# Embedding Recycle as a Criterion to Enhance Sustainability

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## ABSTRACT

The fast pace of transformation in the construction towards more sustainable construction strategy and process indirectly stimulates the training of students in institutions of higher learning. This phenomenon prevents a skill gap within the fresh graduates streaming into to professional practice. Therefore, sustainability features need to be integrated into the higher education curriculum for effective training and instruction to counter the perceived skill gap. The paper tend to proposed the process of embedding 'recycle' in federal polytechnic Bauchi environmental curriculum as a criterion to enhance sustainability. Through a literature review the research found out that the current curriculum has little or no elements of sustainability (Reduce Reuse and Recycle). A proposed inclusion of recycle which could be easily practice is necessary and would be the first of its kind in the polytechnic and if successfully embedded it will give room for other criterial to be included.
**Keywords:** Embedding, Recycle, Criterion Sustainability.

## I. INTRODUCTION

The fast pace of transformation in the construction towards more sustainable construction strategy and process indirectly stimulates the training of students in institutions of higher learning. This phenomenon prevents a skill gap within the fresh graduates streaming into to professional practice. Therefore, sustainability features need to be integrated into the higher education curriculum for effective training and instruction to counter the perceived skill gap. Traditional education instruction places construction professionals as providing 1) schematic design, 2) design development, 3) construction documents and 4) checking and coordination. However, construction instruction should encompass the challenges of knowledge on information availability at design stages [1], the challenges of reviewing all alternative design options [2], the need for specialised engineering knowledge for small building object [3], importance of collaboration among project teams [4 & 5] and need for feedback provision for improvement [6 & 7], defined curriculum integration "as a relationship between academic and occupational or career-technical subject matter that goes beyond what would normally occur in the delivery of either the academic or occupational/career-technical subject matter alone". Similarly, [8] stated that pedagogy as "a highly complex blend of theoretical understanding and practical skill". [9] Theory on zone of proximal development viewed learning as taking hold firstly at the social level and then transcends through cooperative interaction with higher adults or more knowledgeable peers. [10], defined the learning zone as a "child's ability to recognise the value of hints and props even before he is conscious of their full significance". [9], also supports the notion of teachers structuring the step-by-step interaction on task until the learner can carry out the task on their own. Instructional design is the best ways to which training and education is given to students [11]. Systems analysis for effective education and training is related to problem solving [12-13]. In this case, how best can sustainable policies are taught in institutions of higher learning.

## II. METHODS AND MATERIAL

### A. Sustainability and Construction

Growing threat to global warming gives rise to measuring the rate of energy consumptions. Non-

industrial buildings accounted for 40% energy consumption and 72% of US electricity production [4]. Sustainability argues for the establishment of living buildings. This is a system established to assess greenness of a building. This denotes a zero net impact on the environment, water usage, pollution from the project construction and operation [4 & 14]. Energy efficiency is evaluated by CASBEE (Comprehensive Assessment System for Building Environmental Efficiency), SBTool, BREEAM (Building Research Establishment Environmental Assessment Method), Green Globes and LEED (Leadership in Energy and Environmental Design). The US government passed the American Recovery and Reinvestment Act of 2009 enacted on February 17, 2009, targeting to provide funds for a greener economy through greener buildings [15 & 4]. Lean construction and total quality management (TQM) point to the radical changes needed in standard operating procedures (SOP) in other to reduce waste by change and monitoring of the construction process to eliminate waste [4]. [16] found that indoor air quality improvements to productivity gains of building occupants. Prefabrication of building components off site reduces on site works. The environment can be controlled and monitored effectively [17 & 18].

## B. Curriculum and Sustainability

Effective teachers "have a rich understanding of the subjects they teach and appreciate how knowledge in their subject is created, organized, linked to other disciplines and applied to real-world settings. While faithfully representing the collective wisdom of our culture and upholding the value of disciplinary knowledge, they also develop the critical and analytical capacities of their students [8]. Productive pedagogies are "theoretical framework that teachers can use to reflect critically upon their current classroom practice; that is, a vehicle to use as a professional 'vocabulary' (or parlance) around which to have conversations about teaching practice with colleagues and to focus on individual student needs" expressed in table 1.

TABLE 1

THE FOUR DIMENSIONS OF PRODUCTIVE PEDAGOGIES [8]

| Intellectual Quality | Relevance /connectedness | Supportive environment | Recognition of difference |
|---|---|---|---|
| Higher order thinking | Knowledge integration | Student direction | Cultural knowledge |
| Deep knowledge | Background knowledge | Social support | Inclusivity |
| Deep understanding | Problem-based Curriculum | Academic engagement | Group identities |
| Substantive conversation | Connectedness beyond classroom | Explicit criteria | Active citizenship |
| Problematic knowledge | | Student self-evaluation | Narrative |

Curriculum is defined "as a plan for instructional action based on a set of decisions intended to, be reflected in the actions of learners" [19]. Instruction by contrast, is "the system for putting the plan into action". Curriculum design is defined "as the basic organization and plan for action for developing the scope and sequence of subject matter [20]. [21 & 22] suggests that for effective learning, the teacher much use teaching mechanism and connections which are familiar to the students in other to improve learning. However, [23] further opined that assisting a student in decontextualized concepts within a given field of study was more efficient and in line with [9] theory. [9], theory on zone of proximal development viewed learning as taking hold firstly at the social level and then transcends through cooperative interaction with higher adults or more knowledgeable peers. [10], defined the learning zone as a "child's ability to recognize the value of hints and props even before he is conscious of their full significance". [9], also supports the notion of teachers structuring the step-by-step interaction on task until the learner can carry out the task on their own. [24], found that a teacher can provide scaffold or supports in terms of starting teaching based on what d learner already knows to bridge the gap between task requirements and skill of the learner. [25], postulated the use of four elements to describe a system which forms the overall elements namely; interdependent, synergistic, dynamic and cybernetic. In interdependent, all the elements depends on each other to accomplish a set goal and if separated will achieve nothing. Synergistic align all elements to work together in achieving more than what one element can achieve on its own. Dynamic systems provided adaptation and changes according to the environment surrounding the system. Cybernetic system evolves to communicate to each other. [26] Opined that the use of media for instructional purpose in education adhere to models of instructional design. [27] Enegbuma and Ali highlighted the inadequacy of training in construction professionals

towards meeting current design and innovative construction. In any chosen instructional design, the focus can be geared towards:

- Instructional design is learner-centered.
- Instructional design is goal-oriented.
- Instructional design focuses on real-world performance.
- Instructional design focuses on outcomes that can be measured in a reliable and valid way.
- Instructional design is empirical.
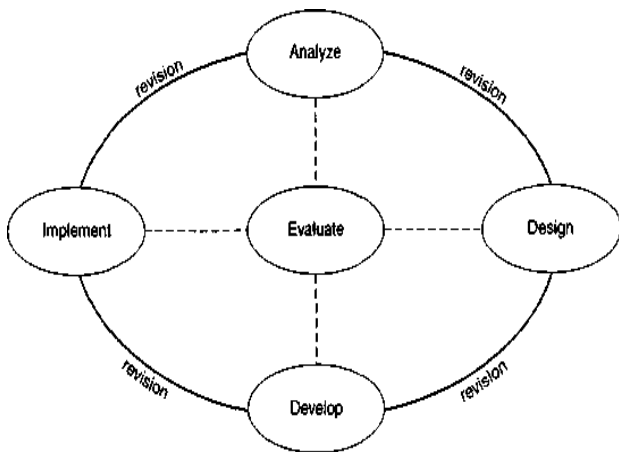- Instructional design typically is a team effort



**Figure 1 :** Core elements of instructional design (ADDID) [11]

Problem-based learning (PBL) forms an innovative instructional method carried out in educational instruction. PBL enhances students' application of knowledge, problem solving skills, higher-order thinking, and self-directed learning skills [28]. Its implementation began in medical education [29 & 30] which later moved to other disciplines in higher education and K-12 education settings [31 & 32]. [33], defines PBL as "a student-cantered pedagogical strategy that poses significant, contextualized, real-world, ill-structured situations while providing resources, guidance, instruction, and opportunities for reflection to learners as they develop content knowledge and problem skills." [28] Stated that "The content, context, connection, researching, reasoning, and reflecting components in PBL problems are not independent of each other. Rather, they are complementary and mutually support each other. Therefore, when designing PBL problems, this supportiveness among the six components is critical to maximizing the effect of each component within the PBL problem as a whole".
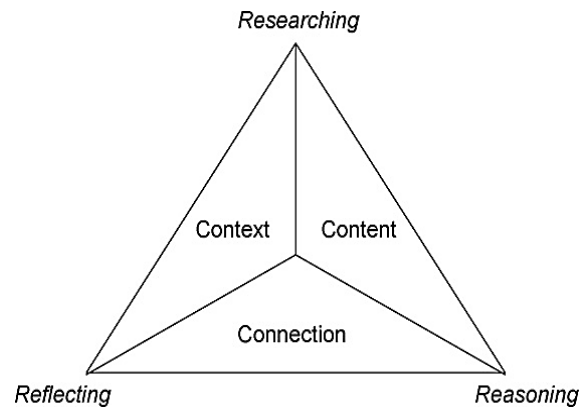


**Figure 2 :** 3C3R PBL problem design model [28]

In examining the relationship between the driver, or catalyst of a particular curriculum integration effort, and the scope and quality of that effort in four sites, [7] found that curriculum integration is difficult in multiple occupation areas; more effective when both academic and vocational instruction occurs at same site; difficult to maintain for multiple student from different schools attending one course; leadership quality in the instructor must exhibit risk taking and innovativeness and financial investments are needed to develop, support, sustain, and expand curriculum integration efforts.

## C. Federal Polytechnic Bauchi Curriculum

In the current environmental curriculum little is been mention about recycle various report illustrates how the inclusion of elements of sustainability (Reduce Reuse and Recycle) can assist in curriculums by provide numerous opportunities for schools, lecturers and students to explore a wide range of the world's most pressing issues. The current curriculum aim is to direct the students towards developing their skills, competencies, understanding and gather attributes that will equip then to be innovative and this general objectives only shows the polytechnic efforts to breed a future generation that would be responsible for the leadership of the future but, the elements that make of the sustainability principles (Recycle Reduce and Reuse) are missing.

## D. Conclusion and Recommendation

In the current curriculum little is been mention about recycle various report illustrates how the inclusion of elements of sustainability (Reduce Reuse and Recycle) can assist in curriculums by provide numerous

opportunities for schools, lecturers and students to explore a wide range of the world's most pressing issues. This would be the first of its kind in the polytechnic as if successfully included the others would follow that is Reduce and Reuse as to re write the curriculum is a bit difficult but to embed or included is easier. Therefore this study proposed the inclusion of recycle as one of the constituent of sustainability which could be easily practice is necessary and would be the first of its kind in the polytechnic and if successfully embedded it will give room for other criterial to be included.

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