REFLECTIONS ON THE IMPACT OF TROPICAL MODERNISM ON AFRICAN PRIMARY SCHOOLS

A comparison of two schools in Sub-Saharan Africa

Emmanuella Ama Codjoe, Justicia Caesaria Tegyeka Kiconco

ABSTRACT: The architectural design of educational spaces in Sub-Saharan Africa after the 1950s was heavily influenced by Tropical Modernism, an architectural style that rose to prominence in Africa during the period of independence movements across the continent. Notably, in growing independent countries such as Rwanda and Ghana, educational buildings assumed profound symbolic significance as tangible representations of progress and development. This article explores the architecture of two primary schools, École Belge in Kigali, Rwanda and Republic Road School in Tema, Ghana. It highlights the role of standardization as well as the role of landscape and climate responsiveness in school designs and today's impact of the school buildings on their respective communities. The two schools in Ghana and Rwanda were selected in order to draw on themes related to Anglophone and Francophone colonial influences. Through site visits and document analysis, general conclusions were drawn to describe how two schools built at the same time but in completely different parts of Sub-Saharan Africa are very similar and yet so different.

KEYWORDS: primary school education, tropical modernism, standardization and modularity, Rwanda and Ghana, climate responsiveness.

INTRODUCTION: Unlike most schools today, educational spaces in precolonial East and West Africa were not confined to designated structures. Later, they transitioned into specific wattle and daub structures, typically made of a framework of woven branches covered with a mixture of mud, clay, and other locally available materials. During the era of colonial rule, various missionaries or religious denominations set up camps to establish mission stations, which included churches, schools, and dispensaries for the purposes of Evangelism and community development (Uduku, 2018).

After the historic 1884 Berlin conference, at which Africa was divided into colonies (Chamberlin, 2014), the European powers started establishing institutional infrastructures such as schools in their major cities and towns; funds were set aside to finance the construction of these buildings. The establishment of colonial schools aimed to supplement the missionary schools (Uduku, 2018); the purpose of these schools was to raise a workforce to run economic and social development projects, as well as occupy administrative positions in the colonies.

The Western educational systems introduced by the Europeans brought about changes in the physical manifestation of educational spaces. According to Uduku (2018, 37), this inspired the establishment of "colonial" schools that had improved permanency due to the use of "modern" materials, which lasted longer and required less maintenance unlike the traditional thatch and mud. The architectural designs of these colonial schools were largely modeled after European standards, with little consideration for the local environmental conditions and appropriate building materials. It was not until the 1940s and 1950s that colonial 'tropical' school design in Africa began to consider environmental conditions and building with appropriate materials (Uduku, 2018; De Raedt, 2014).

The mid-20th century, 'the era of independence in Africa' (Meredith, 2011), specifically from the 1950s to the 1970s, marked the emergence of Tropical Architecture (Fry & Drew, 1964). The era witnessed a surge in the design and construction of schools with a new modernist style, influenced by various factors, including the emerging

UNESCO international school design guidelines and the involvement of transnational architects. These architects from diverse contexts and backgrounds embraced this opportunity to transfer their expertise by spreading their unique modernization concepts across the continent (De Raedt, 2014). As a result, some standardized schools based on tropical modernist principles stemmed from the need for quality and rapid construction. Standardization, emphasizing regularity and repetition, "offered an efficient design that improved construction and provided cost certainty" (Pasquire & Gibb, 2002). Decades after independence in Ghana and Rwanda, many educational spaces designed with tropical modernist principles are still in use and thriving.

ÉCOLE BELGE (NORRSKEN KIGALI HOUSE), KIGALI

In Rwanda, educational spaces first started to develop at the beginning of the last century. Prior to 1900, education in Rwanda was primarily informal, relying on family and 'Amatorero' training schools (Galvin, 2017) to teach various skills such as military training, craftsmanship, and pottery. However, after 1933, which led to the classification of the population along ethnic and racial lines in the Belgian census (Galvin, 2017), Western education gained popularity by providing educated Rwandans with basic skills to occupy administrative positions under the Belgian colonial government. Due to the limited availability of informationon twentieth-century architecture in Central Africa (Lagae, 2003), Congo Belge (now the Democratic Republic of Congo) was referenced to gain insights into education and Tropical Modernist schools. The education policy in Congo Belge notably influenced the education practices in Ruanda-Urundi (now Rwanda and Burundi) (Bud, 2020). In 1948, primary schools underwent reform in Congo Belge and Ruanda-Urundi; the education system in Rwanda was highly exclusive and favored those who completed education in these schools. The primary school reforms aimed to standardize and enhance the overall educational system and school infrastructure in the region.

During the post-colonial era in Belgian colonies in Africa, renowned architects like John de Bosch Kempler, responsible for UNESCO's school construction, and Eugenio Palumbo, who arrived in Congo in 1962, were involved in constructing primary schools (De Raedt, 2014). These schools, following the principles of tropical modernist architecture, went beyond addressing climate concerns and aimed to address the complex reality of education and school construction in Africa. The knowledge gained from these endeavors was shared through Regional Centers, resulting in standardized modules for primary schools that were adapted to local context and climate, as in the case of École Belge in Rwanda. However, after Rwanda gained independence in 1962, the government shifted its focus to increasing primary education access by making it free for all. In 1965, in this climate of independence, École Belge was constructed and established for Belgian children. Consequently, discrimination in Rwanda's education system continued after independence, with limited opportunities and a quota system favoring social group and location. By 1975, primary school enrolment had significantly increased to 386,000 children, compared to 250,000 at the time of independence (Wolhuter, 2014). Following the devastating impact of the 1994 genocide against the Tutsi, the educational system and school infrastructure were left in ruins, causing a significant loss of human resources (Byanafashe & Rutayisire, 2016). In response, a crucial post-conflict education policy was implemented to restore the educational system. As a result, primary schools reopened after the genocide, leading to a substantial increase in access to education, now education for all.

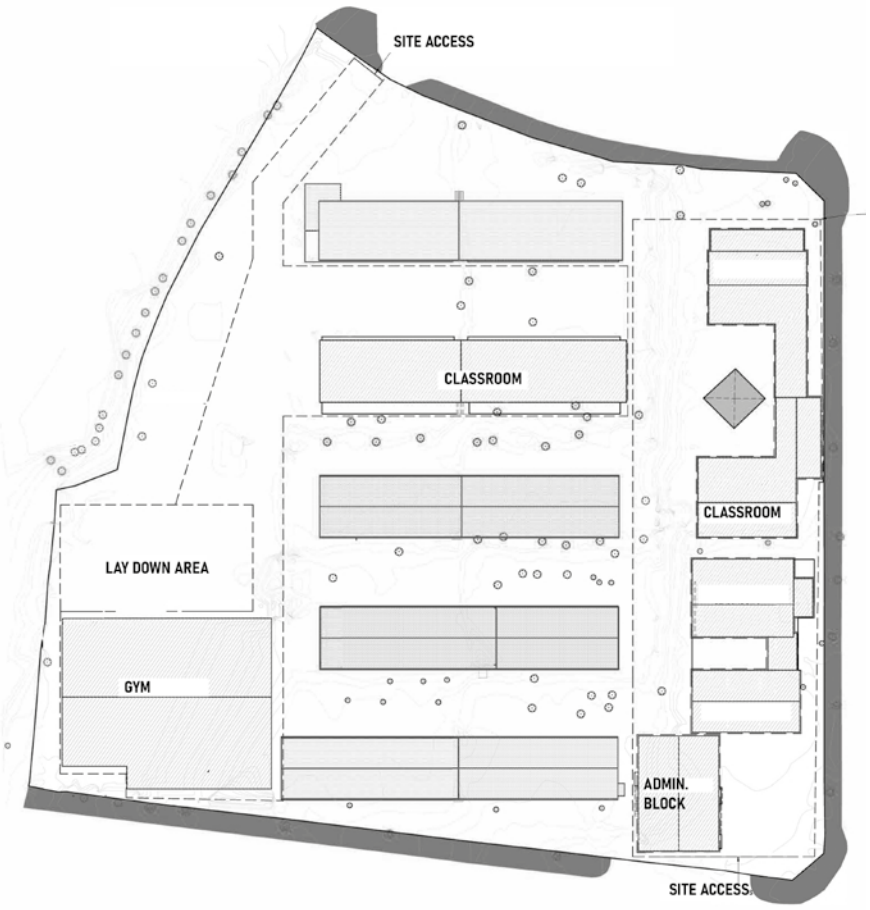
École Belge, situated on Nyarugenge Hill in the Kigali Central Business District (CBD), played a significant role in the early development of the city. As the capital of Rwanda, Kigali was established by Belgian colonialists who initially constructed the school along with other civic and commercial structures. The school was established in 1965 for the children of the Belgian community. It became a pillar in Rwanda's educational system. As a prominent educational institution and symbol of the Belgian presence, it provided education primarily for the Belgian and Rwandan elite, offering a European-style curriculum and teaching methods. The strategic location of École Belge was evidence of its prominence due to its proximity to iconic buildings like the German ambassador's residence, St. Famille Church, Nyarugenge Prison, and Hotel Mille Collines. In 2018, Ecole Belge relocated to another city called Gisozi. This was as a result of the replanning of the Kigali CBD to cater for high-end contemporary business development, contrasting with the historic and low-rise medium-density architectural character of the city. Meeting the architectural and functional criteria of the new CBD, Norrsken Kigali House is situated on the historic École Belge site. As a start-up hub run by a Swedish tech entrepreneur, Norrsken Kigali House, is the first adaptive reuse project in the area.

Erected on the site of the École Belge, the school buildings were not—as is usual in these circumstances—dismantled but extended and adapted to their new functions. This stresses the quality of the original architecture and showcases how educational spaces can be transformed for alternative uses.

Unfortunately, the architects of the École Belge are unknown. What is evident today is that the school was designed with the essence of environmental principles for tropical climates. The site layout was planned, highlighting the main spaces, such as the administration blocks, nine classroom blocks, a gym, and a playground [FIGURE 01]. The school consisted of blocks with repeated structural columns, louvered windows, a mono-pitched roof, and the interplay of brick finish and plaster, creating a rhythmic façade throughout the school. Access to the site was on the northern and southern ends. The northern entrance of the school leads to the gym and five classroom blocks, oriented east-west, strategically capturing cool breezes to promote optimal ventilation. On the other hand, the southern entrance led to the administration block and to four blocks oriented north-south. A central walkway extended towards the northern end of the site with intersecting courtyards between the classroom blocks. The site included the thoughtful incorporation of landscape principles, with trees and plants strategically positioned in relation to the buildings. These innovative landscape concepts were endorsed and aligned with the recommendations of tropical modernist principles aimed at guiding architects and planners (Uduku, 2018). École Belge's architects emphasized the importance of vegetation selection. Adjacent to the classrooms, carefully selected plant species were planted to reduce glare and prevent overheating. Further exploration revealed stairs integrated into the landscape design, accommodating the natural terrain and seamlessly shifting levels. Considering the intense heat, the school buildings were strategically placed on the site to maximize natural ventilation.

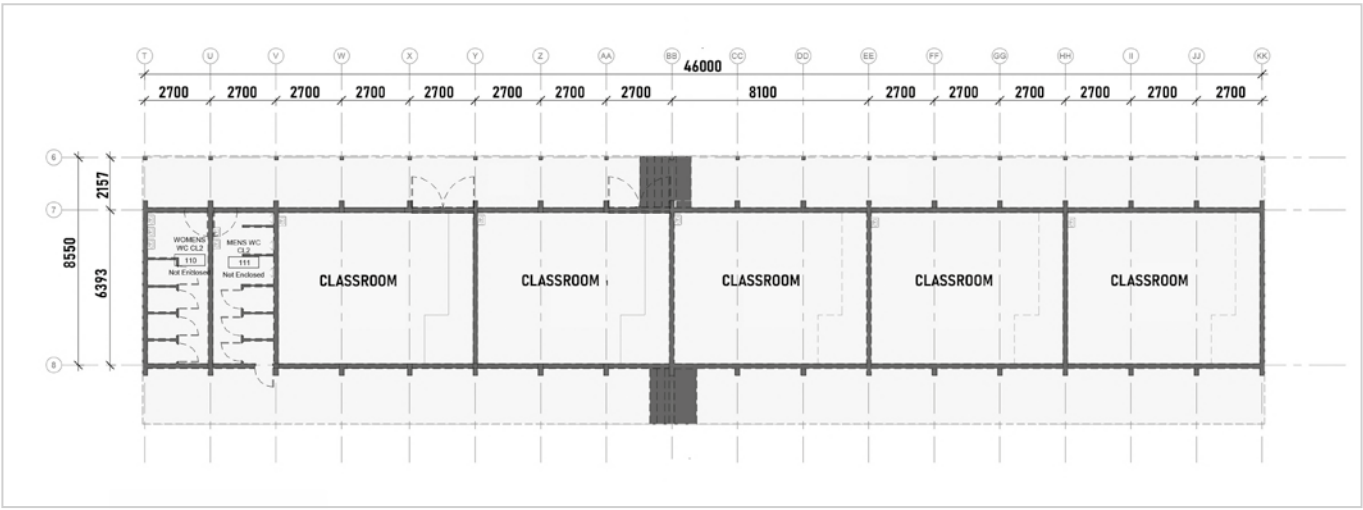
The north and south façades of the classroom blocks featured openings, including windows, doors, and vents, with characteristic openings designed to respond to the climate. These openings maximized natural light during the day, reducing the reliance on artificial lighting and fostered a connection with the outdoors, while the verandas acted as bridges between the classrooms and the beautifully landscaped courtyards. Additionally, the spacious verandas placed on the northern end of the building were characterized by repetitive elements such as columns while offering appropriate shading, keeping the classroom walls pleasantly cool [FIGURE 02].

École Belge was a thoughtfully arranged and environmentally conscious school where aesthetics and functionality harmoniously blended to create an optimal learning environment. Centrally positioned on the site, the classroom blocks followed a basic rectangular layout, featuring five classrooms and washrooms with mono-pitched roofs. The floor layout of each classroom block employed a grid system with uniform grid lines at 2.7-meter intervals



01 Original site plan of École Belge redrawn by Author © MASS Design group, 2018

02 École Belge showing a front view of one of the classroom blocks. The walls and structural columns of the blocks follow a logical pattern of repetition, creating a rhythm on the façade.
© École Belge de Kigali, 2015



03 Typical floor plan of one of the classroom blocks of École Belge. Redrawn by the author © MASS Design group, 2018

[FIGURE 03]. A single classroom within the block had a width of 8.1 meters, consisting of three intervals of 2.7 meters. The washrooms in the block spanned a width of 5.4 meters, encompassing two intervals of 2.7 meters. A single classroom measured approximately 6.4 meters in length, while the veranda was around 2.2 meters. In summary, a classroom block had a total length of approximately 8.6 meters and a height of about 3.0 meters.

In 2019, MASS Design intervened to preserve the historic École Belge classrooms and playgrounds from demolition, emphasizing adaptive reuse and the creation of public green spaces. The site was transformed into an entrepreneurial start-up campus known as the Norrsken hub [FIGURE 04], showcasing the potential for repurposing educational spaces in Rwanda. Norrsken's site layout encompasses three refurbished classroom blocks (classroom 3, 4 and 5) and a new pergola (classroom 2), from the original school and a newly constructed main building called Norrsken House. While the southern area of the site retains four preserved classroom blocks, the northern part repurposes two smaller blocks as a gallery space (compare [FIGURE 01]). The architectural design includes an interconnected passageway that serves to unite all four classroom blocks. Adjacent to this passageway, semi-open collaborative outdoor zones seamlessly connect to compact garden spaces designed for collaborative use. These architectural features serve a dual purpose: they harmonize the coexistence of the old and new constructions while also fortifying the integration of the indoor and outdoor realms. The design of these connecting spaces deliberately blurs the demarcation between the built and landscaped spaces, creating a holistic and unified environment. The

04 The main Norrsken House and refurbished classroom blocks designed by MASS Design Group. © Author, 2023

school has transformed from being enclosed by perimeter walls to embracing the surrounding neighborhood, with a notable boulevard defining its eastern boundary and the integration of green spaces, creating a welcoming atmosphere.

REPUBLIC ROAD SCHOOL, TEMA

In pre-colonial Ghana (known as the Gold Coast), knowledge was primarily transmitted through apprenticeship in trades like smithing, drumming, and herbalism. Children learned by observing the skills of adults and through the use of proverbs, songs, and stories, which taught them proper roles and behavior. Missionaries introduced a Western educational system to the Gold Coast as early as 1765, with a prime focus on primary education and a partial goal to replace Europeans with educated Africans in administrative positions (Berry, 1994).

After 1945, British architects like Maxwell Fry, Jane Drew, James Cubitt, and Kenneth Scott established architectural practices in Ghana. Inspired by the international Modern Movement, these British-trained architects introduced innovative approaches to architectural design suited for the hot and humid conditions of the tropics; their designs took the local climate into account (Fry & Drew, 1964). Soon after, in 1957, Ghana became the first country in Sub-Saharan Africa to achieve independence and remained a testing ground for experiments in climate-responsive architecture as the architectural guidelines established by the early colonial modern architects continued to be relevant (Le Roux, 2003).

Upon coming into power, one of Kwame Nkrumah's, Ghana's first president's priorities, besides industrialization, was to improve the education system. He believed that by providing quality education, children could be nurtured into a skilled workforce capable of managing the economic and social affairs of the country. Nkrumah intended this agenda to generate results as soon as possible, which is why he selected Tema as a pilot project for educational reform in Ghana. The central government of Ghana, through the Ministry of Education, took responsibility for this agenda by allocating a significant portion of the national budget to fund educational projects and the construction of schools all across the country. Between 1951 and 1966, the total number of children attending primary schools grew substantially from 154,000 to 1,480,000 (Provoost, 2020). The bond between the former British colonizing power and newly independent Ghana remained, as reflected in the nationalities of professionals employed in the country. The initial master plan of Tema was proposed by English planner Alfred Alcock, who designed what looked like a typical English New Town. However, Nkrumah sought the expertise of Constantinos Doxiadis to deal with the large scale and the fast pace of development. Undoubtedly, this decision aimed to distance the project from English designers who were closely linked to the colonial power (Provoost, 2021).

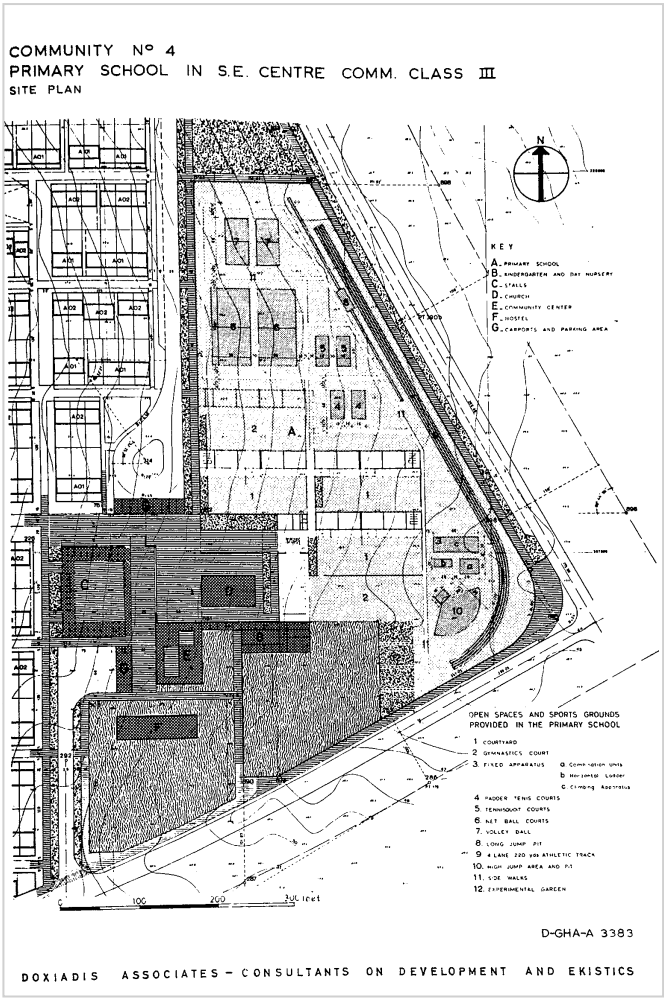
Tema, a planned city on the outskirts of Accra, was to serve as a cosmopolitan city that welcomed immigrants from different places to work in industry. The city was laid out to resemble modern New Town planning (Provoost,

2016); encompassing various elements that ensured a holistic experience for the people living within the city and its environs. The orthogonal grid layout of the city, based on mathematics and hierarchy, was oriented to take advantage of the prevailing direction of the south-west winds. The Tema master plan consisted of five community classes: Community class I, II, III, IV & V. Within every community class III was a primary school, strategically placed so that children could get to school without crossing any highways; thus, the longest distance from home to school was 500 meters. It was mandatory for every child to attend school, and free of charge, these primary schools reflected the ideas of post-independence (Provoost, 2020).

The Republic Road School is situated in the industrial city of Tema (Community 4), established in 1965 by the Ghanaian government. This primary school was designed by Constantinos Doxiadis. The school represents the aspirations for progress and development that emerged in Ghana following its independence. The site layout of Republic Road School is organized into four main classroom blocks, all of which have the same aesthetics, and a playing field for sporting activities on the northern boundary of the site [FIGURE 05]. The school follows a logical pattern of repetition through the use of prefabricated barrel roofs, breeze block walls, and structural columns, creating a rhythmic façade [FIGURE 06]. According to Doxiadis, such repetition was necessary for the rational formation of schools and an essential part of aesthetics (Choudhury, 2006).

The main access to the site is from the northern side, adjacent to a 'cul-de-sac', which serves as a drop-off area, enabling easy access to the school. This entrance leads to a walkway, seamlessly blending with the natural slope of the site and extending towards the southern end. The straight linear path connects with intersecting classroom blocks and courtyards, purposefully designed to evoke a strong sense of order through the use of axes and symmetry. Landscaping played a crucial role in enhancing the aesthetics of both Tema and the school, with vegetation strategically planted in the courtyards to reduce heat gain and enhance the overall beauty of the space.

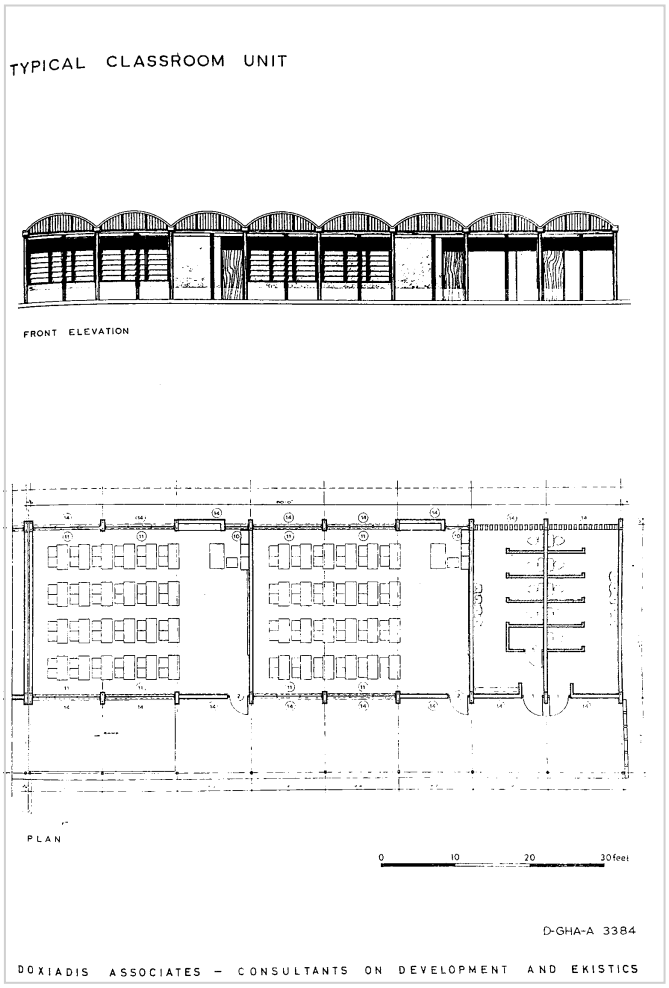
The floor layout of each classroom block has a linear configuration with courtyards situated in between the individual blocks, enabling free airflow through the site. The classroom blocks have an east-west orientation except for one classroom block, which has a north-south orientation. On the southern side of each block, there is a veranda designed for circulation, in addition to roof overhangs that serve as solar shading [FIGURE 07]. The verandas also have ramps designed to facilitate movement over the natural terrain of the site. The exterior walls of the classroom blocks are made of breeze blocks, which double as openings to



05 Site plan of Republic Road School emphasizing the north-south orientation of classroom blocks. © GHANA REPORTS TEMA DOX-GHA-A 91, 1964.

06 Façade of Republic Road School showing the use of repetition of roofs, breeze blocks, and columns. © Author, 2022.

07 Veranda for circulation and roof overhangs for solar shading © Futurestars Charity, 2018



08 Typical classroom unit showing the grid system with approximately 3.0-meter (10-foot) intervals © GHANA REPORTS TEMA DOX-GHA-A 91, 1964

ensure adequate daylighting and ventilation throughout the day, eliminating the need for artificial lighting.

The basic rectangular layout of a classroom block has four classrooms and washrooms sheltered by barrel roof. The use of standardization in this tropical modernist school design is evident through the placement of columns, beams, breeze block walls, and doors, ensuring uniformity and regularity throughout the structure. The floor layout incorporates a grid system with 3.0-meter intervals [FIGURE 08], aligning with the centerline of structural components such as columns and beams. Each classroom is approximately 9.0 meters wide, consisting of three 3.0-meter intervals, while the washrooms are around 6.0 meters wide, consisting of two 3.0-meter intervals. A single classroom has an estimated length of 7.0 meters and the veranda has a length of approximately 3.0 meters, suggesting that single-depth or non-double banked plans achieved the optimum benefits of cross-ventilation in warm, humid climates. The classroom block has a total length of approximately 10 meters and a vertical dimension of 3.0 meters, extending from the concrete flooring to the exposed barrel roof. The spatial configuration includes student seating areas, a desk area for the teacher, an in-built cupboard for books and stationery, and a chalkboard attached to a wall.

WHERE TROPICAL MODERNIST PRINCIPLES AND STANDARDIZATION COINCIDE

École Belge and Republic Road School, as primary schools embodying tropical modern principles and standardization, share notable architectural characteristics despite their disparate locations. However, within these shared principles, they possess distinct features that contribute to their individuality. The school designs exemplify an architectural approach that combines the benefits of modern design, environmental responsiveness, and efficient construction practices to create functional and sustainable educational spaces in the tropical context. Categorizing the distinctive characteristics of each school under landscape, climate responsiveness, and standardization provides insight into the fundamental principles that guided the design of tropical modernist schools at that time. Landscape principles incorporated in the design of École Belge and Republic Road School, ensured harmony with their surroundings. Both schools strategically utilize courtyards and vegetation to improve airflow and create visually appealing spaces. These approaches showcase the significance of landscaping in creating comfortable and inspiring educational environments within tropical settings.

The façades of École Belge and Republic Road School embody aesthetics and functionality. École Belge achieved a rhythmic pattern through the interplay of brick finish and plaster, while Republic Road School utilizes a logical

repetition of prefabricated barrel roofs, breeze block walls, and structural columns. These rhythmic compositions contribute to the overall aesthetic appeal of the buildings and create a sense of uniformity. Generally, the two schools also demonstrate a commitment to climate-responsive design principles, although approaches are tailored to specific contexts. The strategic building placement, façade design, and courtyards between classroom blocks capture cool breezes and maximize natural ventilation. Verandas, included in both schools, act as solar shading and circulation spaces while the openings allow for ample natural light, reducing the reliance on artificial lighting.

The well-designed classroom spaces of the two schools played a pivotal role in shaping the overall learning atmosphere. The comparison of floor plans revealed how the schools prioritize functionality, flow, and accessibility for students, teachers, and staff. The schools utilized standardization, characterized by regularity, repetition, and efficient design for improved construction and cost certainty. Standardization extended to all aspects of the primary schools' design, with prefabricated building components, such as structural columns, beams, doors, windows, breeze blocks, walls, and even entire rooms. While the concept of standardization and the replication of elements are similar in both cases, specificities such as dimensioning differ. For instance, both schools were designed based on a grid system, but the grid interval of École Belge is 2.7 meters while that of Republic Road School is roughly 3.0 meters. Additionally, a classroom block in École Belge comprises five classrooms, while Republic Road School has four classrooms; a single classroom in both schools can be divided into three equal parts.

The use of standardization in these schools creates flexible spaces that allow for adaptability and potential changes in use or reuse without premature demolition, thus extending the building's useful life. École Belge, now transformed into Norrsken Kigali House, serves as a prime example of adaptability, which was made more feasible due to its design's inherent regularity and standardization. This characteristic facilitated changes in its function while preserving a significant portion of the original building. In contrast, Republic Road School has undergone minimal renovations, and the utilization of classroom spaces has remained unchanged. The school is, however, occasionally subject to minimum maintenance and upkeep to preserve its aesthetic appeal.

The use of tropical modernist design principles and the standardization of spaces highlights the longevity and success of these schools' architectural designs, making them enduring examples of thoughtful and environmentally conscious educational spaces shaped by the era in which they were built. This article suggests that the exchange of architectural ideas through the emerging UNESCO international school design guidelines (De Raedt, 2014) and the involvement of transnational architects influenced the school designs to be similar. The emphasis placed on cost-effectiveness, functionality, and climate responsiveness during the design process allowed these schools to adapt and thrive within their contemporary contexts. Remarkably, even after more than 50 years since their establishment, both schools continue to exhibit robustness and are actively used, serving as a testament to the success of the architecture of that era.

CONCLUSIONS

This article explored the evolution of the architectural design of two primary schools, École Belge in Kigali, Rwanda, and Republic Road School in Tema, Ghana, both constructed in 1965. Despite being located in different countries, these schools share similarities in their use of standardization, climate responsiveness, and emphasis on landscape integration. The schools' similarities were attributed to the exchange of architectural ideas during independence, such as the influence of transnational architects, and UNESCO's international school design guidelines. While the schools share common characteristics, they also possess distinct features such as roof design, grid dimensions, openings, and the composition of the classroom blocks. École Belge has undergone a transformation into a start-up campus (Norrsken), demonstrating the concept of adaptive reuse and showcasing its ability to adapt to new functions. In contrast, Republic Road School has remained resilient over time, retaining its original form and function. These enduring buildings demonstrate the significance of thoughtful architectural design in creating comfortable and inspiring learning environments. The similarities and differences identified between these schools offer a deeper understanding of their current implications and potential significance for future research in the design of educational spaces. In current design thinking, educational spaces are expected to be flexible places where different modes of teaching and learning can take place. Analyzing how standardization influences adaptability sheds light on the importance of designing spaces that employ uniformity and regularity. Educational institutions can leverage this insight to create adaptable spaces that accommodate diverse learning experiences. Future research could examine the lasting effects of school design based on UNESCO international school design guidelines and climate-responsiveness in Africa. This could assess students' academic performance, social development, and overall satisfaction to provide a comprehensive understanding of the influence of well-designed educational spaces.

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