ISSN: 0975-833X

Available online at http://www.journalcra.com

International Journal of Current Research
Vol. 12, Issue, 06, pp.12045-12052, June, 2020

DOI: https://doi.org/10.24941/ijcr.38875.06.2020

INTERNATIONAL JOURNAL OF CURRENT RESEARCH

RESEARCH ARTICLE

MAINSTREAMING THE SECONDARY SCHOOLS' PHYSICAL ENVIRONMENT IN EDUCATIONAL INSTITUTIONSTO ENHANCE LEARNING OUTCOMES IN: THE CASE OF SECONDARY SCHOOLS IN NAIROBI COUNTY, KENYA, KENYA

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ARTICLE INFO

Article History:
Received 20th March, 2020
Received in revised form
19h April, 2020
Accepted 17th May, 2020
Published online 30th June, 2020

Key Words:
Physical Environment,
Learning Outcomes.

ABSTRACT

Globally, stakeholders in learning institutions have strived to improve schools' physical environments in an attempt to enhance learning outcomes. It is not known whether the physical environment in public secondary schools in Nairobi County have been mainstreamed to positively influence learning outcomes. The objective of the study was to explore the quality of the physical environment in public secondary schools in Nairobi City County, Kenya The study applied a case study design. A sample size of 39 was proportionally allocated by gender and geopolitical location resulting in 9 boys', 12 girls' and 18 mixed schools. A revised Commonwealth Association of Physical Environment questionnaire was used to collect data. The overall average quality of mixed schools' index (126) was lower than that of boys' and girls' schools (134 for both). A framework of funding improvement of school facilities including the building stock and associated infrastructure is proposed.

Citation: ***Dr. Paul Aloyo, Dr. Solomon Mwaniki, Prof. Caleb Mirerii Dr. Peter Kamau, Kamau and Dr. Dennis Karanja.*** **2020.** "Mainstreaming the secondary schools' physical environment in educational institutionsto enhance learning outcomes in: the case of secondary schools in nairobi county, kenya, kenya.", *International Journal of Current Research*, 12, (06), 12045-12052.

INTRODUCTION

In 2000, most countries around the world pledged to achieve, by 2015, the six Education for All (EFA) goals (UNESCO, 2011). The United Nations Educational, Social and Cultural Organization (UNESCO, 2013) believes that the forthtthird goal of its global vision which is to ill ensure that the learning needs of all young people and adults are met through equitable access to appropriate learning and life skills programs. Physical environment of schools remains a focus of study in Europe and America because of the impact that environment has on the learners' learning outcomes (Ruszala, 2008; Vandiver, 2011). However, much remains to be done, especially in Third World countries like Kenya. Provision of education facilities in Kenya is conceptualized along the population in a given area. The location requirements are that secondary schools be along pedestrian networks, within 500-600 metres of walking distance from residential areas. A consistent definition of neighbourhood size is important if consequent school learning infrastructure is to be provided.

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However the XYZ Physical Planning Hhandbook's vacillation between population sizes of 3,500, 5,000 and 8,000 to constitute a neighbourhood gives rise to misunderstandings on the provision of adequate learning spaces in secondary schools. However, the reality is different. How can the demand for more land for school facilities to cater for the increasing population in urban centers be met despite the non-finite urban boundaries? The average land use allocation to education in urban centers in Kenya is 9.4%. The allocation in urban areas is lowest in Thika Town at 2.0% and highest in Kitale Town at 20.3%. Shrinking of allocations is attributed to annexation for non-educational uses (Ikawa, 2014). In Nairobi City County, only 0.56% of the land is allocated for education facilities. According to the Dakar Framework for Action (UNESCO, 2000), socio-economic progress, durable peace and sustainable development for the African people will hinge on the success of their education systems. Part of the strategy to achieve this vision in Africa is to devote attention to the development of social learning environments that are feasible and sustainable in the local context of the learner. Learning environments must be safe, intellectually stimulating, must have pedagogy based on a learner-centered approach, and democratic values and practices in the teaching-learning interaction. In light of this ambition, the paper explores the quality of the physical

environment in public secondary schools in Nairobi City County, Kenya.

Measuring the School Environment

METHODOLOGY

A case study research design was adopted. There are 72 public secondary schools in Nairobi City County. The number of boys', girls' and mixed schools are 18, 22 and 32, respectively. The sample size was estimated as follows:

$$n = (Nz\text{^}2\ pq) / (E\text{^}2\ (N-1) + z\text{^}2\ pq)$$

n = (72x1.645x1.645x0.05x0.95) / (0.04x0.04x71 + 1.645x1.645x0.05x0.95) = 38.22
n = 39 schools

Where:

n = Minimum sample size
N = Population size = 72 schools
z = Confidence level at 90% (z value = 1.645)
p = Proportion of events in population (5%)
q = Proportion of non-events in population (95%)
E = Accuracy of sample proportions (4%)

A three-step sampling process was used. First schools were classified into girls, secondary and boys schools followed by stratification into geopolitical divisions of Nairobi City County.. The third step was to proportionally allocate the sample size by gender and geopolitical location through random sampling. . T he distribution of the schools was as follows; 9 boys, 12 girls and 18 mixed schools. Primary data were collected using interviewer-administered questionnaires, resource persons' interviews, and the observation of the physical environment.

The Commonwealth Assessment Physical Environment (CAPE) questionnaire was designed after a review of literature on facility assessment instruments (Cash, 1993). A modified CAPE instrument was adopted for its appropriateness in the Kenya context. The variables studied under the external environment included age, area and size of the school, land tenure, master planning, consultants, maintenance, missing facilities, entrances, wayfinding, pleasant aesthetics, security, social spaces, green environment, school ground conditions, exterior wall painting, disaster preparedness, earth tremors and earthquakes, relief and topography and wind interferences. Secondary information was drawn from research journals, books, dissertation and reports.

RESEARCH FINDINGS AND DISCUSSION

Extent of sufficiency of Scschool land sizes, of School Land topography, school grounds, external and green environment. One of the most paramount assets any institution has is the land on which physical infrastructures are put-on. Most of the schools (40.0%) surveyed had an area of less than 4.5 hectares, while only 20% were built on over 13.5 hectares of land. The acreage in boys' schools was larger than that in girls' and mixed schools; with 37.5% of boys' schools built on more than 13.5 hectares, compared to 14.3% and 12.5% for% for mixed and girls' schools, respectively (Table 1.0).

Two approaches to the meaning of school size are commonly adopted. Size may simply refer to the total number of students attending a school. It may, in addition, refer to the geospatial size location of a school at a given date. The second approach is largely found amongst small school advocates. It views school size as a combination of the number of students, the physical size of school buildings, a particular set of values with decision-making practices, and a particular culture (Muir, 2000; Tasker, 2003). Muir (2000) supports the development of small schools whereas Tasker (2003) prefers smaller structures in secondary schools. Both approaches are evident in the provisions for planning school facilities in Nairobi City County. The first approach is based on land acreage and requires secondary schools to have more land than primary schools. Extra land is needed for science laboratories, workshops, assembly halls and playgrounds, and provision for future growth. where there are land constraints, these may be met through construction of high rise school facilities such as classes, offices and dormitories. The minimum area required for single, double and triple stream mixed secondary schools of forms one to four is 3.4, 3.5 and 4.5 hectares respectively. A circulation space per pupil of 6m2 and playfields should be provided. In schools where Agriculture is taught, additional land, estimated at 10% of the above minimum space requirements, should be added. Sharing of sports facilities is encouraged as long as there are no adverse effects offsetting accruing benefits.

The second approach, that hinges school size on population of the students, is more popular among education practitioners. Bloom, Thompson and Unterman's (2010) findings show sustained positive effects of school size on student achievement. Similarly, Schwarte, Strefel and Wiswall (2011), using an instrumental variable approach to provide a rigorous evaluation of school size reforms in New York City, found that newly established small high schools have strong positive effects on student performance. In Nairobi City County, for a boarding school, 1 acre(acre (0.4 hectares) of land should be provided for every 200 pupils to cater for dining halls and dormitories. This minimum acreage assumes an average of 40 students per class. Since all schools expand, even if a school starts off as single stream, it should be allocated at least 6.9 hectares in anticipation of expansion. The maximum size of a school is limited to 480 pupils to avoid the risk of congestion. Each school should therefore be developed to a triple stream capacity. Secondary school facilities in Kenya include an administration centre, classrooms, halls, libraries, laboratories and workshops, dining facilities and canteens, sanitation facilities, car parks, and support facilities such as staff housing. In cases where teachers and other staff are accommodated within school grounds, an additional 2.5 acres should be provided. For boarding schools, 1 acre for every 200 pupils should be added. To forestall the problem of land shortage, a single stream should be allocated 6.9 hectares, in anticipation of school expansion.

According to the provided guidelines, a paltry 9.1% of secondary schools meet the planning requirements of at least 6.9 hectares. One reason for non-adherence to school land size requirements is the policy of creating secondary schools from primary schools. Thus, the size of land in primary schools is diminished and the land requirements for secondary schools are not met. A second observation is the diminishing public school land due to annexation by private interests, as explained by the political economic theory (Ikawa, 2014).

Table 1: Acreage of school

Category	Boys	Girls (%)	Mixed	Total
Less than 4.5 ha	3(373.35%)	5(55.662.5%)	4(28.6%)	2212(40.066.7%)
Between 4.5 to 9 ha	1(11.112.5%)	2(22.225.0%)	5(35.7%)	83(26.79.1%)
Between 9 to 13.5 ha	1(11.112.5%)	0 (0)	3(21.4%)	41(3.013.3%)
Over 13.5 ha	3(373.53%)	1(11.112.5%)	2(14.3%)	64(12.1%)20%

Table 1. The extent of and sufficiency of school land sizes Sufficiency of the school environment

Characteristic	Boys		Girls		Mixed		Total	
	No.	(%)	No.	(%)	No.	(%)	No.	(%)
Acreage of school								
Less than 4.5 ha	3	(37.5)	5	(62.5)	4	(28.6)	12	(40.0)
Between 4.5 to 9 ha	1	(12.5)	2	(25.0)	5	(35.7)	8	(26.7)
Between 9 to 13.5 ha	1	(12.5)	-	-	3	(21.4)	4	(13.3)
Over 13.5 ha	3	(37.5)	1	(12.5)	2	(14.3)	6	(20.0)
Influence of topography on school development								
Yes	_			-		-		-
Yes, especially the development of buildings	1	(1̄.1)	1	(11.1)	1	(7.1)	3	(9.4)
No	8	(88.9)	8	(88.9)	13	(92.9)	29	(90.6)
Condition of the school grounds								
No landscaping, and sidewalks damaged	1	(11.1)	-	-	1	(7.1)	2	(6.2)
Parts of the school are landscaped, others not	3	(33.3)	2	(22.2)	3	(21.4)	8	(25.0)
Most school is landscaped, maintenance poor	-	-	1	(11.1)	3	(21.4)	4	(12.5)
Landscape attractive and well maintained	5	(55.6)	6	(66.7)	7	(50.0)	18	(56.2)
Social spaces in the external environment								
No	-	-	1	(11.1%)	2	(14.3%)	3	(9.1)
No, but the administration is creating some	-	-		-	-	-	-	-
Yes, but inadequate	-	-	2	(22.2)	5	(35.7)	7	(21.2)
Yes	9	(100)	6	(66.7)	7	(50.0)	22	(66.7)
Trees and other green environments adjacent to the buildings								
No	-	-	-	-	-	-	-	-
No, but school plans to plant	-	-	-	-	-	-	-	-
Yes, but inadequate	-	-	2	(22.2)	5	(35.7)	7	(21.2)
Yes	9	(100)	7	(77.8)	9	(64.3)	25	(75.8)

Table 2. The status of schools land security of tenure, master planning and consultant involvement

Characteristic	Boys		Girls		Mixed		Total	
	No.	(%)	No.	(%)	No.	(%)	No.	(%)
Security of tenure								
No	1	(11.1)	1	(11.1)	1	(7.1)	3	(9.1)
No, yet to start processing title	-	-	-	-	-	-	-	-
No, but processing one	1	(11.1)	1	(11.1)	2	(14.3)	4	(12.1)
Yes	7	(77.8)	6	(66.7)	10	(71.4)	23	(69.7)
Master plan for school development								
No	-	-	-	-	1	(7.1)	1	(3.0)
No, but developing one	-	-	1	(11.1)	-	-	1	(3.0)
Yes, but it is outdated	1	(11.1)	2	(22.2)	-	-	3	(9.1)
Yes	8	(88.9)	5	(55.6)	13	(92.9)	26	(78.8)
Consultant involvement in planning infrastructure development								
No	-	-	-	-	-	-	-	-
Sometimes	1	(11.1)	1	(11.1)	2	(14.3)	4	(12.1)
Most times	-	-	7	(77.8)	3	(21.4)	4	(12.1)
Yes	8	(88.9)	-	-	9	(64.3)	24	(72.7)

The percentages are based on the total number of respondents

Politics intertwines with economic structures in Nairobi City County in the process of capital accumulation, which includes annexing of public school land. This was particularly rampant in the 1990's in Kenya (Ikawa, 2014) ibid). Similarly Omole and Owoeye (2012) have documented illegal encroachment onto secondary school land by speculators. Since schools were barely meeting size requirements and student enrolment was on the rise beyond the triple stream recommended, a positive response for crowding was expected. This was not the case in the study. In Nairobi City County access to the public secondary school system overrides the concept of overcrowding in the facilities. Students are not required to attend public schools based on the geographical location of their residence, giving them the flexibility to move to different public schools in case they feel a school is overcrowded. Nevertheless, increase in school size presents other problems. Parents often feel that large schools are less personal, fearing that children would be lost in the system. However, larger schools are more likely to have a good range of sporting, musical and other activities to draw on than smaller schools (Bishton, 2011). It must be noted however that there is no consensus on how to define a small school and, by extension, the ideal school. SLee and Loeb (2000), for example, define small schools areas those with fewer than 400 students and large schools as those with more than 750 students. The Gates Foundation on the other hand recommends no more than 100

Table 4: Adequacy of facilities for learning

Characteristic	Boys		Girls		Mixed		Total	
	No.	(%)	No.	(%)	No.	(%)	No.	(%)
Visual pleasantness of the school								
No	-	-	-	-	1	(7.1)	1	(3.0)
No, but improvements are underway	1	(11.1)	-	-	-	-	1	(3.0)
Yes, especially the external environment	-	-	-	-	2	(14.3)	2	(6.1)
Yes	8	(88.9)	9	(100)	11	(78.6)	28	(84.8)
Adequacy of facilities								
No	2	(22.2)	3	(33.3)	1	(7.1)	6	(18.2)
Yes, but in the process of planning & designing them	3	(33.3)	3	(33.3)	10	(71.4)	16	(48.5)
Yes, but in the process of building	3	(33.3)	2	(22.2)	3	(21.4)	8	(24.2)
Yes, nothing being done about it	1	(11.1)	-	-	-	-	1	(3.0)
Accessing exits and entrances								
No	-	-	-	-	-	-	-	-
Some are hidden	-	-	1	(11.1)	-	-	1	(3.0)
Most are Visible	1	(11.1)	-	-	4	(28.6)	5	(15.2)
Yes, all are accessible	8	(88.9)	8	(88.9)	10	(71.4)	26	(78.8)
Spatial orientation of school facilities								
No	-	-	-	-	-	-	-	-
No, but improvements are underway	1	(11.1)	2	(22.2)	6	(42.9)	9	(27.3)
Yes, but students don't use the new routes	-	-	-	-	2	(14.3)	2	(6.1)
Yes	8	(88.9)	7	(77.8)	6	(42.9)	21	(63.6)

The percentages are based on the total number of respondents

students per grade level, corresponding to 400 students for a typical school comprising of grades 9 to 12 (Vander Ark, 2002). A proposal from the United States Department of Education sets a limit of 300 students through its Small School Initiative (US Department of Education, 2006). Lee and Smith (1997) advocated tha. Tt the ideal high school should enroll between 600 andto 900 students. For purposes of this study, three key take-aways emergeare aing pparent from the foregoing discussion for policy and decision makers deliberating over the efficacy of school size. The first is that school size matters, whether it is conceived in terms of land acreage or the number of students. Conditional on average achievement and time invariant characteristics of a student, math scores are impacted by the size of school a student attends (Egalite and Kisida, 2013). The second take-away is that school matters most in the older grades where the schools are typically larger and students are not confined to a classroom most of the day. The high school student in Nairobi City County fits in this category. A final take-away is that non-ordered and ad-hoc school reforms complicate the application of the planning land standards with regard to the appropriate size of schools in Nairobi City County.

Terrain of School Land: The study sought to find out the extent to which school land terrain could have hindered the development of the schools' physical structure. The results show that physical factors like relief and topography did not hinder the development of 90.6% of the schools surveyed. However, in 6.1% of the cases, a hindrance to the development of buildings was noted (Table 1). In one of the Secondary School severe flooding is experienced when it rains. The school is located in the eastern region of Nairobi City County, which is a relatively flat expanse next to a river that is blocked by solid waste from the low income settlements adjacent to the school. School sites should be sufficiently elevated to avoid drainage from surrounding areas and the land adequately pitched to shed its own surface water quickly. Areas that recorded difficulty in the development of school infrastructure were at the intersection of the elevated portion and where the plains start. Excessive cuts and fills become an unavoidable but difficult method of construction. Areas of excessive rock outcrops are undesirable because of associated high cost of construction. Rock excavation for foundations and service lines are expensive in such areas. However, occasional rock outcroppings and uneven surfaces, in an otherwise excellent site, need not count too heavily against it. These minor shortcomings may often be easily corrected or even turned to advantageous use through imaginative site design, thereby contributing to student achievement. The climate in Nairobi City County as well as its geology and soils is are conducive for the growth of plants. These environments can be further improved through a systematic landscape design program that adds value to the learning process. The importance of green environments within a school setting cannot be denied. Green environments impact student self-esteem and attitude. Yarborough (2001) opines that green environments create opportunities for learning which in turn influence student achievement.

The Status of schools' land security of tenure Security of Tenure Most of the schools surveyed (69.7%) had title deeds. Only 9.1% of the schools investigated did not have a title deed. However, there was indication that the process of acquiring a title deed was ongoing for schools that did not have one (Table 2.). Land tenure constitutes a web of interests on land. First is intersecting interests where there is shared claim to land. Second is overriding interests where a sovereign power has authority to allocate or reallocate land through expropriation. Third is overlapping interests when several parties are allocated different rights to the same parcel of land. Finally, complementing interest exist when different parties share the same interest in one parcel of land and competing interests when different parties contest the same interests in the same parcel of land. The case in public secondary schools in Nairobi City County oscillates between the overlapping and complementing interests. The Education Act 2013 tries to provide for competing interests on land by including religious, local government and national government interests in the provision of school infrastructure. The insecurity of the land tenure has led to the loss of school land to developers, to the extent that all schools were required to have title deeds by the end of 2015. The mismatch between the stated acreage on the survey map and the actual size should be eliminated through the use of the geographic information systems (GIS). technologies for surveying and record keeping.

Security of tenure directly correlates to the development of school facilities hence influences student achievement.

Development of a School Master Plan: The study noted that 78.8% of the schools polled had a master plan for development. However, of the girls' schools, only 55.6% were found to have one. This is low compared to the 92.9% of mixed schools and 88.9% of boys' schools that had developed a plan (Table 2.). The purpose of a facility master plan is to provide a valuable, fact-based planning tool for future facility-related decision making that is consistent with and supportive of the academic mission. It sets a logical course for capital improvements and facility management initiatives over a period of many years. Such a plan is a living document that supersedes the previous existing plan frameworks and should be re-examined and updated on a two-year review cycle. The improvements and development of school infrastructure occasioned by a good school master plan leads to better student attainment. Professional Involvement in Preparation of School Master Plans. Results showed that on average, 72.7% of the schools considered had the help of consultants in planning the facilities. Professionals were engaged in planning school facilities in 88.9% and 64.3% of the boys' and girls' schools respectively (Table 1). The Nairobi City County government has a building and facility approval process and it is therefore expected that the development of or alterations to the school built environment is appreciated and upheld by professionals. No school, it is presumed, should undertake any construction without approval from the relevant departments of Nairobi City County.

An account for this anomaly may be attributed to the fact that public schools, being government controlled, need not apply the development guidelines to the design and management of school facilities. Such laxity in the design and supervision of school facilities results in poor quality of school infrastructure. Lessons from Singapore's Ministry of Education, where a project development and management department manages school infrastructure, are insightful to solve this problem. In addition to managing facilities in schools, the department has a research and procurement section that aids in the sourcing of new technologies for construction as well as bulk procurement of items for schools (Ministry of Education Singapore, 2014). Built environment professionals focused on the development of school facilities within the education department should be engaged by the Nairobi City County. Building Education Success Together (BEST), a collaboration of experienced school facility and community based groups, recommend that school development should not be left to the so-called expert consultants alone. Public participation must be increased in facility planning and thus enable schools to be centrescenters of community (BEST, 2005). Such an approach is now a key component requirement in the Constitution of Kenya, (Republic of Kenya, 2010), thus reducing the expert know-it-all approach. An inclusive and broad based approach to planning new and existing facilities will of course require the inclusion of other professionals like environmentalists and sociologists who hitherto have been marginally involved in school facility planning.

The Status of maintenance of school buildings

Age of School Buildings: The study found that on average, 46.4% of public secondary school facilities in Nairobi City County are between 30 and 39 years old. The average age of school facilities in girls' schools within this age constituted 71.4% of the building stock, compared to those of the boys' schools at 57.1% and 28.6% in mixed schools. Of the school building stock, only 7.1% has been constructed over the last 10 years (Table 3). The percentages are based on the total number of respondents. In a study by Bullock (2007), students arwere found to perform better in schools with buildings aged less than 19 years compared to schools which had buildings over 40 years. Lewis (2001) noted that reading scores are the single most accurate indicators of the ability to do academic work and are influenced positively by newer buildings. Other studies concur that students in newer buildings perform at a higher level than those in older buildings (Cash, 1993; Hines, Earthman and Lemasters, 1996; Stevenson, 2001; O'Neill, 2001). Older buildings usually do not have the main attributes of a modern building that are associated with a positive physical environment conducive for learning like the provision that allows a wide use of technology. An obvious implication is the need to modernize the school building stock for public secondary schools in Nairobi City County where the age of buildings in many schools is approaching the 40 year mark.

Maintenance of School Buildings: Of respondents surveyed, 72.7% indicated that a plan that prioritizes maintenance of buildings was in place. Girls' and mixed schools recorded a lower preparation in maintenance works as shown by 66.7% and 64.3% of the responses respectively. A 100% response rate indicated the readiness of boys' schools to deal with maintenance problems that arose (Table 3). The Draft National Building Maintenance Policy of 2011 anchors its provisions for maintenance in the Constitution of Kenya (Republic of Kenya, 2010) which emphasizes the need for a clean environment and adequate housing as a right of every citizen. The policy statement requires the establishment of an elaborate inventory of the building stock. A system of undertaking planned and periodic surveys of buildings is also made mandatory. These provisions are meant to deal with the sick building syndrome, which is defined as unhealthy and unsafe, dilapidated and decayed building environments. Such environments degrade the quality of life and contribute to poor health, low productivity and antisocial behaviour. Within the school context, the sick building syndrome negatively affects student performance.

Eshiwani (1993) argued that the cheapest and most available materials should be used in constructing school facilities. This outlook must be contextualized, as the foremost requirement then was to offer many school facilities and therefore less emphasis was made laid on the provision of quality school building stock. Challenges related to facility management and life cycles were immaterial, their impact on student learning notwithstanding. Colgan (2003) reflected this view when he noted that whenever there is a heightened need for school buildings, especially due to a rapidly expanding population, the resulting constructions are often inexpensive and inadequate. Glass (1990) suggested five phases that constitute the school infrastructure life cycle. In the first 20 years of a building's life, the maintenance costs are normally limited to minor repairs and small improvements to reflect changes in the instructional programme. In the next period, between 20 and 30 years, the facilities require increasing amounts of annual maintenance and frequent replacement of worn out equipment. From 30 to 40 years, the need for general maintenance increases rapidly.

Most of the original equipment should be replaced, and major items such as roofs and lighting fixtures also need replacement during this period. The time of accelerated deterioration is between 40 and 50 years. In most instances, the neighbouring communities to schools have changed and the school may no longer be located in an area where there are children. Buildings in this phase may be too new to abandon if they were well constructed, but too old to provide an effective learning environment. Beyond 50 years, the buildings should either be completely reconstructed or abandoned. The age of buildings, is inevitably associated with deterioration of school facilities (Honeyman and Sayles, 1995). The 10-year phases afford a user friendly timeline on which a maintenance programme in girls' and boys' schools in Nairobi City County should be developed. Even with maintenance programmes in place, education today is delivered in an entirely new manner, with new tools, techniques and teaching methods that do not fit into the old patterns of school design (Lyons, 2001).

Ott (1976) noted that school administration should be sensitive to the needs of teachers during renovations and suggested the involvement of stakeholders in the planning process of renovation to reduce stress levels among students and teachers and improving their self-esteem in the process. The Portuguese government launched a policy to rehabilitate 332 secondary schools in 2007, with a total investment of 2.45 billion Euros for the first 205 schools. There were three principal concerns in relation to the school building stock. First was physical deterioration. Second was poor environmental standards in terms of energy performance, environmental comfort and sanitary standards. Finally, the buildings were functionally inadequate for teaching (Blyth et al., 2007). The lesson is that there reaches a point when the need for massive capital improvements and renovations in school infrastructure are necessary and become inevitable.

Painting of Exterior Walls and Window Frames: Painting is considered a cost effective means of improving the visual aesthetics of school infrastructure. Table 3 below shows the status of paintwork to external walls and window frames. It is apparent from the table that; in Nairobi City County, 100% and 96.8% of the respondents probed noted that the school external walls had received a coat of paint in the last 10 years. The window frames had also been painted over this duration in 96.8% of the school surveyed (Table 3).

Ruszala (2008) and Yarborough (2001) pointed out that building practitioners should consider the colour of paint on new or existing buildings as it contributes to teacher satisfaction in high schools thereby positively impacting on student achievement. However it should be noted that many materials release volatile organic compounds (VOCs), paint being one of the worst offenders. Paint often contains harmful chemicals, including heavy metals. Emissions from VOCs and other substances in paint irritate the eyes, nose, throat or skin. They also cause headaches, dizziness or nausea. Some substances in paint cause kidney or liver damage. Paint used to be even more dangerous when it contained lead, which causes numerous health problems, including memory loss, learning difficulties and cancer. Lead was banned as an ingredient in paint in 1978. However, schools built before then have old layers of lead paint. When walls or ceilings are scraped to prepare for a new coat of paint, this older lead paint is exposed. When painters are not careful, lead dust or paint chips escape into the air.

Impact of Wind Interference on School Infrastructure: As for the constraining possible effects of wind, 93.3% of the respondents surveyed recorded that this was not a problem in the development of school infrastructure. Problems associated with wind were experienced in 7.1% of the mixed schools (Table 31.12). Wind creates inward and outward acting pressure on building surfaces, depending on the orientation of the surface. Such orientation may be flat, vertical or low sloping in nature. As the wind moves over and around the building, the outward-acting pressure increases as the building geometry forces the wind to change direction. As pressure increases, uplift is created on parts of the building, forcing the building parts to fail if they are too weak to resist the wind loads. When wind forces its way inside or creates an opening by breaking a window or penetrating the roof or walls, the pressures on the building increase even more. Heavy building materials, for example reinforced masonry or concrete, that are well tied to all other building components often survive extreme winds. The weight of these materials helps resist uplift and lateral loads. They also tend to stop windborne debris that can increase damage to the building and pose danger to occupants. However, heavy concrete roof panels and heavy masonry walls that are not adequately connected or reinforced, fail during severe winds. The study found that schools in Nairobi City County used stone and reinforced concrete as a main construction materialsas main construction materials;; hence neither wind speed, nor wind direction adversely affected the building stock. Building shapes that 'catch' the wind, such as overhangs, canopies, and eaves, tend to fail and become 'sails' in extreme winds. Flat roofs can be lifted off when the wind flows over them. The extreme winds pick up and carry debris from damaged buildings and objects located in their path. Even heavy, massive objects such as cars, tractor trailers, and buses are moved by extreme winds and cause collateral damage to buildings. Light objects become flying debris, or missiles, that penetrate doors, walls, and roofs. Heavier objects roll and cause crushing-type dam-age. Winds also carry minute particles and gases. Should the openings face the windward direction, irritants such as smoke and odoursodors distract students thus lowering their performance. An example was found at Kamukunji Secondary School where the cannabis sativa fetor from the neighbouring Jua Kali sheds affected student concentration.

Adequacy of facilities for learning

Pleasantness of School Facilities

The respondents surveyed were consistent in their view that their school environments were pleasant to look at. At an average of 84.8%, school facilities were aesthetically attractive. Only 3%, a small percentage, said that their schools were displeasing (Table 1.134). The Vernon and Greenberger's (1978) aesthetic theory on vandalism in schools proposesd that variables accounting for the enjoyment associated with socially acceptable aesthetic experiences are similarly responsible for the pleasure associated with acts of destruction. Aesthetic variables that bring pleasure serve as discriminative stimuli for destructive behaviour. Ruinous behaviour among students targets school facilities for destruction, leading to a decline in student achievement.

Adequacy of Facilities for Learning: Of the schools surveyed, 48.5% reported that not all facilities required for a public secondary school were available. In 11% of the boys'

schools, respondents indicated that nothing was being done to alleviate the problem of missing school facilities (Table 4). The Physical Planning Handbook (Republic of Kenya, 2012) indicates that a secondary school should have the following accommodation requirements: an administration block, classrooms, a multi-purpose hall, a library, laboratories, a workshop, a canteen, a car park, staff quarters, sanitation facilities and playfields. They constitute the minimum spatial requirements for a public secondary school. However, the guidelines are silent on the provision of a health facility. The findings of inadequate facilities are attributed to underfunding, where funding has not increased proportionately with increasing student enrolments in public secondary schools. These findings are similar to a study of the Status of Missing Physical Facilities in Government Schools of Punjab (Saeed and Wain, 2011). The study had investigated the missing physical facilities and actual needs of the public sector schools of Punjab Province in Pakistan.

The survey revealed majority of schools had problems such as shortage of furniture, lack of Science, Maths, Computer and English teachers, inadequate information technology facilities, shortage of classrooms, inadequate light in the classrooms, and inadequate toilet facilities. A dire need for school improvement in terms of missing physical facilities to meet the learning needs of the students was proposed in Punjab. Stevenson (undated) was able to link missing facilities in schools to student achievement especially lack of storage and laboratory spaces.

Accessing School Facilities: Entrances and exits to the school were easily identified, as indicated by 78.8% of respondents surveyed. In 11.1% of the girls' schools, however, they were hidden and not easily identifiable (Table 4). For example, from the road, the entrance of Jamhuri Secondary School is partly hidden from view due to the encroachment of various land uses on the road reserve next to the school. The Building Code provides the requirements of ingress and egress of all public school buildings thereby predetermining the safety and welfare of occupants. The number and sizes of such exits shall be calculated using a formula that takes into consideration the number of persons and population density of users. The formula is mathematically modeled as:

A = Z x Floor area in sq. ft./ E x B x C x D

Where:

A = Number of units of exit width required
B = Construction of buildings
C = Arrangement and protection of stairs
D = Exposure hazards
E = A factor dependent upon height of floor above or below ground level

A lacuna exists in the guidelines as to the adequate number of access points to the neighbourhood from the school. Controlling access to and from the school is closely related to territoriality leading to the communal ownership of the school. It also acts as natural surveillance along the school fence. However, too many entry points may achieve the reverse, especially in a community where there are incidences of drug abuse and other vices. The design principles of access control on school grounds rely on physical barriers such as the strategic placement of gates. Limited access points allow school personnel to better monitor the comings and goings of individuals during school hours. For example, the main entry to a school can directly funnel people into administration offices, helping to monitor visitor access. The end result is a decrease in the disruption of the learning process.

Spatial Orientation in School Facilities: It was easier to find one's way around boys' schools than around mixed schools, as indicated by 88.9% and 92.9% of respondents, respectively. Girls had a 55.6% response rate on the ease of finding their way in schools (Table 4). An explanation for the discrepancies noted above could be that in mixed schools, there exists a challenge concerning the activities that boys and girls can engage in together in terms of both time and space. Students found by school administrators in the wrong place at the wrong time probably accounts for the problem of way finding. Weisman (1981) posited that the geometric and configuration features of an environment influence human orientation and navigation.

He identified four classes of environmental variables shaping way finding situations: visual access, degree of architectural differentiation, the use of signs and numbers and floor plan configuration. Best (1970) had earlier pioneered a study on indoor navigation where he identified fundamental aspects of a building's route network, like choice points, directional changes and distances as relevant predicators of spatial orientation in complex buildings. The observations in the study are at odds with findings that expect regular users of facilities to easily navigate themthose (Hölscher et al., 2005). In any case the sizes of schools were neither too large nor too complex for cognition by secondary school going students. The apparent contradiction can be resolved by vacating the idea that cognition of the school environment remains constant among the boys whether they are apart or together. Spatial orientation encourages a sense of ownership of the school environment and hence less incidences of vandalism.

Conclusions and recommendation

The study concludes that the external environment of school infrastructure is on the decline, and may negatively impact learning outcomes. Reasons for this trend in the deterioration and subsequent decline of quality of the building stock in public secondary schools was attributed to the age of the school facilities, use of substandard building materials, inadequate funding and a non-targeted policy framework for school infrastructure development. With the governments' implementation of full transition into secondary from primary school, it is clear schools will face unsettling immediate impacts and more longterm implications in provision of building stock and school infrastructure in general, and more specifically implications for positive learning outcomes. The study proposes two approaches in the funding of the development of school infrastructure. The first approach is to design funding policies funding with specific reference to children from poor regions of Nairobi City County so as to upgrade their facilities to standards that are acceptably high, thereby leveling the playing field in so far as school infrastructure is concerned among secondary going students. A second alternative is to base public allocations to schools on need (Watkins and Alemayehu, 2012). The greater the need for school infrastructure development, the more the resources assigned. A logical starting point is to document, using a tracking tool, the cost of all degraded aspects in the school physical environment that require repair. Developed within a medium and long term maintenance program, the physical

facilities should be restored and ultimately replaced with new infrastructure in a systematic manner.

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