TRANSFORMING HIGHER EDUCATION THROUGH INTERDISCIPLINARY INNOVATION: BUILDING SKILLS FOR A SUSTAINABLE SOCIETY

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Abstract

This paper examines how interdisciplinary innovation in higher education can equip students with the knowledge, skills, and values necessary to address sustainability challenges. By integrating diverse disciplines such as technology, social sciences, environmental studies, and policy, universities can foster holistic problem-solving approaches. The article highlights strategies for curriculum transformation, collaborative research, and experiential learning as pathways to build resilience and prepare graduates for a sustainable society. The researchers made the following recommendations that the Nigerian Universities Commission (NUC) should embed sustainability competencies and interdisciplinary requirements into accreditation frameworks. and universities should create hubs for research and teaching that cut across faculties, focusing on Nigeria's pressing challenges such as energy transitions, urban development, and food security amongst others.

Keywords: Transforming, Higher Education, Interdisciplinary Innovation, Sustainable Society

Introduction

The world is currently confronted with a confluence of crises that threaten the stability of societies, ecosystems, and economies. From the accelerating impacts of climate change and biodiversity loss to the persistence of poverty, inequality, and geopolitical instability, humanity faces challenges that are both unprecedented and deeply interlinked (Rockström et al., 2009; Sachs et al., 2019). These challenges cannot be addressed in isolation. Instead, they demand holistic and systemic

solutions that draw on multiple domains of knowledge and practice. Higher education institutions (HEIs), as centers of learning, research, and innovation, hold a critical responsibility in preparing the next generation of leaders and problem-solvers who will navigate these complex realities (Leicht, Heiss, & Byun, 2018).

Yet, despite the central role that universities are expected to play in advancing sustainable development, many HEIs continue to operate within rigid disciplinary silos. The traditional model of higher education privileges specialization over integration, producing graduates who are highly skilled in narrow fields but often ill-equipped to apply knowledge in interdisciplinary or real-world contexts (Sterling, 2010). Such fragmentation creates a disconnect between the type of education offered in universities and the multifaceted nature of global sustainability challenges. For example, addressing issues like renewable energy transitions, urban resilience, or food security requires insights from environmental science, engineering, economics, social sciences, and policy. However, most students are rarely exposed to such cross-cutting perspectives during their formal education.

The need for transformation in higher education is further underscored by global frameworks such as the United Nations' Sustainable Development Goals (SDGs). The SDGs, adopted in 2015, represent an ambitious global agenda to end poverty, protect the planet, and ensure prosperity for all by 2030 (United Nations, 2015). Goal 4 specifically calls for "inclusive and equitable quality education" and highlights the importance of "education for sustainable development and sustainable lifestyles." Achieving this goal requires not only expanding access to education but also transforming its content and delivery. Universities must move beyond the mere transmission of knowledge to the cultivation of competencies that enable students to think systemically, act ethically, and collaborate across disciplinary and cultural divides (UNESCO, 2017).

Interdisciplinary Innovation as a Response

Interdisciplinary innovation has emerged as a critical strategy for aligning higher education with the demands of sustainable development. Broadly defined, interdisciplinarity refers to the integration of concepts, theories, and methods from different disciplines to create new knowledge or solve complex problems (Newell, 2023). Innovation, in this context, extends beyond technological breakthroughs to encompass pedagogical, institutional, and cultural changes that support holistic learning and problem-solving. Interdisciplinary innovation, therefore, represents both a philosophy and a practice of higher education transformation.

The application of interdisciplinary innovation to higher education entails rethinking curricula, pedagogy, and research to foster collaboration across disciplines and to embed sustainability at the heart of educational processes. For instance, interdisciplinary sustainability programs have been established at institutions such as Arizona State University's School of Sustainability and

Wageningen University in the Netherlands. These programs integrate natural sciences, social sciences, and humanities to equip students with comprehensive skill sets needed for tackling sustainability challenges (Brundiers et al., 2021). Such models illustrate the transformative potential of interdisciplinary innovation in preparing graduates for the complexities of the modern world.

Higher Education in the Nigerian and African Context

In Africa, and Nigeria in particular, the case for interdisciplinary innovation is even more pressing. The continent faces acute sustainability challenges, including rapid urbanization, environmental degradation, high unemployment, and fragile governance structures (Lotz-Sisitka et al., 2015). Nigeria, Africa's most populous country, grapples with unique pressures: its higher education system is underfunded, plagued by infrastructural deficits, and burdened with outdated curricula that often fail to prepare students for contemporary societal needs (Adebayo & Akinola, 2020). At the same time, Nigeria's youthful population represents both a challenge and an opportunity. If properly educated and equipped, this demographic can drive innovation and contribute to building a sustainable and inclusive society.

Interdisciplinary innovation in Nigerian higher education would mean breaking away from traditional faculty structures, embedding sustainability in curricula, and fostering collaborations between universities, industry, and government. However, achieving this transformation requires overcoming systemic barriers, including inadequate funding, limited faculty expertise in interdisciplinary teaching, and policy frameworks that are often slow to adapt (Okebukola, 2021). By situating Nigeria within the global conversation on higher education and sustainability, this paper underscores both the urgency and the potential of interdisciplinary innovation in African universities.

Despite widespread recognition of the importance of sustainability education, significant gaps remain in both practice and scholarship. Much of the existing literature focuses on developed countries, with relatively fewer studies examining how interdisciplinary innovation can be operationalized in African or Nigerian contexts (Barth & Rieckmann, 2016). Moreover, while policy frameworks such as the SDGs and UNESCO's Education for Sustainable Development (ESD) agenda provide broad guidance, there is still limited clarity on how these global visions can be translated into concrete reforms at the institutional level. The research problem, therefore, can be articulated as follows: How can higher education institutions be transformed through interdisciplinary innovation to build skills for a sustainable society, particularly in the Nigerian context? This problem is not merely academic but has profound implications for educational policy, workforce development, and the broader pursuit of sustainable development.

Literature Review

Theoretical Framework

Transformative Learning Theory

Transformative Learning Theory (TLT), pioneered by Jack Mezirow (1991), emphasizes the process by which individuals critically examine and revise their assumptions, beliefs, and perspectives. This theory is particularly relevant to sustainability education because it highlights the importance of deep shifts in worldview, moving from fragmented to holistic ways of thinking. The core principles of TLT include:

- Disorienting dilemmas: Learners often experience challenges that disrupt their established frames of reference. For example, exposure to the reality of climate change or unsustainable consumption can serve as such dilemmas in sustainability education (Cranton, 2016).
- Critical reflection: Learners analyze assumptions underlying their beliefs, values, and actions.
- Dialogue and collaboration: Interaction with others supports the validation and transformation of perspectives.
- Action-oriented change: The ultimate outcome of transformative learning is behavioural and social change.

In higher education, TLT supports interdisciplinary innovation by encouraging students to question narrow disciplinary perspectives and embrace integrative approaches. For instance, an engineering student may critically reflect on the ethical and social implications of designing new technologies, while a social science student may deepen their understanding of environmental systems. By fostering such shifts, TLT aligns with the goal of producing graduates equipped for sustainable societies (Sterling, 2010).

Education for Sustainable Development (ESD) Framework

The ESD framework, advanced by UNESCO, provides another vital lens for examining higher education transformation. ESD emphasizes empowering learners to make informed decisions and take responsible actions for environmental integrity, economic viability, and social justice (UNESCO, 2017). Key features of ESD involves:

Competency-based approach: ESD focuses on developing skills such as systems thinking, anticipatory competence, normative competence (understanding values), and strategic competence (Wiek, Withycombe, & Redman, 2011).

Integration across disciplines: ESD requires embedding sustainability across curricula, not restricting it to environmental studies.

Participatory and experiential learning: Students engage in projects, simulations, and community-based learning.

Global-local relevance: ESD encourages contextualization, connecting global sustainability issues to local realities.

For Nigerian higher education, the ESD framework highlights the urgency of equipping students not only with academic knowledge but also with the ability to apply that knowledge in addressing pressing national challenges such as deforestation, urban waste management, food security, and energy poverty (Adebayo & Akinola, 2020). By adopting an ESD approach, universities can embed sustainability competencies into all disciplines, thus reinforcing interdisciplinary innovation.

Global Perspectives on Higher Education and Sustainability

Higher Education's Role in Sustainable Development

Globally, higher education institutions (HEIs) are recognized as essential drivers of sustainable development through their teaching, research, and community engagement functions (Cortese, 2003; Lozano et al., 2015). Universities are increasingly seen not only as knowledge producers but also as agents of social transformation, responsible for equipping graduates with the competencies needed to address sustainability challenges (Tilbury, 2011). This paradigm shift has been accelerated by international frameworks such as:

1. The UN Decade of Education for Sustainable Development (2005–2014), which emphasized reorienting education toward sustainability (UNESCO, 2017).
2. The Sustainable Development Goals (2015–2030), particularly SDG 4.7, which calls for all learners to acquire knowledge and skills for sustainable development (United Nations, 2015).
3. The Higher Education Sustainability Initiative (HESI), launched at the Rio+20 Conference, which mobilizes universities worldwide to integrate sustainability in teaching and research.
4. Universities such as Arizona State University and Wageningen University have emerged as global leaders by creating interdisciplinary programs explicitly designed to address sustainability issues (Brundiers et al., 2021). These examples highlight how HEIs can realign their missions and curricula to meet global sustainability goals.

Interdisciplinary Innovation in Higher Education

A central theme in global scholarship is the need for interdisciplinary and transdisciplinary approaches to education. The complexity of sustainability challenges defies single-discipline

solutions, requiring collaboration across scientific, social, and humanistic domains (Klein, 2017; Newell, 2023).

Curricular reforms: Many universities are embedding sustainability across disciplines rather than isolating it within environmental science programs (Lozano, 2010).

Pedagogical innovation: Problem-based learning, co-teaching, and project-based curricula are increasingly used to foster interdisciplinary competencies (Wiek et al., 2011).

Research integration: The concept of Mode 2 knowledge production (Gibbons et al., 1994) emphasizes application-oriented, collaborative research involving multiple stakeholders.

Skills and Competencies for Sustainability

Global scholarship has identified key competencies required for sustainability-oriented graduates. Wiek, Withycombe, and Redman (2011) highlight five core competencies:

1. Systems-thinking competence – the ability to understand complex interrelations.
2. Anticipatory competence – the ability to envision and prepare for future scenarios.
3. Normative competence – the capacity to understand values and ethics in sustainability.
4. Strategic competence – the ability to design and implement solutions.
5. Interpersonal competence – collaboration, communication, and leadership.

These competencies provide a foundation for curriculum design and assessment in sustainability education worldwide.

Barriers to Global Reform

Despite significant progress, global literature identifies persistent barriers:

Institutional inertia: Universities often resist structural change due to entrenched disciplinary boundaries (Stephens, Hernandez, Román, Graham, & Scholz, 2008).

Funding challenges: Sustainability initiatives require significant investment, which is often lacking.

Faculty capacity: Many educators lack training in interdisciplinary pedagogy (Lozano et al., 2015).

Assessment difficulties: Measuring competencies like systems thinking remains complex.

Nevertheless, global case studies demonstrate that transformative change is possible when institutions commit to sustainability as a core mission.

Nigerian Perspectives on Higher Education and Sustainability

Overview of Nigerian Higher Education

Nigeria has one of the largest higher education systems in Africa, comprising over 200 universities (National Universities Commission, 2022). However, the system faces significant challenges: inadequate funding, poor infrastructure, frequent strikes, and outdated curricula (Adebayo & Akinola, 2020). These systemic issues undermine the capacity of universities to deliver high-quality education, let alone innovate for sustainability.

Sustainability and Interdisciplinarity in Nigerian Universities

Although sustainability has gained attention in Nigerian higher education, progress remains uneven. Okebukola (2021) highlights the "Revised National Policy on Education", which acknowledges the importance of environmental and sustainability education but lacks concrete mechanisms for interdisciplinary integration. Some universities, however, have begun initiatives:

1. University of Ibadan has developed interdisciplinary programs in environmental management.
2. University of Port Harcourt has established energy research centers linking engineering, policy, and environmental studies.
3. Covenant University emphasizes entrepreneurship and innovation, embedding elements of sustainability in curricula.

Nevertheless, these efforts are fragmented, and interdisciplinary innovation remains marginal in most Nigerian universities.

Barriers to Interdisciplinary Innovation in Nigeria

Nigerian literature identifies multiple barriers:

1. Funding deficits: Universities are heavily reliant on government funding, which is insufficient for innovation.
2. Rigid curricula: Programs remain discipline-bound, with limited flexibility for interdisciplinary courses (Adebayo & Akinola, 2020).
3. Limited faculty expertise: Many academics lack exposure to sustainability pedagogy or interdisciplinary research.

4. Policy-practice gap: National policies often emphasize sustainability in rhetoric but fail in implementation.
5. Societal disconnect: Universities often operate in isolation from industries and communities, limiting real-world relevance.

Opportunities for Reform

Despite these barriers, opportunities exist for advancing interdisciplinary innovation in Nigeria:

1. Youth demographics: With over 60% of the population under 25, Nigeria has a vast pool of learners who can drive sustainability innovation if properly trained (UNDP, 2020).
2. Policy momentum: The SDGs and CESA frameworks create incentives for aligning higher education with sustainability goals.
3. Digital transformation: The growing adoption of educational technology presents opportunities for interdisciplinary teaching and collaborative learning (Ejiogu, 2021).
4. Industry partnerships: Sectors such as energy, agriculture, and ICT offer avenues for universities to co-create sustainability solutions.

Interdisciplinary Innovation in Higher Education and Strategies

The call for interdisciplinary innovation in higher education is rooted in the recognition that sustainability challenges are inherently complex, transcending the scope of any single discipline. Problems such as climate change, urban resilience, and food security cannot be solved through technological expertise alone; they require insights from economics, politics, sociology, and ethics. In response, universities worldwide are experimenting with new pedagogical models, curricula, and institutional structures designed to break down disciplinary silos and foster collaboration (Klein, 2017; Brundiers et al., 2021).

This section explores the concept of interdisciplinary innovation, examines global and African case studies, and proposes strategies for embedding interdisciplinary practices in higher education, with particular attention to the Nigerian context.

1. Understanding Interdisciplinary Innovation in Higher Education

Defining Interdisciplinarity

Interdisciplinarity is often contrasted with multidisciplinarity and transdisciplinarity. Multidisciplinarity involves the juxtaposition of disciplines without integration (e.g., environmental science courses taught alongside economics).

Interdisciplinarity entails the integration of concepts, methods, and perspectives across disciplines to create new knowledge or approaches (Newell, 2023).

Transdisciplinarity extends beyond academia, integrating knowledge from non-academic stakeholders such as communities, industries, and policymakers (Gibbons et al., 1994).

In higher education, interdisciplinary innovation therefore refers to institutional and pedagogical practices that foster integration across disciplinary boundaries to produce graduates equipped for complex problem-solving.

Why Interdisciplinary Innovation Matters for Sustainability

The rationale for interdisciplinary innovation in higher education can be summarized in three dimensions:

1. Epistemological: Sustainability issues cut across natural and social sciences; integrating them creates richer, more holistic knowledge.
2. Pedagogical: Interdisciplinary education fosters competencies such as systems thinking, collaboration, and innovation (Wiek et al., 2011).
3. Institutional: By restructuring curricula and policies, universities can align teaching, research, and community engagement with sustainability goals.

Nigerian Examples of Emerging Interdisciplinary Innovation

1. University of Ibadan – Environmental Management

The University of Ibadan has established interdisciplinary programs in environmental management, integrating biology, geography, and policy studies. These programs aim to equip students with both technical and policy skills for managing Nigeria's environmental challenges.

2. University of Port Harcourt – Energy and Environmental Research

The University of Port Harcourt has developed energy research initiatives linking engineering, policy, and environmental studies. These efforts, though limited in scope, show the potential of Nigerian universities to pioneer interdisciplinary solutions in critical sectors such as oil, gas, and renewable energy.

3. Covenant University – Entrepreneurship and Innovation

Covenant University emphasizes entrepreneurship and innovation, embedding sustainability elements into curricula across disciplines. Its model reflects how private universities can lead

reforms by experimenting with interdisciplinary education that prepares students for sustainability-driven labor markets.

Strategies for Embedding Interdisciplinary Innovation in Higher Education

Building on global and African case studies, several strategies emerge for embedding interdisciplinarity in higher education.

1. **Curricular Reform**

- Core sustainability modules: All students, regardless of discipline, should complete courses addressing sustainability challenges.
- Problem-based learning: Courses should be structured around real-world case studies that require interdisciplinary approaches.
- Flexible curricula: Universities should allow students to combine courses across faculties.

2. **Pedagogical Innovation**

- Team teaching: Faculty from different disciplines co-teach courses, modeling interdisciplinary collaboration.
- Project-based assessment: Students should work in teams to design and implement sustainability projects.
- Experiential learning: Community-based projects allow students to connect theory with practice.

3. **Institutional Restructuring**

- Interdisciplinary research centers: Universities should establish centers dedicated to sustainability challenges.
- Cross-faculty collaboration: Incentives should be created for joint research and teaching across departments.
- Policy alignment: National education policies should mandate interdisciplinary integration.

4. **Partnerships and Engagement**

- Industry linkages: Universities should partner with industries to co-create solutions to sustainability problems.

- Community collaboration: Local knowledge should be integrated into curricula and research.
- International collaboration: Nigerian universities can benefit from partnerships with global leaders in sustainability education.

Faculty Development

1. Capacity building: Training programs should equip faculty with interdisciplinary teaching skills.
2. Research funding: Grants should incentivize interdisciplinary research on sustainability issues.
3. Recognition systems: Promotions and awards should reward faculty who engage in interdisciplinary work.

Implications for the Nigerian Context

For Nigeria, the implementation of these strategies requires addressing systemic barriers:

1. Funding: Adequate investment is needed to support curricular reform and research infrastructure.
2. Policy: The National Universities Commission (NUC) should revise accreditation frameworks to promote interdisciplinarity.
3. Faculty capacity: Professional development programs are needed to train lecturers in interdisciplinary pedagogy.
4. Cultural change: Universities must cultivate institutional cultures that value collaboration, flexibility, and innovation.

By adopting these strategies, Nigerian universities can equip graduates with the skills and mindsets necessary for building a sustainable society.

Conclusion

The journey toward a sustainable future cannot be realized without the active transformation of higher education. Interdisciplinary innovation offers a pathway for equipping graduates with the competencies necessary to navigate complexity, foster innovation, and promote ethical stewardship of resources. Nigerian examples highlight both opportunities and barriers.

For Nigeria, the stakes are particularly high. With a rapidly growing population, pressing sustainability challenges, and a youthful demographic, the nation's future depends on how effectively it equips its graduates for the 21st century. Universities must therefore move beyond disciplinary silos and embrace collaborative, interdisciplinary, and community-engaged approaches.

Recommendations

The following recommendations were made.

1. The Nigerian Universities Commission (NUC) should embed sustainability competencies and interdisciplinary requirements into accreditation frameworks.
2. Universities should create hubs for research and teaching that cut across faculties, focusing on Nigeria's pressing challenges such as energy transitions, urban development, and food security.
3. Universities should encourage co-teaching between faculty from different disciplines to demonstrate collaboration in practice.
4. Universities should integrate indigenous practices and community wisdom into curricula to contextualize sustainability education.

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