TREE PLANTING AROUND THE SCHOOL BUILDINGS AND THERMAL COMFORT OF STUDENTS: A PANACEA FOR IMPROVED ACADEMIC ENGAGEMENTS

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ABSTRACT

This study examined tree planting around the school buildings and thermal comfort of students as a panacea for improved academic engagements. The learning environment plays a crucial role in shaping students' academic performance, well-being, and overall engagement in school activities In the context of carrying out this research, the following subheads were expounded on: the concept of tree planting, the concept of school buildings, and the concept of thermal comfort, to mention a few. The study mentioned the effect of tree planting around the school buildings on students improved academic engagements to include enhanced thermal comfort/concentration, reduced stress/mental fatigue, and improved air quality/cognitive functioning, to mention but a few. The effect of thermal comfort of students on their academic engagements, as highlighted in the study, included improved concentration/cognitive performance and enhanced participation/classroom engagement, among many others. Limited space for tree planting and slow growth/long-term nature of trees, etc., were mentioned as the challenges encountered in planting trees to enhance thermal comfort and improve academic engagements of students in school buildings. The mitigation to the challenges of planting trees to enhance thermal comfort and improve academic engagements of students in school buildings as mentioned in the study included maximizing available space with strategic tree planting and choosing fast-growing and resilient tree species. The study concluded that tree planting around school buildings is a vital strategy for enhancing students' thermal comfort, well-being, and academic engagement. One of the recommendations made was that schools should incorporate tree planting as a fundamental part of infrastructure development.

KEYWORDS: Tree Planting, School Buildings, Thermal Comfort, Students and Academic Engagements

INTRODUCTION

The learning environment plays a crucial role in shaping students' academic performance, well-being, and overall engagement in school activities. Among the many environmental factors influencing students' cognitive abilities, thermal comfort—the ability to maintain a pleasant temperature in classrooms—stands out as a critical determinant of concentration and productivity. In many schools, particularly in regions with high temperatures, excessive heat can hinder students' ability to focus, leading to fatigue, discomfort, and reduced participation in academic activities (Rony & Alamgir, 2023). As educational institutions seek sustainable solutions to improve learning conditions, tree planting around school buildings emerges as a natural and cost-effective strategy for enhancing thermal comfort and fostering an environment conducive to learning (Ramchunder and Ziegler, 2021).

Trees have long been recognised for their ability to regulate temperatures through evapotranspiration and shading effects, reducing the impact of heat on built environments. In school settings, strategically planted trees can lower surrounding temperatures, mitigate the urban heat island effect, and improve air quality—factors that directly contribute to students' physical comfort and mental alertness (Yang, Xu, Duan, Yang, Zhang, Zhang, and Xie, 2023). According to studies in environmental psychology, students who learn in green, shaded environments experience lower stress levels and enhanced cognitive functioning, leading to greater academic engagement and retention of information (Basu, Sharma, Kumari, Rastogi and Mishra, 2024). This underscores the need to integrate nature-based solutions, such as afforestation programs within school premises, to create a healthier and more stimulating learning atmosphere.

Beyond thermal regulation, tree planting also offers psychological and physiological benefits that enhance students' learning experiences. Exposure to green spaces has been linked to improved mood, increased attentiveness, and reduced symptoms of anxiety and fatigue among students (Basu, Sharma, Kumari, Rastogi, and Mishra, 2024). Schools that incorporate greenery into their infrastructure often report higher student satisfaction, greater willingness to participate in class, and improved interpersonal relationships (Abimbola and Agboola, 2023). By providing natural shade and cooling effects, trees help transform the school environment into a more inviting and comfortable space, reducing the negative impact of excessive heat on students' cognitive performance (Lanza, Alcazar, Hoelscher, and Koh, 2021).

Furthermore, tree planting contributes to sustainability and environmental consciousness among students. When students are actively involved in tree-planting initiatives, they develop a sense of environmental responsibility, understanding the crucial role trees play in combating climate change and enhancing ecological balance. This hands-on engagement fosters a deeper appreciation for nature and instills lifelong values of conservation and sustainability. Schools that embrace afforestation programs not only improve immediate learning conditions but also cultivate environmentally literate individuals who are committed to preserving natural resources for future generations (Ainin and Asafri, 2023).

Despite the clear benefits of tree planting in promoting thermal comfort and academic engagement, many schools, particularly in developing regions, continue to overlook this simple yet effective solution. Poor landscape planning, rapid urbanisation, and a lack of awareness regarding the impact of school microclimates contribute to the persistence of uncomfortable learning

environments (Barrett, Treves, Shmis, Ambasz, and Ustinova, 2019). Addressing this gap requires policy interventions, institutional commitment, and community participation in tree-planting initiatives tailored to school environments. Schools must recognise tree planting as an essential component of educational infrastructure rather than a mere aesthetic addition.

Tree planting around school buildings is more than an environmental enhancement—it is a strategic intervention that directly influences students' thermal comfort, psychological well-being, and academic engagement. By integrating trees into school landscapes, educational institutions can significantly improve learning conditions, reduce heat stress, and foster a generation of environmentally conscious students. As the demand for sustainable educational spaces grows, embracing nature-based solutions such as afforestation will be key to creating resilient, student-friendly learning environments that promote both academic success and ecological sustainability.

CONCEPT OF TREE PLANTING

Tree planting refers to the act of intentionally placing young trees, or seedlings, into the ground to cultivate a new tree population, often done to contribute to reforestation, environmental restoration, landscaping, or to combat climate change by increasing carbon sequestration through the trees' ability to absorb carbon dioxide from the atmosphere. Tree planting is the process of transplanting tree seedlings, generally for forestry, land reclamation, or landscaping purposes.

FIG: 1

Source: https://ecotree.green/en/blog/what-is-a-tree#:~:text=Definition%20of%20a%20tree&text=Here's%20our%20simple%20definition:,the%20plant%20needs%20to%20grow.

Tree planting is the deliberate process of cultivating trees to enhance environmental sustainability, improve air quality, and provide ecological benefits. It involves selecting appropriate tree species, preparing the soil, and ensuring proper care for growth. Tree planting plays a crucial role in mitigating climate change by absorbing carbon dioxide, reducing the urban heat island effect, and preventing soil erosion. In both rural and urban settings, trees contribute to biodiversity conservation, water cycle regulation, and improved living conditions. Additionally, tree planting supports agriculture, offers shade, and enhances the aesthetic appeal of landscapes, making it a fundamental aspect of ecological preservation.

According to Wikipedia (2025), tree planting is the process of transplanting tree seedlings, generally for forestry, land reclamation, or landscaping purposes. It differs from the transplantation of larger trees in arboriculture and from the lower-cost but slower and less reliable distribution of tree seeds. The Encyclopaedia of Occupational Health & Safety (2011) defined tree planting as "putting seedlings or young trees into the soil."

Beyond its environmental impact, tree planting carries social, economic, and psychological benefits. In educational institutions and public spaces, trees create comfortable, shaded environments that enhance well-being and productivity. They also provide economic advantages by increasing property value, reducing energy costs through natural cooling, and supplying resources such as timber and fruits. Psychologically, green spaces have been linked to reduced stress levels and improved mental health. As societies increasingly recognise the importance of afforestation, tree planting initiatives continue to be integrated into urban planning, climate action strategies, and sustainable development efforts worldwide.

CONCEPT OF SCHOOL BUILDINGS

A building is an enclosed space, such as a house or factory, that has walls and a roof and is typically stationary. According to Usanga and Usanga (2024), buildings may be found in a wide range of sizes, forms, and purposes. School buildings are physical structures that are designed to educate students. They are designed to be safe, accessible, and conducive to learning. School buildings are designed with functional floor plans and appealing architecture. They are designed to support educational goals and provide a positive experience for students, teachers, and staff, they are designed to favor conditions for teaching and learning without disturbances. School buildings are designed to meet acoustic, thermal, and ventilation requirements; also, they are designed to be flexible to meet current and future educational needs.

FIG: 2

Source: https://educationbusinessuk.net/features/what-makes-good-school-building

School buildings typically have many rooms, including classrooms, playgrounds, and outdoor areas. They may include offices, lecture theatres, laboratories, and multi-story student residences. Also, they may incorporate smart technologies for automated lighting, heating, cooling, and security systems. School buildings refer to the physical structures that are designed and constructed for educational purposes. They include walls, doors, windows, and roofs, as well as the materials, colours, shapes, and dimensions of the teaching areas and classrooms. School buildings play a significant role in shaping the learning environment and can vary in size, design, and architectural features. Over time, school architecture has evolved, reflecting changes in educational approaches, policies, and pedagogies.

School buildings are critical environments whose environmental quality variables are susceptible to study because of their impact on student learning outcomes. "school building" means— (A) any structure suitable for use as a classroom, including a school facility such as a laboratory, library, school eating facility, or facility used for the preparation of food, (B) any gymnasium or other facility which is specially designed for athletic or recreational activities for an academic course in physical education, (C) any other facility used for the instruction of students or for the administration of educational or research programs, and (D) any maintenance, storage, or utility facility, including any hallway, essential to the operation of any facility described in subparagraphs (A), (B), or (C).

CONCEPT OF THERMAL COMFORT

Thermal comfort is when the people using a building do not experience any cold or hot feelings, that is, when humidity, temperature, and air movement conditions are nice and adequate to the activity conducted there. Thermal comfort" refers to a person's state of mind regarding their satisfaction with the surrounding temperature, meaning they feel neither too hot nor too cold, and is largely influenced by factors like air temperature, humidity, air movement, clothing, and personal activity level; essentially, it's the feeling of being comfortably warm or cool in an environment. Olurotimi and Mfon (2023) mentioned that thermal comfort is the condition of mind that expresses satisfaction with the thermal environment and is assessed by subjective evaluation (ANSI/ASHRAE Standard 55, 2017).

According to Usanga and Isaac (2024), thermal comfort is a state of mind that expresses satisfaction with the surrounding environment. It is influenced by a range of environmental and personal factors and is a critical consideration in the design and operation of buildings, particularly in heating, ventilation, and air conditioning (HVAC) systems. Thermal comfort refers to the personal, subjective psychological condition an individual experiences in a given environment, which can also be objectively assessed based on certain factors to predict how the majority of occupants will feel. Thermal comfort is a complex concept, which can vary greatly from one individual to another. It is defined as the feeling of well-being that people experience in a given space, a feeling influenced by various parameters such as temperature, humidity, air quality, and insulation.

Thermal comfort is the condition of mind that expresses subjective satisfaction with the thermal environment. Thermal comfort means taking into account a range of environmental,

work-related, and personal factors when deciding what makes a comfortable workplace temperature. Toftum (2004), cited in Ekanem and Akwaowo (2023), defined thermal comfort as the condition of the mind that expresses satisfaction with the thermal environment. Thermal comfort is said to be achieved in a building when the highest possible percentage of all occupants are thermally comfortable. Thermal comfort can help in under-resourced settings where efficient use of resources is crucial (Godwin, Awofala and Oni, 2023).

EFFECT OF TREE PLANTING AROUND THE SCHOOL BUILDINGS ON STUDENTS IMPROVED ACADEMIC ENGAGEMENTS

A conducive learning environment plays a crucial role in shaping students' academic performance and overall well-being. One often overlooked but highly effective strategy for improving school environments is tree planting. Trees not only enhance the aesthetic appeal of school surroundings but also contribute significantly to students' physical and psychological comfort. By providing shade, improving air quality, and fostering a sense of tranquillity, tree planting positively influences students' ability to focus, engage in learning activities, and participate more actively in school life. Below are some key effects of tree planting on students' academic engagement as mentioned by numerous scholars, including Balasha, Balasha, Masheka, and Sikuzani (2022):

- **Enhanced Thermal Comfort and Concentration:** Tree planting helps regulate temperatures around school buildings by providing shade and reducing heat absorption. Cooler learning environments prevent heat-induced fatigue and discomfort, allowing students to concentrate better, stay engaged in lessons, and retain information more effectively.
- **Reduced Stress and Mental Fatigue:** Exposure to green spaces has been linked to lower stress levels and improved mental well-being. Trees create a calming atmosphere that helps students feel more relaxed, reducing anxiety and promoting a positive mindset, which enhances participation and academic motivation.
- **Improved Air Quality and Cognitive Functioning:** Trees absorb pollutants and release oxygen, leading to cleaner air around school environments. Better air quality contributes to improved respiratory health and cognitive functioning, allowing students to remain alert and actively engage in classroom activities.
- **Encouragement of Outdoor Learning and Social Interaction:** Green spaces provide shaded outdoor areas that support interactive learning experiences, group discussions, and recreational activities. This encourages active participation, teamwork, and a more engaging academic environment.
- **Fostering Environmental Awareness and Responsibility:** Involving students in tree-planting initiatives cultivates environmental consciousness and a sense of responsibility. Hands-on participation in greening efforts enhances their connection to nature, inspiring lifelong sustainable practices and critical thinking skills.

EFFECT OF THERMAL COMFORT OF STUDENTS ON THEIR ACADEMIC ENGAGEMENTS

A well-regulated thermal environment is essential for students' academic performance, as extreme temperatures can hinder concentration, productivity, and overall engagement. Maintaining optimal classroom temperatures ensures a comfortable learning atmosphere, promoting better cognitive function and participation. The following are the effects:

- **Improved Concentration and Cognitive Performance:** A comfortable classroom temperature helps students focus better on lessons, reducing distractions caused by discomfort. Extreme heat or cold can impair cognitive abilities, leading to slower information processing and reduced retention of knowledge.
- **Enhanced Participation and Classroom Engagement**: When students feel physically at ease, they are more likely to participate actively in discussions, ask questions, and collaborate with peers. Comfortable learning environments encourage enthusiasm, curiosity, and deeper engagement with academic activities.
- **Reduced Fatigue and Stress:** High temperatures can cause dehydration, dizziness, and exhaustion, while cold temperatures can lead to discomfort and sluggishness. Maintaining thermal comfort minimizes these issues, ensuring students remain alert, motivated, and stress-free throughout the school day.
- **Better Physical Health and Attendance:** Poor thermal conditions can contribute to illnesses such as heat exhaustion, colds, or respiratory problems, leading to increased absenteeism. A well-regulated classroom environment helps maintain students' health, reducing sick days and improving academic consistency.
- **Greater Academic Performance and Productivity:** Schools that prioritize thermal comfort provide a more supportive atmosphere for learning, allowing students to complete tasks efficiently and perform better in assessments (Romero, Miranda, Montero, Sepúlveda and Valero-Amaro, 2023). By creating an environment conducive to sustained engagement, students achieve higher academic outcomes and overall success.

CHALLENGES ENCOUNTERED IN PLANTING TREES TO ENHANCE THERMAL COMFORT AND IMPROVE ACADEMIC ENGAGEMENTS OF STUDENTS IN SCHOOL BUILDINGS

While tree planting around school buildings offers numerous benefits for thermal comfort and academic engagement, several challenges hinder its implementation. These challenges range from environmental factors to administrative and financial constraints. Understanding these obstacles is crucial for developing effective strategies to integrate greenery into school environments. Below are some notable challenges schools face in planting trees for improved thermal comfort and academic engagement as mentioned by numerous scholars, including Binabid and Anteet (2024):

- **Limited Space for Tree Planting:** Many schools, especially in urban areas, have limited land for tree planting due to dense infrastructure and small compounds. The lack of adequate space makes it difficult to plant and maintain enough trees to provide significant thermal benefits.
- **Slow Growth and Long-Term Nature of Trees:** Unlike artificial cooling solutions, trees take years to mature and provide effective shade. This slow growth process discourages schools looking for immediate solutions to thermal discomfort and academic disengagement.
- **Lack of Awareness and Commitment:** Some school administrators and stakeholders may not fully understand the benefits of tree planting in enhancing thermal comfort and student engagement. This lack of awareness often results in low prioritization of tree-planting initiatives in school development plans.
- **Inadequate Funding and Maintenance:** Tree planting and maintenance require financial investment for seedlings, soil preparation, watering, and protection against pests or diseases. Many schools, particularly those in underfunded areas, struggle to allocate sufficient resources for these activities.
- **Environmental and Climatic Challenges:** Certain regions face harsh environmental conditions such as poor soil quality, prolonged droughts, or heavy rainfall, which can affect tree survival. Schools in such areas may find it difficult to sustain tree-planting efforts without additional irrigation or soil enhancement measures.
- **Risk of Structural Damage and Safety Concerns:** Large trees planted too close to buildings may pose risks, such as root damage to foundations or falling branches during storms. Concerns about potential hazards can make school authorities hesitant to plant trees near classrooms.
- **Conflicts with Infrastructure Development Plans:** School expansion projects, such as constructing new classrooms, parking lots, or playgrounds, often conflict with tree-planting initiatives. In many cases, existing trees are removed to make way for infrastructure, reducing greenery and its associated benefits.

HOW TO MITIGATE THE CHALLENGES OF PLANTING TREES TO ENHANCE THERMAL COMFORT AND IMPROVE ACADEMIC ENGAGEMENTS OF STUDENTS IN SCHOOL BUILDINGS

Despite the challenges associated with tree planting in school environments, several strategies can be implemented to overcome these obstacles and maximise the benefits of greenery. Addressing these challenges requires collaboration between school administrators, environmental experts, government agencies, and the community. Below are some effective ways to mitigate the difficulties associated with planting trees to enhance thermal comfort and improve students' academic engagements as mentioned by Abuseif, Dupre, and Michael (2022) and numerous other scholars:

- **Maximising Available Space with Strategic Tree Planting:** Schools with limited land can adopt creative planting strategies such as vertical greening, rooftop gardens, and potted trees (Rout, Sahoo, Khuntia, and Singh, 2024). Selecting compact tree species that provide shade without taking up excessive space can also help optimise small school compounds.
- **Choosing Fast-Growing and Resilient Tree Species:** To address the slow growth of trees, schools can plant fast-growing, drought-resistant species that provide quicker shade benefits. Native trees adapted to local climate conditions require less maintenance and are more likely to thrive in their environment.
- **Increasing Awareness and Policy Support:** Schools should educate administrators, teachers, and students on the importance of tree planting for a better learning environment. Government agencies and environmental organisations can support tree-planting policies by integrating afforestation into school infrastructure development plans.
- **Securing Funding and Community Involvement:** Schools can seek financial support from government grants, corporate sponsorships, and non-profit environmental organisations to fund tree-planting initiatives. Engaging parents, students, and local communities in tree-planting activities encourages long-term care and sustainability.
- **Implementing Proper Tree Maintenance Plans:** Regular tree maintenance, including watering, pruning, and pest control, ensures healthy growth and longevity. Schools should designate teams or partner with environmental groups to oversee the proper care of trees and prevent potential risks such as root damage or falling branches.
- **Adapting to Environmental and Climatic Challenges:** Schools in areas with poor soil conditions or extreme weather should invest in soil enrichment techniques, rainwater harvesting for irrigation, and protective tree shelters. This helps trees survive harsh conditions and continue to provide cooling benefits.
- **Integrating Trees into School Development Plans:** Schools should incorporate tree planting into long-term infrastructure plans rather than viewing it as a separate initiative (Turner-Skoff and Cavende, 2019). Designing school compounds with designated green spaces ensures that trees remain a priority, even as the institution expands.

CONCLUSION

Tree planting around school buildings is a vital strategy for enhancing students' thermal comfort, well-being, and academic engagement. By providing shade and improving air quality, trees help regulate temperatures, reduce heat stress, and create a more conducive learning environment. Beyond physical benefits, green spaces promote mental alertness, reduce stress, and encourage environmental consciousness among students. However, many schools still overlook this simple yet effective solution. Integrating tree planting into educational infrastructure is crucial for fostering sustainable, student-friendly learning environments. As schools prioritise sustainability, afforestation will play a key role in ensuring academic success and ecological resilience.

RECOMMENDATIONS

- Schools should incorporate tree planting as a fundamental part of infrastructure development. Educational institutions should work with environmental experts to strategically plant shade-providing trees around classrooms, playgrounds, and walkways to maximize thermal comfort and improve air quality.
- Governments and educational policymakers should develop and enforce policies that mandate afforestation programs in schools. Providing incentives, funding, and technical support for tree-planting initiatives will ensure sustainability and long-term maintenance of green spaces.
- Schools should actively engage students, teachers, and the surrounding community in tree-planting programs. Incorporating environmental education and hands-on tree-planting activities into the curriculum will foster a culture of sustainability and instill lifelong environmental responsibility in students.

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