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Sustainable Construction Education in Private Higher Education Institutions: Bridging Green Building Practices and Settlement Planning for Global Urban Resilience

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Abstract:

There is a critical demand for a paradigm shift in construction education to reduce the effects of climate change and rapid urbanisation. Therefore, this study systematically reviews the local and global literature to examine how Private Higher Institutions (PHIs) integrate Sustainable Settlement Planning (SSPs) and Green Building Practices (GBPs) into curricula using PRISMA guidelines. A total of 98 peer-reviewed studies (2015–2025) were analysed. The findings show that macro-level SSP remains underrepresented, and the micro-level is biased toward GBP. This continuously fragmented sustainability training could benefit society. The effectiveness of pedagogies includes interdisciplinary design studios and problem-based learning, but PHIs face challenges such as a lack of faculty expertise, rigid accreditation structures, and resource constraints. The SLR ascertained the exceptional possibilities of PHIs to accelerate curricular innovation. Also proposes a framework that is significant for integrating GBP–SSP education. Policy recommendations identified how PHIs can align with SDG 11 (Sustainable Cities and Communities), thus contributing to global sustainability transitions.

Keywords:

Sustainable, construction, settlement, planning, PRISMA

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1. Introduction

The construction sector holds a crucial position in the global sustainability discourse. This is because of socio-economic development, which is a major contributor to environmental degradation. Currently, Min *et al.* (2022) and Zainordin and Zahra (2020) support that the construction industry accounts for nearly 40% of global energy-related carbon dioxide emissions. This makes it a central actor in the climate crisis and the single largest consumer of natural resources. These effects are beyond carbon emissions but could include resource depletion, biodiversity loss, and the generation of significant construction waste. Demolition waste affects the environmental impact (Min et al., 2022; Al-Numan, 2024). As the global community strives toward the United Nations Sustainable Development Goals (SDGs), most especially SDG 11 on sustainable cities and communities, reforming the practices of the construction industry emerges as a non-negotiable priority.

Despite this, the unprecedented pace of urbanization is an environmental imperative. According to UN-Habitat (2021), Awuah and Abdulai (2022) state that by 2050, over 60% of the world's population is projected to reside in urban areas, with most of this growth occurring in emerging economies (UN-Habitat, 2021; Awuah and Abdulai, 2022). The rapid expansion of cities has a critical impact on both opportunities and risks, which induces opportunities for inclusivity to redesign urban settlements for resilience and efficiency. There are risks of perpetuating unsustainable practices that worsen climate vulnerability and socio-spatial inequality. Therefore, addressing these challenges involves a practical innovation in building design. These demands systemic thinking that could integrate the micro-scale optimization of individual structures with the macro-scale planning of infrastructure, resource flows, and settlements. These two perspectives are critical for cultivating professionals capable of shaping resilient urban futures.

Education is a key to transformation in Higher Education Institutions (HEIs). It is preparing the next generation of architects, construction managers, and engineers to address sustainability in all its dimensions (Ul Hassan *et al.,* 2025; Storms *et al.,* 2019; Rosak-Szyrocka and Wolniak, 2025). Nevertheless, public universities have received substantial scholarly and policy attention in this regard. The growing role of Private Higher Institutions (PHIs) remains critically underinvestigated. For rapidly urbanizing regions, PHIs are the source producers of industry-ready graduates due to their responsiveness to market demands, close ties with professional bodies, and agility (Agboola *et al.,* 2025; Noaime *et al.,* 2025). Thus, their significance lies in innovating and embedding sustainability into curricula. Although existing literature mentions that PHI contributions to sustainability education remain limited, which often privilege Green Building Practices (GBP). These GBP are energy efficiency, material life cycle analysis, and renewable integration, while overlooking the bigger systemic domain of Sustainable Settlement Planning (SSP) that involves urban resilience, socio-ecological planning, and infrastructure interdependencies.

This imbalance creates a significant research and practice gap. Graduates should be well-equipped to improve energy performance at the building level but inadequately prepared to engage with the complex, interdependent challenges of urban sustainability (Zamban, 2024). The lack of a consistent educational framework that could bridge the gap between GBP and SSP undermines the sector's capacity to play a vital role in global climate and urban resilience goals. To strengthen the practical relevance of this study, the paper demonstrates how sustainable construction education in PHIs translates into real-world industry outcomes by aligning curricula with current green building standards, regulatory frameworks, and labour market needs. Furthermore, PHIs are structurally positioned to pioneer the reforms, strategies, pedagogical models, and institutional barriers that remain underexplored in the academic literature. Therefore, this study focuses on three interrelated objectives:

1. To identify the extent and nature of GBP and SSP curriculum integration within PHIs offering construction-related programs.
2. To ascertain the pedagogical models used in delivering sustainability content and their effectiveness in cultivating both technical and systemic competencies; and
3. To establish the institutional, structural, and policy barriers that affect PHIs from attaining cohesive sustainability education, alongside potential enablers for reform.

Addressing these objectives, this study contributes a significant knowledge base that informs accreditation bodies, curriculum designers, and policymakers in positioning PHI education with the necessities of climate mitigation, sustainable urbanisation, and professional readiness for a rapidly developing construction industry. Additionally, the study integrates industry-led case studies, partnerships with construction firms, and experiential learning approaches. These include internships, site-based training, and the use of digital tools like Building Information Modelling (BIM). Furthermore, graduates are equipped with competencies in sustainable materials, energy-efficient design, and resilient settlement planning. By clearly linking educational strategies to measurable improvements in construction practices, workforce readiness, and policy implementation.

2. Conceptual Framework

The conceptual framework of this study aims to bring together Green Building Practices (GBP) and Sustainable Settlement Planning (SSP) through the dual lens of Systems Thinking and Sustainability Transitions Theory (STT). The integration in this case highlights the imperatives of bringing together technical, building-level knowledge and systemic, broader-perspective knowledge into construction professional education, in this instance, for Private Higher Institutions (PHIs) (Pan & Pan 2021). Systems Thinking documents environmental, social, and technological subsystem interdependence within the built environment. While STT provides a conceptual model of analysis for the change-making potential of schools for facilitating sustainability transitions (Jia & Desa, 2022; Petrović, 2023). The coupled models provide for closer critical investigation of curriculum innovation instead of disjunctive orientations and position PHIs to potentially influence significant sustainable urban development.

2.1 Micro-Level Competencies: Green Building Practices (GBP)

At the micro-level, Green Building Practices (GBP) signify the practical underpinning of sustainability education in construction programs concerning higher education levels. GBP curricula typically underline carbon reduction, material innovation, and resource efficiency at the level of individual buildings (Tetteh & Owusu Kwateng, 2025). Significant competencies include principles of the circular economy and the application of life-cycle analysis of materials to reduce waste and increase reuse (Sumter *et al.,* 2021); the implementation of energy efficiency plans such as smart energy systems, building energy modeling, and passive design (Orikpete *et al.,* 2023). Also, the integration of water conservation technologies and waste minimisation approaches within building projects is critical (Kumar *et al.,* 2024).

Although GBP lays the foundation for students to work with the technical expertise that defines building environmental mitigation, literature is adamant about enumerating its limitations (Rudahinyuka, 2024). Prioritizing building size over system-level interdependence and externalities existing at the urban and regional levels of sustainability (Bai *et al.,* 2016) can be suicidal. Without interrelations at a system level, GBP education would lead to building-scale specialists in sustainability but inefficient practitioners when faced with urban resilience issues.

2.2 Macro-Level Competencies: Sustainable Settlement Planning (SSP)

Sustainable Settlement Planning (SSP), however, starts at the systems level by putting the buildings in the context of the larger socio-ecological systems. SSP approaches coupled dynamics of infrastructure systems energy, transport, water, and waste—how they react in concert to produce urban sustainability impacts (Ruttonsha, 2019). It also focuses on the water–energy–food nexus and metropolitan metabolism regarding city-level resource flows and waste streams as components of systems in a more extensive system (McGrane *et al.,* 2019). SSP also focuses on climate resilience and disaster risk reduction, like flood protection, heat adaptation, and sea-level rise management (Rani *et al,* 2020). Specifically, SSP also covers the social dimension of sustainability through encouraging equitable, just, and participatory town planning that reconciles urbanisation and socio-economic objectives (Hariram *et al.,* 2023).

Whereas GBP would technically shine in its concentration at the building level, SSP expects its graduates to bring systemic thinking to identify out-proximate urban development impacts, infrastructure entanglements, and socio-economic interdependencies. Scholarship bears witness, however, that SSP is too low in construction education, where study lies mainly on technical mitigation with no hope of socio-ecological integration (Ruttonsha, 2019; Rani *et al,* 2020). The gap is an affirmation of an unbalanced trend that stops the potential of construction education from significantly contributing its share towards sustainable cities.

2.3 Curriculum Innovation in Private Higher Institutions (PHIs)

Private Higher Institutions (PHIs) take the lead in construction education, particularly in the urbanising context of the Global South, where they are responsible for issuing a large majority of professional degrees in architecture, civil engineering, and construction management (Agboola *et al.,* 2025). With their flexibility, extensive industry connections, and fee-for-service funding model, they are well-suited to take the lead in the incorporation of sustainability competencies into curricula. In relation to state universities, PHIs are better placed to react more quickly to market and professional needs and thus are strategic agents of change for sustainability education reform (Noaime *et al.,* 2025).

Despite such potential, PHIs have been insufficiently documented in the literature because most studies have focused on large numbers of public universities. The three fundamental gaps are: (1) few empirical studies that assess the sustainability curricula in PHIs; (2) few faculty capacity covering GBP and SSP areas; and (3) financial constraints vis-à-vis the gigantic pedagogic change (Awuah and Abdulai, 2022). These are aggravated by stringent accreditation standards, which promote traditional engineering material at the expense of interdisciplinary integration of sustainability (Storms *et al.,* 2019).

But PHIs' responsiveness to industry needs does pose a particular challenge to them in taking the lead in designing fresh paradigms for the curriculum based upon micro-level GBP and macro-level SSP within a blended, systems framework. By doing so, PHIs not only provide technical know-how but also the ability to create sustainable cities and communities, hence completing education and global Sustainable Development Goals agendas (SDG 4: Quality Education; SDG 11: Sustainable Cities and Communities).

2.4 Theoretical Anchors: Systems Thinking and Sustainability Transitions Theory

Institutionalization of GBP and SSP through training PHIs is explained most aptly by two interlinked sets of theory, Systems Thinking and Sustainability Transitions Theory (STT). The two together form a robust analysis platform in narrating the shift from training to sectoral transformation towards global sustainability agendas.

Systems Thinking requires comprehension of the dynamic relationship between macro-scale and micro-scale systems. In the context of construction education, it means the comprehension of how a single design decision, e.g., building orientation, material choice, or energy conservation, is nested within and governed by larger infrastructural, ecological, and socio-economic systems (Pan & Pan 2021). Through the integration of Systems Thinking in the curriculum, learners can see beyond reductionist solutions and witness interdependencies, feedback loops, and long-term resilience trade-offs throughout the built environment (Banson et al., 2018). These teach technical expertise to the graduates and also render them the ability to envision the ripple effect of design intervention through urban and ecological systems.

Sustainability Transitions Theory (STT) takes one step beyond this systems-thinking understanding in describing the institutional, structural, and socio-technical transformation of transforming the building sector to become more sustainable (Jia & Desa, 2022; Petrović, 2023). In the multi-level perspective (MLP) ontology of transformation, transformation is mediated via relations among macro-scale landscape pressures (e.g., climate change and urbanization), meso-scale regime dynamics (e.g., long-term architectural policies and accreditation structures), and micro-scale niche innovations (e.g., inaugural pedagogical architectural designs in PHIs). PHIs can thus be placed as niche agents that institutionalize and innovate curricular innovations, breaking prevailing education paradigms and opening transitions to sustainability. Through policy goals such as the United Nations Sustainable Development Goals (and target SDG 11: Sustainable Cities and Communities), PHIs can use innovation to put sustainability skills into the construction sector at scale (Petrović, 2023).

2.5 The GBP–SSP Nexus in Construction Education

The model developed during the present research depicts the GBP–SSP relationship in terms of a spectrum of sustainability abilities. GBP on one end of the spectrum teaches students technical competencies of low-impact building design, focusing on energy efficiency, lifecycle assessment, and application of renewables (Awuah and Abdulai, 2022). On the other end, SSP develops system capacities of urban climate resilience, infrastructure dependencies, and socio-ecological coordination (Storms *et al.,* 2019). Both are important: GBP goes to the extreme of taking individual buildings to reduce environmental footprint, while SSP puts all those efforts into perspective in achieving sustainable and resilient cities.

PHIs, being halfway business and halfway academy, are best positioned to synthesize GBP and SSP into a systems pedagogy. Systems Thinking allows curricula to teach that construction practice at the micro-scale depends on settlement systems at the macro-scale. STT positions PHIs themselves as the levers to facilitate such convergence, de facto merging sustainability as a hard skill rather than an add-on elective.

Synthesis of theory anchor aims to emphasize that education in sustainable construction should be able to escape the micro-level orientation of GBP to cover SSP as a foundation of the curriculum. It is only under such a connection that practice graduates are positioned to survive double proof of sustainable building design by participating in the planning and governance of sustainable cities.

Table 1. Literature Synthesis: Sustainable Construction Education in Private Higher Institutions

Author(s)	Key findings/insights	Relevance to topic
Agboola et al., 2025	Student-driven initiatives can accelerate campus sustainability and create experiential learning opportunities.	Demonstrate how private HEIs can embed student-led projects to teach green building and settlement planning in practice.
Alexander, 2020	Clear protocols improve review reliability and transferability	Informs how private HEI research/evaluation of curriculum change should be conducted
Al-Numan, 2024	Construction significantly depletes resources; mitigation via materials, design, and regulation.	Provides content for teaching resource-efficient materials and life cycle thinking
Awuah & Abdulai, 2022	Complex governance challenges require integrated training across planning and construction.	Emphasis needs to be placed on settlement governance alongside technical skills.
Bai et al., 2016	Systems approach advances integrated urban policy and practice	Supports systems-thinking modules linking building practices to urban systems
Braun & Clarke, 2019	Reflexive thematic analysis supports rigorous qualitative synthesis	Useful for HEI curriculum evaluation and qualitative research components
Hariram et al., 2023	Integrated models are necessary for balanced sustainability decisions	Useful theoretical basis for interdisciplinary courses
UN-Habitat (Annual Report), 2021	Emphasises compact, inclusive and resilient settlements; capacity building	Anchors HEI programs to normative international frameworks
Jia & Desa, 2022	Social entrepreneurship links finance, innovation, and place-based transformation	Suggests entrepreneurial modules for students to translate green ideas into viable projects
Kumar et al., 2024	Hybrid methods identify multi-criteria barriers and solutions	Illustrates the application of decision-making tools in environmental management modules
McGrane et al., 2019	Nexus framing helps integrated urban infrastructure planning	Supports cross-sectoral modules connecting buildings to utilities and food systems

Min et al., 2022	Shows links between emissions and operational building performance	Reinforces the need for energy performance and emissions literacy in curricula
Noaime et al., 2025	Campus design influences learning, well-being, and sustainability behaviors.	Evidence to support campus-as-living-lab pedagogy in private HEIs
Orikpete et al., 2023	Renewable integration improves efficiency and autonomy	Teaches technical solutions for green buildings and microgrids
Pan & Pan, 2021	Policy, technical, and economic levels are needed for a zero-carbon	Curriculum must include the policy and economics of decarbonisation
Petrović, 2023	Integrated frameworks facilitate system transitions	Useful for capstone modules on transition planning
Rani et al., 2020	Embedding DRR in planning is critical for resilient cities	Adds DRR content to settlement planning modules
Rosak-Szyrocka & Wolniak, 2025	HEIs can be innovation engines connecting research and city needs	Maps institutional roles that private HEIs can adopt
Rudahinyuka, 2024	Local capacity, cost, and awareness barriers; strategies proposed	Directly relevant to SSA private HEIs contextualizing green practices
Ruttonsha, 2019	Place-based relational dynamics needed for design	Supports context-sensitive teaching of settlement planning
Storms et al., 2019	Tools support resilient campus planning and pedagogy	Use of resilience tools as teaching/assessment instruments
Sumter et al., 2021	Design education lacks circularity competencies	Suggests incorporating the circular economy into construction curricula
Tetteh & Kwateng 2021	Identifies repeated barriers and proposes solutions	Useful review to inform course reading lists and project briefs
Ul Hassan et al. 2025	Recommend systemic transformation of HEIs to be crisis-ready	Supports institutional change strategies in private HEIs
Utermohl de Queiroz et al. 2025	Scoping methods to map pedagogical strategies	Methodological precedent for curriculum scoping in construction education
Zainordin & Zahra, 2020	Identifies key carbon drivers in construction activities	Useful for teaching carbon auditing and mitigation
Zamban, 2024	Education is central to the sustainability transition	Supports advocacy for stronger HE curricula in sustainability

Authors Source

3. Methodology

This study employed a Systematic Review of Literature (SRL) following the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA 2020) protocol (Utermohl de Queiroz *et al.,* 2025). Systematic review was deemed most suitable since it permits integration and critical synthesis of literature available and thereby identifies patterns, discrepancies, and best practices in the application of Green Building Practices (GBP) and Sustainable Settlement Planning (SSP) in Private Higher Institutions' (PHIs) construction projects. The research is methodologically consistent, clear, and replicable, and forms a solid foundation for evidence-based recommendations.

3.1 Database Selection

For a general and quality academic foundation, five discipline-specific and multidisciplinary academic databases were searched in an orderly fashion: Web of Science, Scopus, ScienceDirect, Taylor & Francis Online, and SpringerLink. They were utilized because they provide extensive coverage of peer-reviewed journals, international coverage, and high-quality building, construction, urban planning, and sustainability studies education research coverage (Okoli & Schabram, 2015).

Searching multiple databases avoided publication bias and enabled a more comprehensive review.

3.2 Search Strategy

A complex search strategy involving a Boolean approach was employed to search for studies on the topic, utilizing keywords and topic words for curriculum innovation and evaluating sustainability themes. The most specific search terms were: "sustainable construction education" OR "green building education", "settlement planning" OR "urban resilience education", "curriculum innovation" AND ("construction management" OR "architecture" OR "engineering"), "private higher institutions" OR "private universities". English-language peer-reviewed journals from January 2015 to March 2024 were targeting the rising trends of sustainability policy, green technology, and curriculum change. Omitting the most recent and limiting to the most recent ensured that the pragmatic applicability of PHIs was not sacrificed.

3.3 Inclusion and Exclusion Criteria

Selection criteria were used in the effort to ensure selected studies were proper and of quality. Inclusion criteria were focused studies with a clear statement on HE curriculum integration of GBP, SSP, or sustainability. Field-based studies aligned with the construction, e.g., civil engineering, architecture, construction management, or urban planning. PHI-based studies in or translatable to PHIs or giving translatable insights for comparable contexts. Exclusion criteria were grey literature such as conference proceedings, technical reports, dissertations, and non-peer-reviewed publications. Non-relevant studies to the discipline, i.e., technically oriented design or engineering studies without a curriculum context. Publication in the undefined time periods outside of 2015–2024.

3.4 Screening and Selection Process

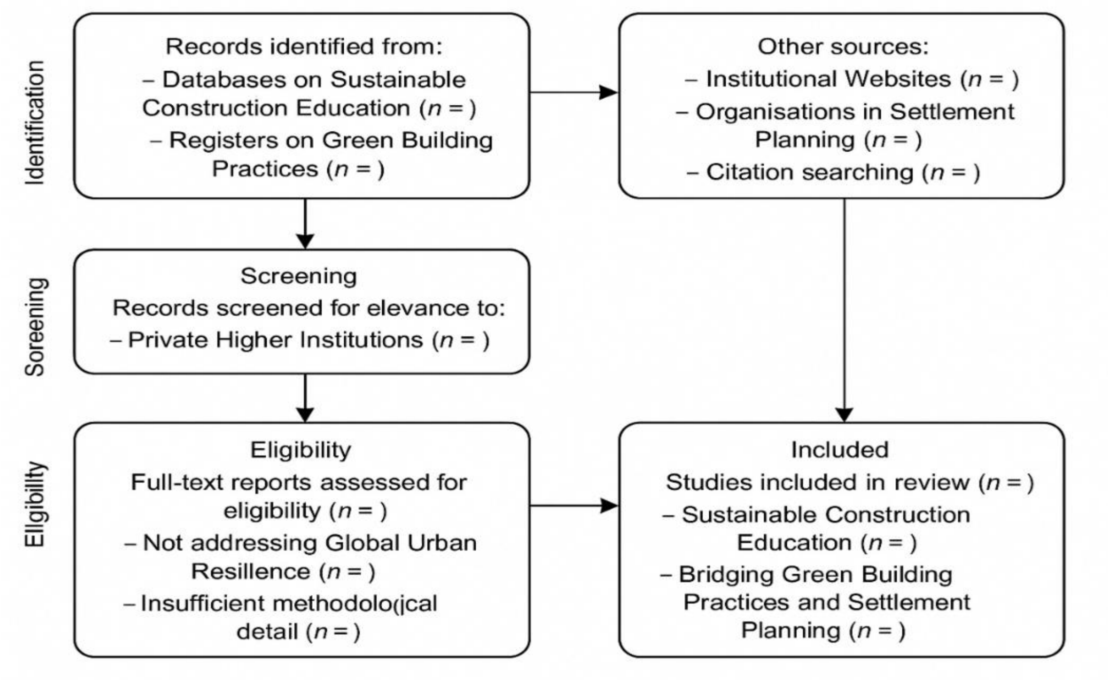
The whole records were downloaded, imported into Mendeley Reference Manager for elimination of any duplicity and provision of a clean data set to screen. Three-phase selection was applied: Title and abstract screening for exclusion of studies clearly irrelevant. Full-text screening to ascertain GBP, SSP, or learning objectives of sustainability curriculum compatibility. Quality assessment in terms of methodological description, educational relevance, and contribution towards research objectives (Alexander, 2020).

PRISMA process flow chart (Figure 1) indicates all the processes, from screening and identification to determination of eligibility and inclusion.

3.5 Thematic Analysis

Thematic coding, research-driven, was achieved via a combination of deductive and inductive involvement to enable pre-conceived and emergent themes to be identified (Braun & Clarke, 2019). Four thematic frameworks were developed, which include green building practices (GBP), micro-level embedding of energy efficiency, life cycle assessment, and building performance simulation into the curriculum. Also, sustainable Settlement Planning (SSP) includes macro-level systems thinking encompassing infrastructure planning, urban resilience, resource flow, and socio-ecological integration. Pedagogical Models: Education models such as problem-based learning, studio-based learning, and interdisciplinary simulations. There are institutional barriers in terms of organizational and functional concerns, such as imbalances of teaching faculty capacities, accreditation constraints, and constraints on material or financial resources. Generated thematic patterns were then integrated into an official report, synthesizing international trends, significant gaps, and GBP and SSP integration into PHI curricula implications.

Figure 1. The methodological mapping of the review



Author's Source

4. Results and Discussion

4.1 Trend in Curriculum Integration

PHI building construction curriculum studies share exposure to an imbalance in the integration of sustainability principles. Green Building Practices (GBP) have been given complete treatment in the courses, typically modules under building lifecycle analysis, renewable energy adaptation, and global standards on sustainability rating systems such as LEED and BREEAM. This emphasis is a reaction to a global movement in developing education that focuses on measurable, market-valued competence at the building level to ready graduates to meet near-term industry needs for building energy efficiency and sustainability (Agboola *et al.,* 2025; Noaime *et al.,* 2025).

Conversely, Sustainable Settlement Planning (SSP) receives minimal priority to its inherent saliency. SSP matters of urban resilience, interdependent infrastructure, and socio-ecological planning are relegated to being dealt with indirectly or in specialist policy and planning modules. Therefore, construction graduates who possess unmatched building-level sustainability competencies with no system-level high-level challenge recognition are typical of urban and regional sustainability performance, which is critical in construction education (Awuah and Abdulai, 2022). This unbalanced emphasis ensures disconnected education for sustainability, technically accomplished at the micro-scale and not at the macro-scale of systems thinking. Current studies in education for sustainability also reveal the prevalence of city- or region-scale issues over building- or project-scale solutions, to the detriment of graduates' ability to tackle issues of sustainability at the cross-scale (Storms *et al.,* 2019). For PHIs, with increasingly greater speed and reaction to human needs in the short term, the trend poses a tremendous challenge: curricula may suitably equip graduates to address business needs today, but cannot suitably equip them to address social and environmental needs in the long term.

4.2 Pedagogical Models

The review ascertained that problem-based learning (PBL), interdisciplinary studios, and simulation-based projects are extremely important pedagogies for integrating sustainability in construction education. These pedagogies not only improve technical competence but also improve teamwork. Also, problem-solving, critical thinking, and systems-level thinking are part of 21st-century competencies expected of construction practitioners. Interdisciplinary studios, for instance, bring together students in planning, engineering, and architecture to work in teams on an integrated design project, hence bridging the gap between SSP-based urban systems and GBP-inspired building interventions (Banson et al., 2018).

Even with such developments, pedagogical gaps continue to remain. Most PHIs still retain compartmentalised technical curricula in which sustainability is a secondary add-on to be addressed and not a core thread. Compartmentalization rigidifies discipline boundaries and restricts learners from acquiring systemic perspectives necessary to address issues related to sustainability. In addition, curricula do not typically offer systematic exposure to policy, governance, and ethics problems—problems of the highest significance to close technical solutions and public goals and prepare graduates to function in the broader institutional and regulatory context (Jia & Desa, 2022; Petrović, 2023).

Combined, these findings suggest that PHIs have the dual responsibility of balancing the achievement of market-complete technical proficiency with that of change-enabling sustainability literacy. Without a direct pedagogic challenge, graduates will be technically proficient practitioners but strategically limited in their capacity to contribute to systemic sustainability performance.

4.3 Private Higher Institutions (PHIs) challenges

PHIs' rigorous curricula on sustainability are being weakened under attack by a list of persistent constraints cumulatively taking hostage of the institutions in graduating students with a capacity to manage building-level and settlement-level issues for sustainability. To start with, knowledge gaps among lecturers are an inevitable constraint. Most of the PHIs lack inter-disciplinary qualified lecturers in GBP and SSP. This paucity of knowledge limits the field and content of instruction, which can culminate in one making use of fragmented subject-matter knowledge that is not able to provide learners with a coherent image of construction sustainability (Awuah and Abdulai, 2022).

Second, there is a built-in budget limitation. Sustainability education of quality will come at a cost, and capital investment will be required in simulation labs, certification programs (e.g., LEED, BREEAM), and campus SSP courses. Tuition model PHIs must work with budgets that hinder experiential and hands-on education—fields at the very essence of systems thinking and intentionally planned applied problem-solving skills (Storms *et al.,* 2019). Third, the stringency of accreditation suppresses curriculum innovation. These convention program accreditation requirements are full of conventionally formatted content and have little space to accommodate interdisciplinary or experimentally designed GBP and SSP blocks. These pedagogical innovation constraints of a structural kind encompass the trade-off in relying on conventional compartmentalized pedagogy and losing effort in producing students capable of coping with complexity in urban sustainability challenges (Awuah and Abdulai, 2022). These together constitute evidence of a paradox: despite all, how PHIs are more entrepreneurial and flexible than public counterparts, structural, financial, and regulatory strains strongly reduce their own capacity to integrate holistic sustainability education.

4.4 Synthesis: Why the Gap Matters:

The literature drives the agenda for the PHI building construction sustainability education gap. The students are excellent at building-level sustainability, but all too frequently not so skilled with handling the systemic, scale-up issues of region-level and city-level planning for sustainability. This shortage of systems thinking limits the constructive value of the construction industry to contribute to global aspirations for sustainability in broader contexts, i.e., United Nations Sustainable Development Goal 11 (SDG 11) and constructing secure cities and communities (United Nations, 2020). Policy- and practice-related consequences of such a shortage are two-fold. First, PHIs, by their response capacity as institutions and industry pressure compliance, can be change leaders to sustainability if adequately funded and endowed with powers of regulation. Second, keeping SSP out of curricula reduces the output of building professionals trained at designing sustainable buildings but wastefully incompetent at designing sustainable cities.

In short, the GBP–SSP is an add-on issue of the curriculum and a strategic imperative question. PHIs must redefine curricula as graduate full-spectrum, inter-disciplinary learning environments for both micro-scale technical competencies and macro-scale system leadership capabilities, and thereby be empowered to contribute sustainably to city building.

5. Policy and Practice Implications

The findings of this review reveal significant systemic gaps in how sustainability is incorporated into construction education within Private Higher Institutions (PHIs). Addressing these gaps requires a coordinated response that spans institutional, regulatory, and industry domains, ensuring that graduates acquire both technical proficiency and systems-level sustainability literacy.

5.1 Implications for Private Higher Institutions (PHIs)

The implications of the results of this review are dire system loopholes in PHIs' use of construction education to achieve sustainability. The loopholes should be addressed by a converged effort among institutional, regulatory, and industry players in boosting graduates' technical competence and system-level capability for sustainability. PHIs must be integrating SSP and GBP in the mainstream courses and not as electives or peripheries of an integrative and mainstream syllabus. This will give all the graduates micro-level technical skills and macro-level systems thinking capabilities (Storms *et al.,* 2019). Some of the key strategies are to incorporate interdisciplinary simulation and studio-based projects as capstones to provide experiential learning experiences that simulate the conditions of sustainability in a holistic way (Storms *et al.,* 2019).

Formation of curriculum reform boards with sustainability practitioners, industry, and accrediting body members as members to lead the adoption of new and cross-disciplinary models of learning (Ul Hassan *et al.,* 2025). Leveraging their sector passion and organizational flexibility, PHIs can lead the experimentation with new education models that can serve as blueprints for sector-end-to-end higher education transformation (Rosak-Szyrocka and Wolniak, 2025).

5.2 Implications for Accrediting Agencies

Accreditation regimes have considerable influence over curricular shape. Contemporary standards, as much as they prioritise at most up to anything the traditional disciplinary subject matter, do so maybe only at the cost of interdisciplinarity and integration of sustainability (Rosak-Szyrocka and Wolniak, 2025; Ul Hassan *et al.,* 2025). The accrediting agencies can also advance system education for sustainability further through

Strengthening accreditation standards to formally appreciate and honor interdisciplinarity for sustainability. Incorporating measurable sustainability performance standards, e.g., SSP to GBP credit ratio, or for cross-disciplinary learning, in quality assurance systems. Regulation of space design for PHIs to bring innovative pedagogic designs within some leeway to innovate without sacrificing levels of compliance with accreditation. All these would place education at the center with sustainability and restore its sovereignty over professional competence (Ul Hassan *et al.,* 2025).

5.3 Implications for Policymakers

Government ministries and education agencies have a key role in upscaling PHIs to overcome educational structural obstacles for sustainability. Policy measures can include Targeting aid to teacher training, where teachers possess GBP and SSP area expertise (Agboola *et al.,* 2025; Noaime *et al.,* 2025). Institutionalizing national centers of educational excellence for sustainable construction, where education and training, curriculum development, and industry linkage occur. Facilitating industry-academia collaboration through collaborative research projects, tax incentives, or investments with the capacity to make the curriculum more responsive to evolving sustainability issues (Noaime *et al.,* 2025; Rudahinyuka, 2024). Policymakers must actively step in and address the resource and knowledge deficit that currently inhibits PHIs' ability to deliver innovative sustainability education.

5.4 Implications for Industry

The postgraduate system and technical sustainability ability directly impact the building. Industrial engagement can ensure maximum relevance of practice and curriculum in the real world by investing in co-design of curriculum with PHIs in partnership, where the learning of students cycles back into actual-world sustainability challenges and industry best practice (Agboola *et al.,* 2025; Tetteh & Owusu Kwateng, 2025; Noaime *et al.,* 2025). Providing internships, apprenticeships, and project-based participation, where students may test GBP and

SSP learning in the real world. Participation in co-operative programs for certification, e.g., incorporating LEED or BREEAM principles into program studies, to align graduate skills with global industry demands. It can bridge the divide between practice and education and propel the industry towards further contribution to more sustainable city development at higher speeds.

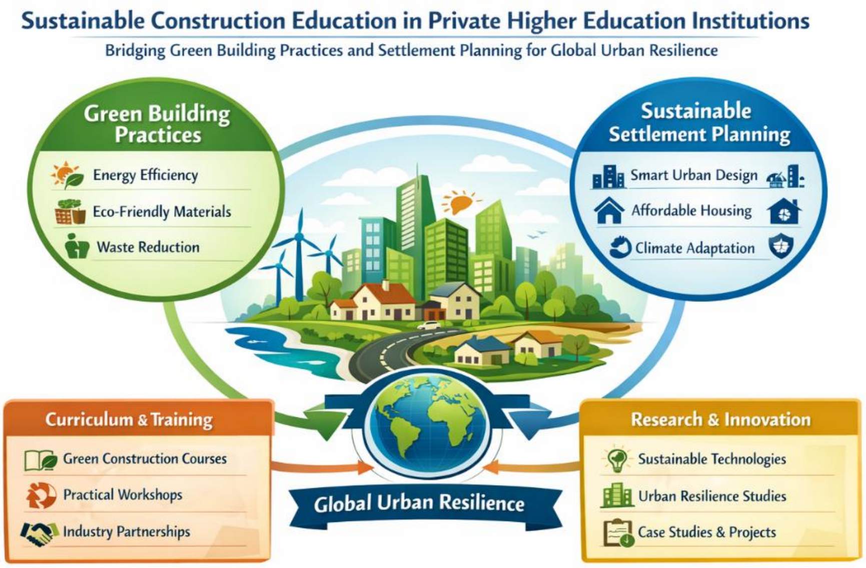
5.5 Integrative Perspective

Guidelines as a general whole in overall aggregate require a multi-stakeholder context to orchestrate sustainability education as the sea's call. PHIs cannot orchestrate GBP–SSP bridging independently; there must be system intervention by business partners, policymakers, and accrediting agencies. With built-in interdisciplinarity, lecturers' capacity building, and curriculum alignment with industry and society needs, PHIs can be the drivers to United Nations Sustainable Development Goals (namely SDG 4: Quality Education and SDG 11: Sustainable Cities and Communities) (Kumar *et al.,* 2024; UN, 2020).

5.5.1 Conceptual Framework: Sustainable Construction Education Model

This conceptual framework illustrates how construction education, particularly within private higher education institutions, translates sustainability drivers into practical results for the construction industry and society at large. The model links for layers are listed below.

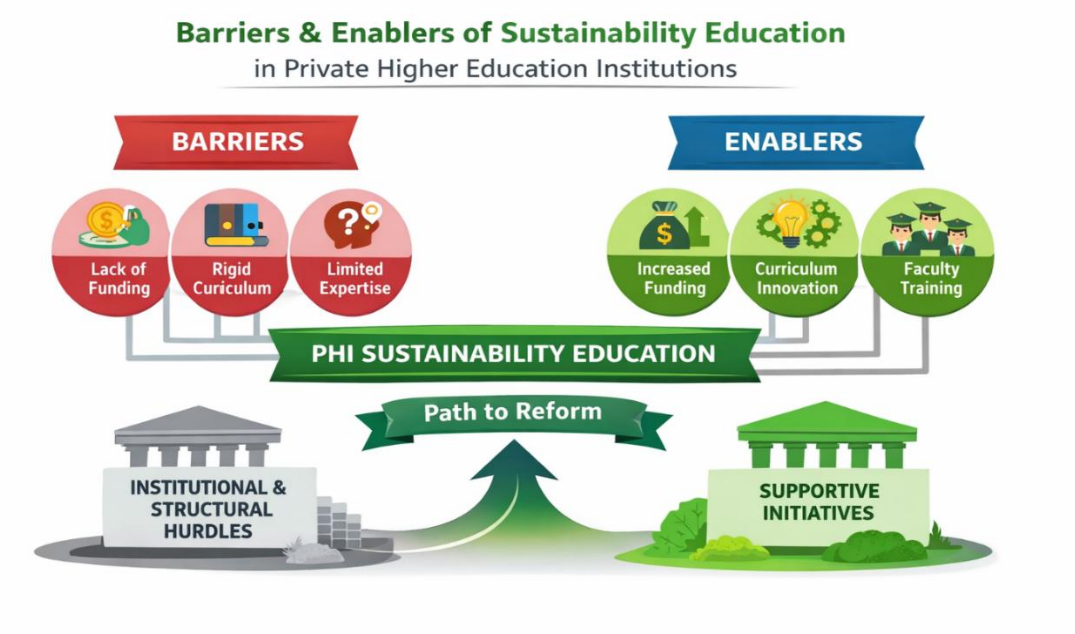
Figure 2. Conceptual framework illustrating the institutional, structural, and policy dynamics shaping sustainability education in PHIs



Author's own development with the assistance of artificial intelligence (ChatGPT)

Figure 2 presents a conceptual framework demonstrating the institutional, structural, and policy dynamics shaping sustainability education within Private Higher Education Institutions (PHIs). The diagram systematically contrasts key barriers such as limited funding, rigid curricula, and insufficient sustainability expertise. With these critical enablers, such as targeted investment, curriculum innovation, and faculty capacity development. Therefore, positioning PHI Sustainability Education at the centre shows the interdependent nature of these forces. Also, demonstrates how strategic enablers can mitigate systemic constraints. The "Path to Reform" emphasizes a transition from fragmented institutional practices toward cohesive and policy-aligned sustainability education. This integrative framework advances existing literature by moving beyond descriptive accounts to offer a practical. Hence, a reform-oriented lens that can guide institutional transformation and policy formulation. There is a need for future empirical research, thereby strengthening its relevance to high-impact sustainability and higher education journals.

Figure 3. The Barriers–Enablers Framework for Sustainability Education in PHIs



Author's own development with the assistance of artificial intelligence (ChatGPT)

Figure 3 explains the framework, which illustrates the key institutional, structural, and policy factors that influence the effectiveness of sustainability education within Private Higher Education Institutions (PHIs) and highlights pathways for reform. Firstly, on the left side, are the major barriers that hinder cohesive sustainability education. These include a lack of funding, which limits investment in sustainable infrastructure, research, and curriculum development. Also, rigid curricula, which restrict the integration of emerging sustainability and green construction concepts. The limited expertise refers to insufficient staff capacity and specialised knowledge in sustainability-related disciplines.

Secondly, on the right side, the framework identifies critical enablers that can reduce these challenges. These are increased funding: supports curriculum renewal, research initiatives, and infrastructure development. Also, curriculum innovation enables the integration of sustainability principles, green building practices, and settlement planning into teaching and learning. Faculty training enhances academic capacity, ensuring lecturers possess the skills and knowledge required to deliver sustainability-focused education effectively.

Thirdly, at the centre, PHI Sustainability Education is the core objective of developing an integrated and coherent sustainability education system within private higher education. The connecting pathways determine how barriers and enablers directly influence this significant goal.

Therefore, at the base of the framework, the Path to Reform indicates the transition from institutional and structural barriers to supportive initiatives. This pathway underscores the significance of policy reform, institutional commitment, and strategic interventions to transform barriers into enablers. Targeted reforms, such as PHIs, can strengthen sustainability education and contribute meaningfully to broader goals of sustainable development and urban resilience. Generally, the framework provides a structured lens for analysing existing challenges, whereas identifying actionable opportunities for reform will make it useful for policy development, institutional planning, and future research in sustainability education tools.

6. Conclusion

The review has caused a dissonance between micro-level and macro-level competencies in modules of sustainability education, particularly in Private Higher Institutions (PHIs). While GBP was seriously implemented everywhere to produce qualified graduates at the micro-level with respect to energy efficiency, lifecycle design, and material optimization, SSP at the macro-level research had been neglected. Such an overall lack not only isolates the sustainability education but also denies the graduates the capacity to handle future urban resilience issues at the city and local level.

Institutional Potential and Constraints: The article shows that PHIs, through institutional responsiveness, sectoral networks, and market awareness, are well placed to innovate. However, there exist high barriers comprising highly specialist teacher expertise, cost pressure, and inelastic accreditation contracts, which deter them from embedding successful sustainability learning into the curriculum.

Need for Collaborative Systemic Reform: These will have to be addressed by a collaborative, multi-actor effort by accreditation agencies, policy makers, and industry partners.

Curriculum Integration and Pedagogical Innovation: The kind of model being sought here requires macro, mandatory integration of GBP and SSP into master curricula augmented with pedagogic models like problem-based learning, cross-disciplinary studios, and simulation-based projects. These are the kinds of reforms that should be done to create system-ready graduates able to design not just sustainable buildings but also sustainable cities, mainstreaming construction education into the UN Sustainable Development Goals (SDG 4 and SDG 11).

Study Limitations: While this review is an integration of the trends, pedagogies, and general issues that are on the rise, it is also limited in that it can only draw on sources authored in English and not grey literature, upon which national development of PHIs outside the international publishing mainstream might be ruled out. Subsequent research will then need to take account of empirical case studies of PHI in the Global South and longitudinal assessments of curriculum reforms in attempting to evaluate how far these have impacted graduate capacities and industry performance.

Strategic Role of Education in Sustainability: The future of construction sustainability does not lie in technology, but on the shoulders of education that forms the workforce of tomorrow. The shutdown of GBP–SSP translates to PHIs being able to realign their function from passive, reactive labor skill providers to proactive drivers of global change to sustainability.

Future Research Directions

Follow-up research must empirically explore how PHIs in the Global South integrate GBP and SSP into the curriculum, and contextual enablers, challenges, and best practices. Long-term research over several years must test the impact of such curriculum innovation on graduate capability, employability, and industry practice sustainability. Research must explore problem-based learning quality, interdisciplinary studio courses, and simulation exercises to develop systemic sustainability capacity. Along with English-language learning on how computer software, such as BIM and urban simulation, can help in implementing region-based innovations. Also, the greater translational value of sustainability education at multiple scales will be covered. Overall, this research will inform integrative curriculum planning as a way of preparing graduates with skill sets to address micro- and macro-level sustainability issues in the construction sector.

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