IJNRD.ORG ISSN : 2456-4184
INTERNATIONAL JOURNAL OF NOVEL RESEARCH AND DEVELOPMENT (IJNRD) | IJNRD.ORG
An International Open Access, Peer-reviewed, Refereed Journal

Sustainable Practices in Schools as an Educational Tool in India

[1]Neha Reddy Battalapalli, [2]V.V. Kusum Priya, [3]Guide: Ar. Ch. Srinivas, [4]Ar. Srishti Srivastava

[1]M.Arch (Interior Design), [2]B.Arch, [3]Associate Professor, [4]Assistant Professor
[1]Department of Architecture,
[1] JNAFAU, Masab Tank, Hyderabad, Telangana, India

Abstract : Extensive research have examined the relationship between the physical environment in schools and children's academic performance. However, the role of a school physical environment as a pedagogical tool has rarely been addressed.Infusing Sustainable practices in schools set a stage for the attributes of sustainability to become teaching tools that help children develop a conscience of sustainability and complexity of living and built systems around us.The purpose of this article is to highlight the various sustainable practices in schools and their role in making schools a more valuable learning environment for students. To do this, a set of case studies were used, and several recommendations are drawn as key directions to improve sustainable practice in school buildings.

IndexTerms **-Sustainable practices, pedagogical tool, educational enhancement, environmental awareness.**

INTRODUCTION

School buildings and landscapes are often thought of as places where learning occurs but not as sources of learning. Rather than being instructional, the campus is designed to be convenient, efficient, or aesthetically pleasing. Thus, the same education could be experienced in several campuses. Many architectural programs or plans for public school don't support the educational programme, or sustainability. (Taylor and Engass 2009).While over the years, strong evidence and studies have shown that school building affects student's health and ability to learn.(KATs 2006,(World.GBC) 2013)

However, the architecture and scenery of the school reflect a concealed curriculum that has a significant impact on the learning process. Certainly, the environment can be a silent curriculum, which can contribute to positive or negative learning experiences.(Taylor and Engass 2009)

Thus, a school's physical environment, which includes buildings and grounds, increases student's environmental awareness through hands-on learning, and makes sustainability a visible part of the school. Thus, sustainable practices offer tremendous benefits for students, staff, and the environment.

Aside from the significant advantages of sustainable practices in schools, using them as a teaching tool equips future generations with the skills they will need to meet the environmental issues of the coming decades while also preserving our natural resources and environment. As a result, the design itself can be used to communicate and shape teaching and learning ideals. Schools that integrate sustainability and education as a way of life on campus benefit both the facility's operations and educational activities. In order for a school to be a sustainable institution for the rest of its existence, the institution must be operated and maintained sustainably. Sustainability must become as much a part of the school culture as discipline and cleanliness.

Teaching youngsters about sustainability as a valuable virtue should include a visible demonstration of sustainable behavior. (GELFAND AND FREED 2010)

AIM

In this paper, we explore the role of sustainable practices in education when the building is intended to function as an interactive learning source. We accomplish this through highlighting the implication of these practices on the education of a child.

METHODOLOGY.

The paper includes case studies of several buildings taken from diverse regions across India. Building A: Manav Sadhna, Ahmedabad. Building B: Rishi Valley School, Chittoor, Andhra Pradesh. Building C: Tanpo Solar School,Zanskar, Ladakh, India. Building D: Mod Skool, Yamuna Khadar, Delhi, India. While each building has its own characteristics, they all serve the same purpose, which is to support the educational sector. The study tries to understand the various sustainable practices which are incorporated in these schools, and their influence on a child's learning.

CASE STUDIES

4.1 Manav Sadhna, Ahmedabad

The Manav Sadhna centres are clusters of multipurpose activity campuses set amidst the largest slum of the city of school for the young, vocational training center for the ladies, gym for the men, crèche for the children, health camp on weekends, craft production unit for women and community center for festive celebrations and events.

The center is an apt example of sustainable design using recycled waste as the building components. Reducing pollution and energy through recycling of waste is thus a creative way the architecture expresses environmental concern.

Apart from its flexible layout, which allows for multipurpose activities, the building also functions as an open book, providing an example of how domestic and municipal waste can be turned into affordable, functional and aesthetic building materials.

Fly ash, dump fill site debris, crate packing, plastic bottles, glass bottles, rags, wrappers, metal scrap, shattered ceramic wares, compact disc, electronic hardware, as well as other waste have been recycled into walling, roofing, flooring, and fenestration elements, among other things.

Thus, architecture creatively reflects environmental concern by reducing pollution and energy consumption through waste recycling, economically empowers the poor by creating economic opportunities through value addition processes, and enhances the quality of life by developing affordable and long-lasting alternative building products for their homes.

Figure 1: floor plan

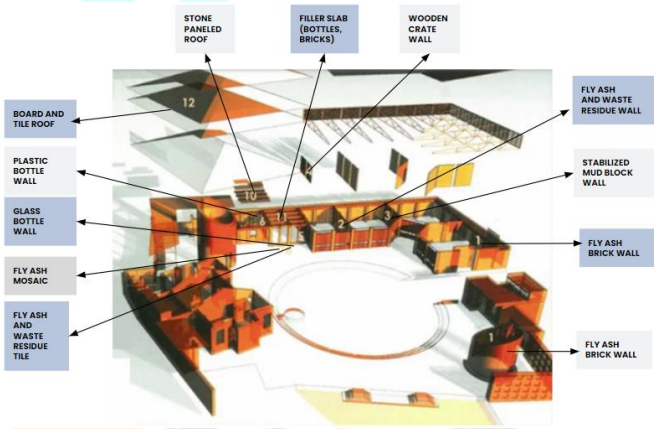

Figure 2: Building material

4.2 Rishi Valley School, Chittoor, Andhra Pradesh

In A Sheltered Valley, Rishi Valley School lies at the apex of Rishi Konda. Through discussion and engagement, the institution encourages connections between students and professors, as well as relationships with nature by allowing students and faculty to experience the natural world's benefits. Meanwhile, in the past, damage to the environment had caused a wasteland to spread across the neighboring lands. The natural environment has been said to have been restored to its proper original state as a result of ongoing environmental preservation initiatives such as tree planting. There is now an organic garden, a herb garden, and an orchard on campus. The area was also certified as a bird preserve by the International Council of Bird Preservation (now known as BirdLife International) in July 1991.[1]

Figure 3: The Valley Made Verdant Through Sustained Reforestation (View Of The School Campus From Duranta Hill).

4.3 Tanpo Solar School,Zanskar, Ladakh

Tanpo is a small hamlet of 30 homes that rely on farming for their livelihood. The settlement is only accessible during the winter via the Chadar frozen ice journey, and children must walk all along the frozen river to reach Leh's main city. Children do not have access to another school.

Tanpo hamlet community in the remote valley of the Zanskar river in Ladakh, India, requested the project. The primary architectural challenge was to provide an appropriate learning environment in the Himalayan cold without using fossil fuels.

The goal is to build a passively heated school for winter use. [4]

The building has a modular structure with the opportunity for future expansion with an open-source design. During the day, the school's trombe wall collects and stores the sun's energy, and at night it radiates that energy back to the environment. By incorporating the Trombe wall, zero energy construction is made possible. This can help keep costs low and allows the constructing team to make complete use of resources available in Ladakh. The school may also most effective use domestically sourced materials

and laborers, to keep in line with the sustainability and ethics of both organizations. The design attempts to acquire a low ecological effect, by means of the use of locally accrued construction materials, like stone, pebble, and mud. The beams and planks came from lower regions of Ladakh, and the glass was the most effective fabric that got here from an industrial source, having no conventional alternative. [11]

Figure 4: The Upper Wall Structure Is Built Of Two Layers Of 30cm Sun-Dried Mud Bricks, With Locally Sourced Straw Insulation Between.

4.4 Mod Skool,Yamuna Khadar, Delhi, India.

ModSKOOL is the design of a low-cost, modular school for 250 students that can be built in a few hours and then disassembled by the community as rapidly as possible to avoid government demolitions and annual floods. It was envisioned as a response to the drastic forced evictions enforced on a farming community in the Khadar region of India. The design can be constructed rapidly by fastening locally accessible bamboo metal joints. Every study hall has openable wooden boards with privately made covers as dividers and windows. A layered sheet with cover and thick material for protection shapes the rooftop. The plan is environment responsive to keep the school warm in winters, shield the youngsters from downpours and mosquitoes during storms as well as hot waves in summer while taking into consideration satisfactory ventilation. The design creates a comfortable and lively space for the students that is conducive to learning and not subject to the vagaries of nature.

The school was erected in two locations, the first utilizing native building materials such as bamboo and dried grass, and the second using the local skill of 'charpai' — traditional cot weaving widespread in the region. The approach of this design is most affordable and has employed local skills. It has also instilled a sense of responsibility and pride in the local community as they see their construction materials and cycles used to build a viable school for their children. The school's design philosophy reflects the teaching philosophy, which emphasizes holistic and sustainable education. [13]

Figure 5: The ModSkool

SUSTAINABLE PRACTICES

In this paper, these sustainable techniques served as a basis for the subjective assessment process of the case studies.

Passive Sustainable Design

Orientation and climate, daylighting, and natural ventilation, reducing energy requirements for the building.

Active Sustainable Design

Electrical, Plumbing, HVAC, And Other Systems

Energy Conservation

Renewable Energy Systems, These Systems Are Often Used In Conjunction With Passive Design Strategies.

Building Materials And Finishes

Produced Or Sourced Locally, Environmentally Friendly Materials, Durable, Reusable, Or Recyclable.

Vegetation

Using Trees, Plants, And grasses that are native, Passive Energy Strategy.

Rainwater Harvesting

Cost-effectively used directly for lawns, toilets etc. Drinking purposes after proper treatment.

Wastewater Treatment (Onsite)

Zero Waste

Waste Segregation (Onsite)

SCHOOL ENVIRONMENT AS A TEACHING TOOL

Continuous engagement with the environment There is no better method to teach children than to lead by example. When teachers learn to see the environment as a source of meaning, they can begin to use the world of physical objects as a teaching tool to help pupils comprehend the underlying rules and principles that govern our complicated universe. The idea is to consider the physical environment and the quality of the air as active and necessary components of the learning process. [2009, TAYLOR AND ENGGASS].

Below are the informed learning environments which combine architecture with learning adapted from TAYLOR AND ENGGASS,2009.

Natural: School playgrounds serve as community parks, nature trails, fitness courses, gardens, zoos, habitats, weather stations, and experimentation sites.

Educational impact - Understanding life zones: climate, terrain, flora and fauna, water, etc.

Built: Building systems teach through structural clarity, the curriculum decides the design of the building.

Educational impact - Learners study the physical objects and translate them into ideas. Thus, architecture is pedagogy. Physical elements or manifestations in the environment act as visual Prompts or cues that help students learn.

Cultural: Include museums, galleries, plazas, health centers, local ethnicity and style, the workplace, families, and homes.

Educational impact - The entire learning process is documented visually and verbally. Performance is judged more critically and evaluated in more detail than it does with testing alone.

LEARNING FROM THE SUSTAINABLE PRACTICES INCORPORATED IN SCHOOLS

The issue of sustainability is a cultural issue. It needs to be very actively integrated into the community.

7.1 Site, Outdoor learning, landscaping:

Rishi Valley School has incorporated the following strategies of Improved Design Potential:

Native Landscaping, Vary kinds of gardens for gaining knowledge of vegetable, herb, insect, flower, butterfly, Preserve, restore, or create habitat for local creatures. Use indigenous substances and constructing methods, Outdoor lecture rooms, Ecosystem Restoration water irrigation structures, water recycling structures, cisterns for rain series canals, construction for power plays. Connections to neighborhood agriculture or landforms.[1]

Educational Implications: Natural resources, Ecology, Environment Cycles, Agriculture, Irrigation, Biology, Community, Culture, weather, climate, Energy, preservation, conservation.

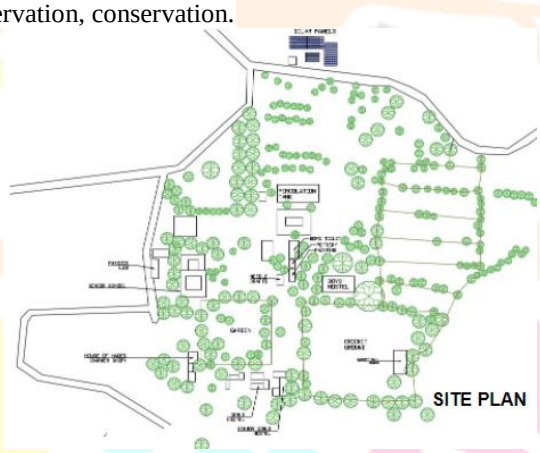

Figure 6 : Rishi Valley School site plan.

7.2 Water

Use of visible rainwater harvesting at Rishi valley school. Seven percolation tanks at the edge of campus have led to the regeneration of 150 acres of a barren hillside.

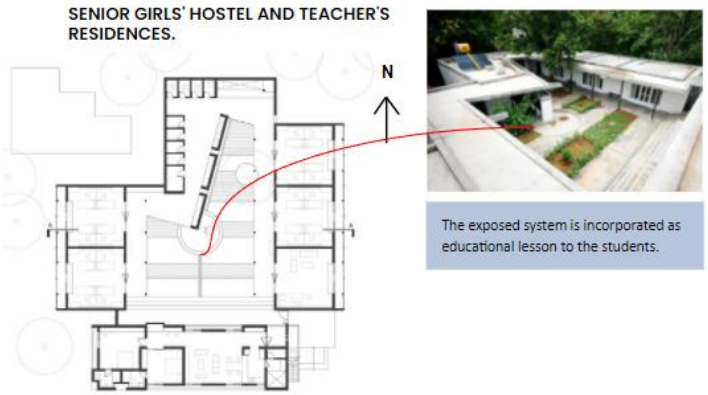

Figure 7 : Rishi Valley School rainwater harvesting system.

Educational Implications- Mechanics, water conservation, drainage, and irrigation systems.

7.3 Energy

Rishi Valley School: Use of Alternative sources of energy:
Biogas Plant meets 25% of School Cooking Needs, Solar Driven Installations Provide Steam For Cooking, Solar Water Heaters Serve Dormitories, Solar panels are cleaned by students for educational purposes. Provision of windows on either side for cross ventilation.

Figure 8 : Rishi Valley School

Tanpo Solar School: A special Trombe wall inside the school's building produces the idea of zero energy construction by capturing and storing energy from the sun during the day, and radiating it at night. This will help keep costs down and allow the construction team to take full advantage of all of Ladakh's resources.

Educational Implications- Electricity, Alternate sources of energy, conservation, climate, microclimate, HVAC, light.

7.4 Material and Resources

Rishi Valley School: Use of Local Building material- exposed brick, local stone, wood, metal chairs and wooden desks with built-in shelves for storage, straw mats.
Manav Sadhna, Ahmedabad: Fly ash from a nearby thermal plant, dump fill site garbage, crate packaging, plastic water bottles, glass bottles, rags, and wrappers, metals scrap and broken ceramic wares, compact disc and electronic hardware collected from waste, etc. have been transformed into walls, roofs, flooring and fenestration elements.
Use of local residents, youth, for the construction for skill enhancement.

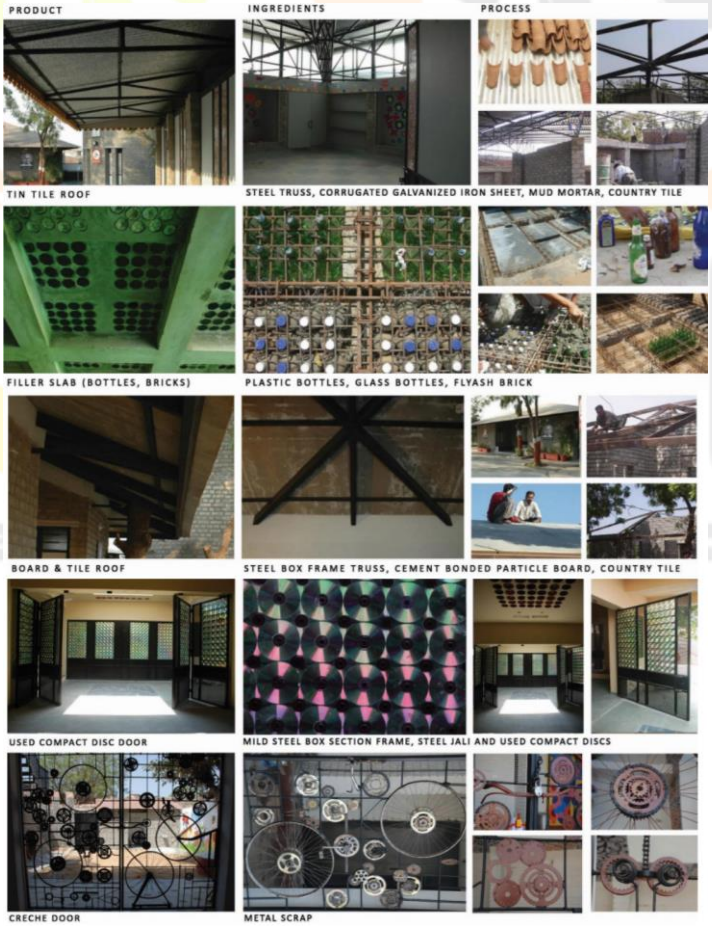

Figure 8 : Use of Recycled material for construction Manav Sadhna

ModSkool: Use of non-polluting material and locally available material for construction like bamboo.

Tanpo Solar School: Use of locally available materials like stone, pebble, and mud.
Educational Implications- Material, Waste management, Structure, Texture, Health, R-Value.

7.5 Indoor Environmental Quality

Natural lighting, cross ventilation practiced in all the buildings in the above case studies, use of courtyards, orientation with respect to the climate can be observed in the above case studies.
Educational Implications- Shadows, light, solar system, seasons, reflection, refraction, absorption, Temperature, air quality.

Figure 9 : Windows provide for cross ventilation at Rishi Valley school

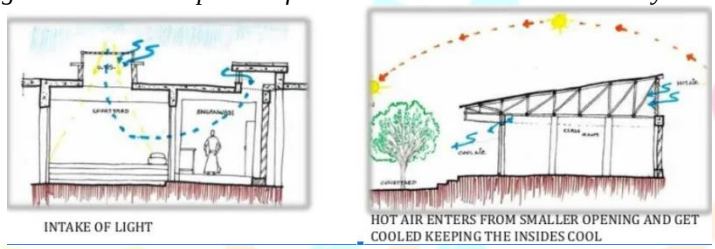

Figure 10: Climatic response at Manav Sadhna

Manav Sadhna: All the spaces are oriented towards the windward side facing the open court to ease cross ventilation. Natural cross ventilation through glazed ventilators. Skylights on the edge walls wash off the light on wall planes to bring in illumination without glare of the direct sun. The same is accomplished with stained glass bottles embedded in the slab.

CONCLUSION

Schools serve as a powerful pedagogical instrument and play a major role in children's primary learning. Sustainable practices empower children to gain knowledge, understanding and to appreciate the environment as it relates to our society. A positive childhood experience lays the foundation for the growth of an environmentally friendly adult. The learning process will be considerably influenced and decisions about how to shape the learning environment will be informed if the learning environment is viewed as an active learning source that reflects a concealed curriculum. The following are some of the conclusions that may be derived from this research:

- Raising awareness of environmental issues.
- Integrating pedagogy into school design will encourage environmental responsibility among students by using sustainable practices as a teaching tool.
- Architects should design schools to maximize their potential as learning manifestations for sustainability by incorporating educational sustainable practices.
- Students will be able to acquire knowledge and develop practical skills by participating in hands-on learning activities given by the sustainable practices at school, as well as in the operation of their schools.
- As a result, it is recommended that sustainability practices be implemented in school buildings in order to improve our students' health and performance while conserving our natural resources and the environment. These practices aid in the transition of a school into a 3-dimensional textbook. Furthermore, by designing schools to operate as a pedagogical tool, the government will be able to inculcate a deep understanding of sustainability in students and share this knowledge with the entire community.

ACKNOWLEDGMENT

First, I would like to express my sincere gratitude to my mentor Asst. prof. Ar. Srishti Srivastava, Department of architecture, Jawaharlal Nehru Architecture and Fine Arts University, for their constant support and encouragement. I would like to thank my parents for their support in all possible ways through which no amount of praise can tribute their effort. And furthermore, I need to thank my friends for being a help to the fulfillment of my research. I believe, I owe my sincere and deepest gratitude towards all of them.

REFERENCES

[1] The role of Space in setting the Educational Environment: Devina Jesrani
[2] A School That Values Connectedness: An Educational Project in the Midst of a Beautiful Natural Environment Hiroshi Mochizuki
[3] Krishnamurti Foundation India. Information Brochure. (Retrieved Nov30,2006;http://www.rishivalley.org/news/Information-brochure-9-08-04%20final.pdf)
[4] https://www.re-thinkingthefuture.com/architecture/housing/manav-sadhna-by-yatin-pandya/
[5] https://www.archdaily.com/882317/tanpo-solar-school-csomas-room-foundation

[6]https://www.designboom.com/architecture/csomas-room-foundation-sight-to-sky-tabpo-solar-school-ladakh-india-10-27-2017/
[7] Linking Architecture and Education: Sustainable Design of Learning Environments Anne Taylor, Katherine Enggass
[8]Sustainable schools as pedagogical tools for environmental education Parisa Izadpanahi and Richard Tucker Deakin University, Geelong, Australia
[9] Clark, H. (2002) Building education: The role of the physical environment in enhancing teaching and research. Issues in practice, ed.,ERIC.
[10] Cole, L. B. (2013) The teaching green school building: A framework for linking architecture and environmental education, Environmental Education Research, ahead-of-print), 1-22.
[11] Lyons Higgs, A. V. M. (2006) Teaching through modeling: Four schools' experiences in sustainability education, Journal of Environmental Education, 38(1), 39-53.
[12] https://www.archdaily.com/882317/tanpo-solar-school-csomas-room-foundation
[13]https://designmuseum.org/exhibitions/beazley-designs-of-the-year/architecture/modskool#:~:text=ModSkool%20is%20a%20school%20that,the%20Yamuna%20river%20in%20India.&text=The%20school's%20design%20mirrors%20its,that%20includes%20issues%20of%20sustainability..
[14] UCA, U. C. A. (2005). Building Green for the Future: Case Studies of Sustainable Development in Michigan. C. Eisner. AnnArbor, Michigan, Urban Catalyst Associates UCA, Michigan Department of Environmental Quality.
[15] Walden, R., Ed. (2015). Schools for the Future - Design Proposals from Architectural Psychology. Koblenz, Germany, Springer.
[16] Yudelson, J. (2008). The Green Building Revolution, ISLAND PRESS.