13	An inappropriate school environment does not allow teachers to teach and students to learn to the best of their abilities.	4.25	0.97
2	8	Uncomfortable weather hampers teaching and learning.	4.17	0.58
3	10	Classrooms offer flexibility and reconfiguration for effective teaching and learning.	4.00	0.00
4	14	A dirty, poorly maintained, and unseemly building hinders teaching and learning and reduces student achievement.	4.00	0.00
5	12	A dirty or poorly maintained building creates an inappropriate teaching and learning environment.	3.83	1.03
6	9	Classrooms are large enough to allow for diverse teaching and learning.	3.75	1.06
7	3	Poor air quality contributes to absenteeism, especially among students with asthma.	3.58	1.38
8	5	Natural lighting boosts the morale of teachers and students.	3.25	1.54
9	11	School districts carefully assess school buildings to determine when aging facilities need major renovation or replacement.	3.17	1.40
10	4	Poor air quality contributes to lethargy, dry skin, and headaches.	3.00	1.54
11	2	Classroom noise is of particular concern for students with hearing loss or attention deficits.	2.75	1.48
12	7	Temperatures that are too hot or too cold compromise the performance of teachers and students.	2.58	1.72
13	6	Lack of sufficient light can increase absences and decrease student achievement.	2.50	1.45
14	1	Noise interferes with teachers' ability to teach and students' ability to learn.	2.50	1.62

Table 3. School C.

Ranks	Question Numbers	Assertions	Means	Standard Deviation
1	12	A dirty or poorly maintained building creates an inappropriate teaching and learning environment.	4.58	0.51
2	13	An inappropriate school environment does not allow teachers to teach and students to learn to the best of their abilities.	4.08	0.29
3	3	Poor air quality contributes to absenteeism, especially among students with asthma.	4.00	0.00
4	8	Uncomfortable weather hampers teaching and learning.	3.83	0.72
5	10	Classrooms offer flexibility and reconfiguration for effective teaching and learning.	3.83	0.39
6	2	Classroom noise is of particular concern for students with hearing loss or attention deficits.	3.75	0.87
7	5	Natural lighting boosts the morale of teachers and students.	3.50	1.17
8	14	A dirty, poorly maintained, and unseemly building hinders teaching and learning and reduces student achievement.	3.42	0.67
9	4	Poor air quality contributes to lethargy, dry skin, and headaches.	2.58	1.51
10	11	School districts carefully assess school buildings to determine when aging facilities need major renovation or replacement.	2.42	1.78
11	9	Classrooms are large enough to allow for diverse teaching and learning.	2.25	1.42
12	6	Lack of sufficient light can increase absences and decrease student achievement.	2.17	1.47
13	7	Temperatures that are too hot or too cold compromise the performance of teachers and students.	1.83	1.40
14	1	Noise interferes with teachers' ability to teach and students' ability to learn.	1.58	1.38

Table 4. School A.

Ranks	Question Numbers	Assertions	Means	Standard Deviation
1	15	There are enough classrooms in the school.	4.00	0.00
2	16	There is enough furniture and seating for teachers.	4.00	0.00
3	20	Adequate teaching materials are available for teaching-learning activities.	3.17	1.99
4	18	Labs are well-equipped for learning.	3.00	2.09
5	21	The school has adequate health facilities for first aid and emergencies of students.	3.00	1.81
6	22	The school has a very good playground and/or sports.	3.00	2.09
7	24	The school toilets are adequate.	3.00	2.09
8	23	The school has a very good playground and/or sports.	2.67	2.06
9	17	The classrooms have enough furniture for the students.	2.42	1.56
10	19	There is a well-equipped library in the school.	2.33	1.97

The analysis of the results derived from Table 6 shows that the assertions ranked numbers 1 to 5 obtain averages above 3 with remarkably the assertion number 15 (there are enough classrooms in the school) ranked first (average 4.08) of all assertions with very strong consistency (0.29). Similarly, assertion number 16 (There is enough furniture and seating for teachers) ranked second in order of average (4.00) decreasing with maximum consistency (0.00). Assertions numbers 23, 20 and 18, present averages above 3 with largely disparate consistencies.

Table 5. School B.

Ranks	Question numbers	Assertions	Means	Standard Deviation
1	15	There are enough classrooms in the school.	4.00	0.00
2	16	There is enough furniture and seating for teachers.	4.00	0.00
3	20	Adequate teaching materials are available for teaching-learning activities.	2.17	1.47
4	23	The school has a very good playground and/or sports.	2.08	1.62
5	21	The school has adequate health facilities for first aid and emergencies of students.	1.83	1.34
6	18	Labs are well-equipped for learning.	1.75	1.36
7	24	The school toilets are adequate.	1.58	1.16
8	19	There is a well-equipped library in the school.	1.48	0.67
9	17	The classrooms have enough furniture for the students.	1.25	0.45
10	22	The school has sufficient recreational facilities.	1.00	0.00

Table 6. School C.

Rank	Question Numbers	Assertions	Means	Standard Deviation
1	15	There are enough classrooms in the school.	4.08	0.29
2	16	There is enough furniture and seating for teachers.	4.00	0.00
3	23	The school has a very good playground and/or sports.	3.75	1.22
4	20	Adequate teaching materials are available for teaching-learning activities.	3.50	1.09
5	18	Labs are well-equipped for learning.	3.42	1.38
6	19	There is a well-equipped library in the school.	2.58	1.24
7	24	The school toilets are adequate.	2.58	1.31
8	17	The classrooms have enough furniture for the students.	2.42	1.08
9	21	The school has adequate health facilities for first aid and emergencies of students.	2.42	1.31
10	22	The school has sufficient recreational facilities.	1.75	1.36

4.2. Interpretations

Considering the assertions answered with very high consistency by teachers of these three schools, the following table presents the not insignificant realities.

4.2.1. First Research Question on Teaching, Learning, and Student Achievement

Table 7 demonstrates that teachers in two schools surveyed (schools A and B) respond to assertions number 13 (An inappropriate school environment does not allow teachers to teach and students to learn to the best of their abilities) and number 14 (A dirty, poorly maintained, and unseemly building hinders teaching and learning, and reduces student achievement) with very high averages and consistencies. For these two assertions, school C indicates a lower average but with very high consistency.

Table 7. Results on the first research question.

First research question related to teaching, learning, and student achievement—Assertion numbers.	Means	Standard Deviations
Table 1 School A.		
13	4.92	0.27
14	4.58	0.90
3	3.75	0.97
Table 2 School B		
13	4.25	0.97
8	4.17	0.58
10	4.00	0.00
14	4.00	0.00
Table 3 School C		
12	4.58	0.51
13	4.08	0.29
3	4.00	0.00
10	3.83	0.39
8	3.83	0.72
2	3.75	0.87
14	3.42	0.67

Teachers in two schools (B and C) respond to assertions number 8 (Uncomfortable temperature handicaps teaching and learning) with very high averages and consistencies.

Teachers in one school (School C) respond to assertions number 2 (Classroom noise is of particular concern for students with hearing loss or attention deficits), number 3 (Poor air quality contributes to absenteeism, especially among students with asthma), and number 12 (A dirty or poorly maintained building creates an inappropriate teaching and learning environment) with very high averages and consistencies.

The results observed above indicate that teachers agree that the environment plays a crucial role in teaching and learning. This corresponds to the statements in the literature.

Question #25: Table 8 shows Percentage of success in state exams of the last three years.

The average performance over the past three years shows the following results:

School A 55%;

School B 59%;

School C 66%.

Question #26: Table 9 shows Years of teaching and learning in a low-quality school environment.

Table 8. Percentage of success in state exam of the last three years.

School year	2018-2019	2019-2020	2020-2021	Averages
School A	50%	53%	62%	55%
School B	57%	55%	65%	59%
School C	60%	68%	70%	66%

Table 9. Years of teaching and learning in a low-quality school environment.

Years	1 - 5	6 - 10	11 - 15	16 - 20
School A	3	21	9	3
School B	3	24	6	3
School C	15	12	0	9

For the years in which teaching and learning took place in a low-quality school environment in the last ten years, teachers expressed themselves as follows:

School A24/36 67%;

School B27/3675%;

School C27/3675%.

Number 36 indicates the number of teachers surveyed in this school.

Question #27: Table 10—Teachers' complaints to competent school authorities.

The above table on teachers' complaints shows the following results:

School A 50% of teachers complained about the situation.

School B 42% of teachers complained about the situation.

School C 75% of teachers complained about the situation.

Question #28: Table 11—Complaints from students and/or parents to teachers and principals.

The table above concerning complaints from parents and students shows the following results:

School A 50% of parents and/or students have complained about the situation.

School B 50% of parents and/or students complained about the situation.

School C 75% of parents and/or students complained about the situation.

Analysis of the data collected from Table 11 sufficiently shows that 75% of teachers in School C indicate that parents and/or pupils have complained of poor conditions or poor-quality school environment. It should also be noted that the pupils of this school showed better performance (66) compared to the other two schools (School A 55% and School B 57%).

4.2.2. First Research Question on School Infrastructure

Table 12 shows that the The teachers of all three schools meet assertions number 15 (There are enough classrooms in the school) and number 16 (There is enough furniture and seating for teachers) with very high averages and consistencies.

Table 10. Teachers' complaints to competent school authorities.

	Oui		Non		Observation	
School A	18/36	50%	18/36	50%	50%	Yes
School B	15/36	42%	21/36	58%	42%	Yes
School C	27/36	75%	9/36	25%	75%	Yes

Table 11. Complaints from students and/or parents to teachers and principals.

	Oui		Non		Observation	
School A	18/36	50%	18/36	50%	50%	Yes
School B	18/36	50%	18/36	50%	50%	Yes
School C	27/36	75%	9/36	25%	75%	Yes

Table 12. First Research Question on School Infrastructure.

First Research Question on School Infrastructure—Assertion Numbers	Means	Standard Deviations
Table 4 School A		
15	4.00	0.00
16	4.00	0.00
Table 5 School B		
15	4.00	0.00
16	4.00	0.00
19	1.48	0.67
17	1.25	0.45
22	1.00	0.00
Table 6 School C		
15	4.08	0.29
16	4.00	0.00

The teachers at school B respond to assertions number 17 (Classrooms have enough furniture for students), number 19 (There is a well-equipped library in the school), and number 22 (School has sufficient recreational facilities) with low averages but with very high consistencies.

The results observed above indicate that teachers agree that the environment plays a crucial role in teaching and learning. This corresponds to the statements in the literature.

5. Discussions, Conclusion, and Recommendations

5.1. Discussions

The results of this study highlight several important observations that are critical to determining that school infrastructure has a serious impact on student learning and achievement. The data produced by this study show that there is strong

adherence from all teachers for what they consider to be very important characterized by high and low standard deviations. This finding is consistent with the knowledge presented in the literature.

5.2. Conclusion

This study aims to determine the impact of school infrastructure on student learning and achievement. The results obtained from teachers on assertions 2, 3, 8, 10, 12, 13, and 14 concerning teaching, learning, and student achievement, and numbers 15, 16, 17, 19, and 22 concerning school infrastructure, garnered very high approvals. This sufficiently shows that the school environment and infrastructure are the basis of the results that educators seek as the ultimate goal in their profession: performance, student performance at school, and success in everyday life.

These statistically valid observations indicate that school infrastructure is a necessary condition that should be taken into consideration for any school made available to pupils. School administration authorities should understand the importance of school infrastructure before blaming students' lack of performance in schools and in everyday life simply on teachers and principals. Successful teaching and learning stem from several factors that require radical changes to achieve satisfactory outcomes for the general population.

5.3. The Recommendations

The results of this study suggest that continuous improvement of school infrastructure must be considered and recommended for all schools in order to optimize student achievement and teacher delivery.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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Appendix 1

SURVEY QUESTIONNAIRE

Heads of schools and teachers:

The questionnaire that we are pleased to submit to you has no other claims than those relating to the realization of our study entitled:

Impact of school infrastructure on student learning and achievement: Case of three official schools in the Kinshasa-Ngaliema education division.

We ask for your cooperation and ask you to respond seriously and especially professionally.

The information you provide will allow us to prepare this study and we thank you in advance for any help you would like to give us.

Do not write your name as this survey is completely anonymous.

Instructions

For each question, circle the number that roughly indicates your approval.

1	2	3	4	5
I totally disagree.	I disagree, but not totally.	I do not approve and I do not disapprove.	I agree, but not totally.	I totally agree.

TEACHING—LEARNING—PERFORMANCE

1) Noise interferes with teachers' ability to teach and students' ability to learn.

1　　　　2　　　　3　　　　4　　　　5

2) Classroom noise is of particular concern for students with hearing loss or attention deficits.

1　　　　2　　　　3　　　　4　　　　5

3) Poor air quality contributes to absenteeism, especially among students with asthma.

1　　　　2　　　　3　　　　4　　　　5

4) Poor air quality contributes to lethargy, dry skin and headaches.

1　　　　2　　　　3　　　　4　　　　5

5) Natural lighting boosts the morale of teachers and students.

1　　　　2　　　　3　　　　4　　　　5

6) Lack of sufficient light can increase absences and decrease student achievement.

1　　　　2　　　　3　　　　4　　　　5

7) Temperatures that are too hot or too cold compromise the performance of teachers and students.

1　　　　2　　　　3　　　　4　　　　5

8) Uncomfortable weather hampers teaching and learning.

1　　　　2　　　　3　　　　4　　　　5

9) Classrooms are large enough to allow for diverse teaching and learning.

1　　　　2　　　　3　　　　4　　　　5

10) Classrooms offer flexibility and reconfiguration for effective teaching and

learning.

1   2   3   4   5

11) School districts carefully assess school buildings to determine when aging facilities need major renovation or replacement.

1   2   3   4   5

12) A dirty or poorly maintained building creates an inappropriate teaching and learning environment.

1   2   3   4   5

13) An inappropriate school environment does not allow teachers to teach and students to learn to the best of their abilities.

1   2   3   4   5

14) A dirty, poorly maintained, and unseemly building hinders teaching and learning, and reduces student achievement.

1   2   3   4   5

SCHOOL INFRASTRUCTURE.

15) There are enough classrooms in the school.

1   2   3   4   5

16) There is enough furniture and seating for teachers.

1   2   3   4   5

17) The classrooms have enough furniture for the students.

1   2   3   4   5

18) Labs are well equipped to learn.

1   2   3   4   5

19) There is a well-equipped library in the school.

1   2   3   4   5

20) Adequate teaching materials are available for teaching-learning activities.

1   2   3   4   5

21) The school has adequate health facilities for first aid and emergencies of students.

1   2   3   4   5

22) The school has sufficient recreational facilities.

1   2   3   4   5

23) The school has a very good playground and/or sports.

1   2   3   4   5

24) The school toilets are adequate.

1   2   3   4   5

25) Success in the state examinations of the last three years.

a) 2021 b) 2020 c) 2019 d) average =

26) For how many years has teaching and learning taken place in a low-quality school environment in this school?

a) 1 - 5 ans b) 6 - 10 ans c) 11 - 15 years d) 16 - 20 years

27) Were there complaints from teachers to the relevant school authorities?

a) Yes b) Not

28) Were there complaints from students or parents to teachers and school principals?

a) Yes   b) Not