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Sustainability and Creativity Methods: Agents of Change in Teaching the Arch-Design Studio

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ABSTRACT: The aim of this paper is to explore conventional methods of teaching the arch-design studio with ideas of sustainability and creativity as agents of change. If this is realised, it means the students of architecture can be grounded in designing with sustainability and creativity ideas and can be professionals that design and build with ideas of creativity and sustainability. So, there are real buildings and places that satisfy our clients, the society and in harmony with the environment. The objectives are to know those and what it takes to participate and to explain and recommend the methods in teaching the arch-design studio. Stakeholders of architectural education have observed that the architectural design studio teaching is failing to meet the yearnings and needs of the users, societies, cultures, environments and technological developments and for solution have strongly argued for sustainability and creativity as a combined force of teaching the arch-design studio. Although there are similarities in the curricula of training architects all over the world, but educators go about it in their own convenient and suitable ways and styles and the ideas of sustainability and creativity are not taken seriously and also not formally incorporated in the curricula of training. These stakeholders say that something has to be done to improve the ways and methods of training architects, especially the teaching of the arch-design studio. The study finds collaboration of the academics and practicing architects, integrated team work of inter/multi-disciplinary and selection criteria in teaching the methods of ideas relating to sustainability and creativity in the arch-design studio.

Keywords: *Teaching/Learning, Methods, Sustainability and Creativity, Arch-Design Studio*

INTRODUCTION

Arch-design Studio, Sustainability and Creativity

History of Arch-Studio Teaching

The Ecole des Beaux Arts in France started the idea of the arch-design studio in the 18th century. It had a kind of teaching; theory in the classroom and design in the ateliers (studios). It provided academic architectural training and was open to students of any nationality. It attracted many architects from the US in the 19th and early 20th centuries (Conway & Roenisch, 2005), and became synonymous with architectural education in France, England and America (Moffett, et al., 2003). This system continued into the 20th century, initially within the offices of architects; the atelier of Le Corbusier, and at later stage within schools of art and design, and more recently within schools of architecture. The design studio is the melting pot and therefore the core of the education of architects (Charalambous & Hadjisoteriou, 2009).

Arch-Studio Teaching with Respect to Sustainability

Altomonte (2012) asserts that sustainability should be integral to architectural design and education and therefore maintains it should be the ultimate aim of any pedagogical process at all levels of education. Altomonte (2012) argues further for educational and professional legislative frameworks to create real drivers and demands for sustainability – beyond the unique meeting of carbon-reduction targets, and its explicit inclusion in the curriculum of educating architects. Therefore architectural education should foster knowledge, skills, and competence in sustainable architectural design, aiming to achieve comfort, delight, well-being, energy efficiency in new and existing buildings, and in urban spaces and be promoted within a culturally, economically, and socially viable design process at all stages of the training of architects.

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Arch-Studio Teaching with Respect to Creativity

And Horng et al. (2005) argue that the concept of creativity must be a key factor in new teaching strategies and curriculum design. Also, Jeffries (2007) reaffirms the need for new teaching methods in the design-studio to increase creative thought. There is a consensus on the necessary introduction of the concept of creativity in higher education (Altomonte, 2012) because creativity as a concept of bringing forward new ideas is seen by many as the driving force in the design process of architectural design education. But the objectives of creativity in building design should not be originality for its own sake. Essential is the search for new ways of solving problems (functional, technical, social, urban and aesthetic) in sustainable (intelligent and environmentally responsible) ways. Hence as this research has find out, sustainability and creativity have become the driving force in teaching the arch-design studio.

Statement of the Problem

Many writers on architectural education have observed that the architectural design studio teaching is failing to meet the yearnings and needs of the users, societies, cultures, environments and technological developments as it was modelled after the curriculum of the Beaux Arts and the Bauhaus. There is a need to bridge this gap to enable architectural schools train students and young architects to relate properly to the society and develop appropriate architecture for our local and peculiar environment. Therefore the general consensus is that sustainability and creativity should be the teaching force in teaching the arch-design studio. This is the purpose of this research and these various authors stress, argue and support the concept and ideas of sustainability and creativity in teaching the design studio to bridge this gap and that it is an important venture (Olotuah, 2001; 2012; Olotuah & Adesiji, 2005; Adeyemi, 2000, 2012a; 2012b; UIA/UNESCO, 2002, 2003; Allwood, et al., 2012; ARUP, 2012; Altomonte, 2012; Bala, 2010; Gurel, 2010; Holloway, 2013; The GOETHE Institute, 2013; Baosol, 2013; ARUP, 2012; Buchanan, 2012; Bala, 2010; Koutsoumpos, 2007; Kowaltowski et al., 2010; Crul & Diehi, 2006; Parashar, 2010).

Definition of Terms

Sustainability (Sustainable Architectural Design Education) and Creativity

Sustainanble architectural education implies the architectural design education that meets the needs of the present without compromising the ability of future generations to meet their own needs (UIA/UNESCO, 2003). Sustainability now encompasses all of the varying facets of environmental sensitivity, as well as broader issues of health and well-being, and social responsibility (Al-Hassan, 2009). The Windsor forum of 2004, itemizes sustainability in four "Es" categories – Environment, Economy, Equity and Esthetic. Under Equity is Education where the research approaches are derived. In the Esthetic aspect; 'if a building, landscape, or city is not beautiful, it will not be loved; and if it is not loved, it won't be cared for, and if it is not cared for, it won't be durable, lasting or sustainable.

Creativity: Creativity is a concept of bringing forward new ideas and shunning repetition of unproductive ideas. Though creativity can not be learnt but can be encouraged, motivated and fostered in arch-design education by the following - setting well defined problem limits, imposition of restrictions (building codes, site conditions, costs, etc), brainstorming/visual brainstorming, browsing, charette, excursions, focus groups, other peoples viewpoints, using crazy ideas, using experts, visualizing a goal, working with dreams and images, etc and giving students design tools such as drawing, CAD and model making (Kowaltowski et al., 2010).

This study is on sustainable and creative teaching of the architectural design studio for a holistic learning of the students. And from the research theory of constructivism with respect to sustainability and creativity ideas of teaching the arch-design studio, the following characteristics are derived as the research themes and defined thus:

Teaching and Learning: Teaching is the act or profession of giving instruction and is synonymous to learning and both make up an education, of architects. The effectiveness of any system depends on the quality and devotion of the individuals involved in teaching (Ughamadu & Okoye, 1998). Thus, that process or activity the teacher designs to make teaching is to target learning, as teaching is to bring about learning. As the learner is placed under the teacher's guidance and direction and both involved in activities, the learner not only interacts with the teacher but with the entire teaching environment, knowledge, information, facts, altitudes, skills and values which are the ingredients of the content to be learnt as passed on to the learner through teaching. The type of learning in architectural design studio could be referred to as the constructivist approach, problem-solving, learning by doing, reflection-in-action (Schon's) – the student and teacher reflects on each other's actions – these mutual reflection activities form the critique process (Demirbas & Demirkan, 2003). The general teaching method in architectural design education is by the 'project method'. Although in the empirical study by Demirbas and Demirkan, it was concluded that there is a shift from learning by experiencing (CE) and learning by doing (AE) to learning by reflecting (RO) and learning by thinking (AC).All of these four learning styles occur in the design studio process.

Arch-Design Studio: This is the melting pot of training architects in higher institutions. "The Architecture Studio – Tutorial-Learn By Doing Experience: As a learning experience, the architecture studio can be related to music tutorials, dance and art studios, and similar educational experiences. It is a cross between one-on-one tutorial education and the learn-by-doing character of apprenticeship. The student does something with guidance and then gets critical feedback on what has been done. Then the student does it again and again, with subtle or great differences,

and again receives critical feedback. Each effort is a learning experience, an increase in knowledge, in knowing how and what to do, in the ability to develop self-criticism and self-motivation" (Steven W. Hurtt in Widsor Forum, 2004, 263). Gross & Do (1997) emphasise that the arch-design studio is king: it is where the knowledge about buildings is applied, and it is where the act of designing – generating, evaluating, and developing alternatives – is learned and practiced. A recurring challenge of architectural education is thus to integraate domain material taught in lecture format courses into the design studio learning experience. In the highly social environment of the design studio students learn to critique and to respond to criticism, and teaching and learning are achieved by collaboration, integration, adaptability and motivation.

Importance of Teaching Sustainability and Creativity Ideas in the Arch-Design Studio

Using sustainable ideas to teach the arch-design studio and consequent construction of buildings is a requirement if we want to enable humane and prolonged existence on our planet. Many people want affordable housing – a chance to build or buy and maintain their own home. Such urgent problems in developing countries are largely neglected by affluent nations which have an abundance of empty buildings and which continue to amass wealth. When social responsibility pervades the global construction scene, humankind will care for every member with fairness. Sustainable practices must sustain all societies. We must protect our planet as an indefinitely habitable home by teaching to using building materials carefully, conserving material and energy resources, favoring renewable and recyclable resources, preferring less energy-intensive materials, minimizing waste, preserving undeveloped land as a natural resource, and avoiding the pollution of land, water, and air.

Sustainable teaching to obtain sustainable buildings can be achieved worldwide. There are many places to begin, many points to attack the problems, many better ways to build our structures and cities, and more efficient ways to use, replenish, and recycle our resources. Holcim Forim of Sustainable Construction mentions: high-tech solutions, low-tech methods, research, development, education, industrial breakthroughs, design innovation, legislative or economic measures, widespread adoption of sound practices new or old as standard practices – the list goes on. The good news is that most of these solutions are achieved by teaching sustainable ideas in the arch-design studio, a must way to start indeed. Great potential lies in replacing detrimental practices with sound practices and multiplying the improvement over and over again in structures and towns throughout the world. Progress will be gradual and slow, but change will be effective if it is continual and widespread.

As for creativity, Koutsoumpos (2007) re-calls that architectural design education is expected to teach creativity, and that in the design studio the students are supposed not merely to learn how to form space, how to shape places or how to fashion buildings according to a pre-existing pattern. We, as teachers, have the responsibility to break this conformity, make them think innovatively, have a fresh view on the built environment, be able to design a world even better than before, a world that possibly we cannot even imagine. Asasoglu et al. (2010), argue that the conflicts of modern times demand high levels of creativity from the architect. Creativity, with all its social and physical connotations, should therefore be the guiding concept in the revision of arcchitectural education. Students (irrespective of their inborn talent levels) learn creative modes of thinking that are highly important in practicing architecture. Some educational philosophers might argue that creativity is congenital, and that it cannot, therefore, be taught. It may be true that talent, inclination, intention and determination help to realise creativity at an early age, but through conducive and eliciting teaching methods anyone can be sensitised towards a rich variety of ideas, outside influences, knowledge and creativity at a proper age (Bruner, & Lufburrow, 1963; Illich, 1970).

Medawar posits that 'creativity is a rapid intuitive deduction, which owes its power to the infirmity of our powers of reasoning, an illumination, or a kind of awareness, or yet a generative act in architectural discovery, which obviates an image of a fragment of a possible world. That creativity beyond analysis is a romantic illusion we must outgrow. It cannot be learned perhaps, but it can certainly be encouraged and abetted. Therefore sustainability and creativity must be taught and balanced in the arch-design studio because for example, emphasis is often times placed on original and creative designs than sustainable ideas or issues, that is, designs that work (serve functional requirements, are buildable, etc.). Students imitate the style of faashionable architects without understanding the implications for users or the appropriateness for local context. And less experienced students view architectural design as an opportunity to express their inner creative urge, rather than as a challenge to resolve a complex set of technical and social issues (Gross & Do, 1997).

Criticisms of Sustainability and Creativity

Baird (2011) laments that; we have reached a point where sustainability in education and practice of architecture need to be addressed more rigorously. He relates how Ellen Grimes during an academic conference in April 2011 for whom sustainability too often turns into the desire to return to a putatively original nature, she argues instead for an approach to the environment that is committed to the design of new ecological conditions. Also how Vyas Ujjval in same conference gave a documentation of numerous claims made by both clients and third parties against architects in relation to the environmental performance of their designs. Some of the allegations narrated by Ujjval are the technical failure of building components that may have resulted from environmental design ambition. Second set of allegations are that buildings, once completed, failed to meet their designers' predictions of improved environmental performance, or lowered operating costs.

That is one of the reasons this research argues that all the important experts are needed in the teaching of the design

studio for sustainability and creativity.

Creativity on the other hand is, being innovative, entrepreneurship, ability to bring into being by force of imagination. Members of the Windsor forum (2004) agree that creativity cannot be taught but manifests with time on practice. Some authors show evidences that higher education seldom adopts practices that favour creativity. Thus most graduating professionals are capable only of applying what is common knowledge in conventional ways (Alencar & Fleith, 2004). The architectural design process is based on a creative phase where creativity is highly valued and literatures on creativity are rich in ways to stimulate the decision-making process, but the tools are rarely formally present in the building design process. The results indicate that instructors apply methods that may stimulate creativity mostly informally, with some positive results (Kowaltowski et al., 2010).

But Morrow et al. (2004) find that if more emphasis is laid on sustainability than creativity in the training of architects, it will lead to producing non-creative architects and consequently non-beautiful architecture. Members of Windsor Forum (2004) again agree that sustainability stressed in line of world reality should be emphasised more than creativity in the training curriculum and that creativity is not necessarily something you must acquire during the course of training as it comes with exposure, experience and time.

Teaching Methods of Sustainability in Arch-Design Studio

Reasons for Teaching Sustainability Ideas in Architecture

The exigencies of a world in which temperatures, sea-levels, populations, pollution and fuel costs are all rising, while fossil-based energy reserves are falling, mean architecture must do more to help in the creation of truly sustainable cities and buildings. One of the suggestions implicit in many discussions of sustainability is that the architectural profession in general and architecture schools in particular are somehow unaware of the environmental agenda, and that some kind of enormous restructuring or resetting of architectural education is therefore required (Borden, 2008). Therefore, teaching of sustainable architecture in the design studio is one of the ways and surely a fundamental way of achieving sustainability in architecture.

Realising Sustainability in Architecture Teaching

Sustainability architecture teaching in the arch-design studio can be realised by collaboration of working together of specialists and integrated teaching by bringing together all the building designers and technical specialists. The strategies can rest on these teaching objectives – ARUP, a global firm of consultants recommends: carbon, water (services), materials, climate change, community and the environment, and operation. So for carbon, the ideal is to teach all building projects to be carbon neutral in operation. Energy-efficiency systems and lowcarbon materials are key to sustainable designs. US Green Building Council (1996) argues that a multidisciplinary approach allows team members to share expertise and coordinate individual teaching design efforts to achieve a well-function and integrated design. And students should not only be encouraged to enquire with each other disciplines to get information and ideas, but also forced to work in pairs, groups and together in the design studio. (Table 1 and Table 2)

The methods that are promising and especially useful in

Table 1: Showing methods and their descriptions of teaching sustainability ideas in the arch-design studio.

Method	Description
Site Inputs.	Use of site topography, and adopting two or more different sites with different climatic conditions for the same design scenario.
Land Use.	Building orientation for advantages of air movement, sun effect and easy accessibility.
Compatibility to climate.	Effects of micro-climate on a building.
Energy Efficiency.	Mass/space ratio.
Solar Control.	Control of transparent surfaces (summer daytime/winter night-time).
Heating/Cooling.	Active gain system (scatter or linear mass/compact mass system.
Natural Ventilation.	Wind and solar chimney (may not be applicable to the Tropic). Enough/Cross ventilation.
Natural Lighting.	Access and adequate daylight.
Acoustics.	Control, transmission, reception, and effects of sound; the characteristics of a room that determine the qualities of sound in it relevant to hearing.
Eco-Technology and New Technology.	Solar collector, and the potential offered by new technologies to inform design on sustainability.
EcoMaterials and Traditional and New Materials.	The use of natural materials, use of traditional/local and new materials, utilising local manufacturers, suppliers and labour where possible.
Landscaping.	Concerned with the planning and design of outdoor space and design techniques include planting trees to shade buildings from the sun or protect them from wind, using local materials, on-site composting and chipping to reduce green waste hauling, and also may involve using drought-resistant plantings in arid areas (xeriscaping) and area of garden and landscape can also be allowed to grow wild to encourage bio-diversity.

Continueing: Showing methods and their descriptions of teaching sustainability ideas in the arch-design studio.

Method	Description
Reuse, Recycle & Renewable Sources.	To collect rainwater and the use of rainwater for irrigation/Demolition debris reuse and recycling.
Arch-Sustainability Sources.	Such as WCED (1987), US Green Building Council (1996), Bourdeau (1999), Young (2003), etc.
Interiors	The design of the interior of a building.
Lectures, Workshops, Seminars & Conferences/Professionals participation.	By academics and non-academics, the experts and experienced professionals in sustainability issues – energy performance of buildings, environmental impacts, water and resources management, thermal, acoustic and visual comfort, etc. Participation and collaboration of multi/inter/trans disciplinary teaching staff teams.
Exhibitions, Concerts & Book Presentation.	Encouraging students to attend these that pertain to sustainability.
Comprehensive case studies/Built case studies.	Exploration and analysis of built case studies that embody sustainable environmental design.
Research and Visits to building sites.	Individual and group research by internet and physical exploration by visiting historical, contemporary, on-going building construction sites and urban spaces, as research generates new and innovative solutions.
Preparing Drawings to Approval level.	Students to prepare drawings up to a planning permission level, including the required schemes of structural engineering, building construction and the organisation of the construction work, accompanied by detailed drawings regarding interior design and landscape elements completed by an environmental impact study.
Group Brainstorming, Browsing and Use of Software.	Students group brainstorming supported by lecturers and professionals. Browsing on sustainable buildings and their performance, and use of sustainability software.
Pair/Group work/Live projects.	Pair and Group work of design projects/participating in design and construction of live projects.
Peer Learning.	Students learning from interactions amongst themselves.

Table 2: Glossary of various methods that may stimulate creativity in teaching the arch-design studio
(Source: Clegg & Birch, 2007; Mycoted, 2007; Kowaltowski et al., 2010)

Method	Description/Knowledge about them
Analogy	Association of uncommon ideas and concepts coming from other domains to produce new, innovative solutions. Analogy is considered the most appropriate technique to enhance creativity in students. The technique is appropriate for all course levels. Design methodology courses and sustainable design can profit most from the application of Analogy. The advantages of this method are the possibility of increasing students' repertoire. Analogies help the design discussion by integrating meaning and communication to design.
Metaphors	This is also association of uncommon ideas and concepts coming from other domains to produce new, innovative solutions. Metaphors increase the exploration of various design solutions and develop lateral thought processes, but thought that analogy is a difficult method to apply in the design-studio system. The main problem is related to finding adequate examples and avoiding shallow associations, which may compromise design choices. Students lack analytical tools to reflect with some depth on their design problem and this causes difficulties in using analogies as a design tool. With time and increased experience, students will learn to see a design problem from various angles, both conceptually and as abstractions. Once they are able to proceed this way, analogies are applied with more ease and productivity.
Biomimicry	Finding models in nature which are similar in problem definition and which may be imitated or may inspire solutions. Biomimicry is considered the transfer of technology between life forms and man-made constructs. The analysis of nature's systems may lead to the seeds of inspiration in a creative design process and Biomimicry is a method increasingly employed in design processes of famous architects like Ken Yeang and Calatrava. For instance, an often cited example is the Eastgate Centre in Harare, Zimbabwe; a shopping centre designed by Mick Pearce and built in 1996. The thermal comfort of the building is supported by principles discovered in termite mounds. Ken Yeang uses other examples. The understanding of the chemical structure of DNA may stimulate the conception of building elements and as an analogy, a pile of dishes of a restaurant kitchen demonstrates that building slabs may gain in stability when rotated.
Brainstorming	Spontaneous generation of large number of ideas and/or possible solution to a problem, with choice of best solution only at the end of the process. Brainstorming is probably the best-known method to stimulate creativity, where experts from various fields put their ideas forward without prior judgment. There are basic rules to Brainstorming: Focus on quantity; No criticism; Unusual ideas are welcome since they combine and improve ideas. Brainstorming is a conference technique by which a group of people attempts to find a solution for a specific problem by amassing ideas spontaneously.

Continueing: Glossary of various methods that may stimulate creativity in teaching the arch-design studio
(Source: Clegg & Birch, 2007; Mycoted, 2007; Kowaltowski et al., 2010)

Method	Description/Knowledge about them
Attribute Listing	Decomposition of a problem into attributes or key-factors which may be improved, changed or substituted. This breaks the problem into parts and investigates them individually. The technique consists in identifying essential characteristics of a product or process and reflects on ways to modify and improve them. An inventory of all aspects of a problem should be made: types of material used, dimensions, building technique, fabrication process, user requirements, etc. Once the list is ready, priorities are marked and alternatives suggested. The combination of ideas increases exponentially with the number of attributes.
Mental Map	Diagrams of items organized around a central concept with connections and branching on a theme or proposition. Mental Map or Tree diagram is based on the potential of idea generation when structured according to initial concepts. This method is usually associated with the visual representation of ideas, to help the ''free association'' process of Brainstorming. Ideas are classified, structured and visually presented. By mapping information, rapid expansion and exploration of an idea occurs. Analogy of images may be part of this method. In design processes, this method is often identified in the drawings of architects, especially in first sketches.
Design Repertoire	This is a design reference with concept of creativity. Design repertoire is of prime importance to enhance the creative process. Conceptual abstractions, coming from references, create bridges between mental and physical activities and are the basis for deeper exploration of theoretical concepts of design repertoire. Formal repertoire is also known to be the most often applied information in the design-studio. Given a specific design reference, a student may learn to identify relevant concepts and build a theoretical basis for his/her design knowledge, which can then generate new design solutions.
TRIZ	Structure a problem into its generic domain and search for the solution through a matrix of 40 principles found in patents. In TRIZ, problems are structured according to 40 basic inventive principles, identified as: weight of moving object; length of moving object; speed; force; stress; shape; temperature; illumination intensity; power; loss of energy, time, substance, information; reliability; ease of maintenance, operation repair; etc. If these principles are identified and codified, they could be taught to people to make the process of creativity more predictable. . The transfer of TRIZ principles to the architectural design process was attempted and the case study presents some promising results in relation to facilitating decision-making. 16 specific architectural design goals including environmental comfort (visual, thermal, acoustics and smell), ergonomics, efficiency, equilibrium, flexibility, visual impact, independence, movement, functionality or practicality, productivity, rationalization and security and safety were used.
CATWOE	Technique consisting in seven steps: Appreciating the unstructured problematical situation Understanding the worldviews of the key stakeholders Creating root definitions of relevant systems Making and testing conceptual models based upon worldviews Comparing conceptual models with reality Identifying feasible and desirable changes Acting to improve the problem situation
Assumption busting	A list of assumptions about the problem is made. Correctness in relation to the problem at hand is tested. New assumptions appear and the most applicable of these are used to find solutions.
Morphological analysis	A problem-solving technique based on problem structuring and elimination of the illogical solution combinations
NAF (Novelty, attractiveness and functionality)	Solutions are analysed as to their novelty, attractiveness and functional usefulness. Grades are given on a 1–10 scale for each attribute
Other people's viewpoints	Technique to encourage people to adopt unfamiliar viewpoints during a problem discussion
PDCA (Plan, Do, Check, Act)	PDCA is a four-step problem-solving process also known as the Deming Cycle. Starting with: PLAN: Establish goals and processes necessary to deliver results in accordance with the specifications. DO: Implement the processes. CHECK: evaluate the processes against the goals. ACT: introduce action to improve the process and start the PDCA process over.
QFD	Method to transform user demands into design quality, to deploy the functions forming quality, and to deploy methods for achieving the design quality into subsystems and component parts, and ultimately to specific elements of the manufacturing process.
Random stimuli	Random stimulus is based on randomization with exploration of associations to novel non intentional ideas. The Random Word technique starts with a random word used to generate new associations. This helps to look at problems from unusual sides directing thought toward creative solutions.

Continueing: Glossary of various methods that may stimulate creativity in teaching the arch-design studio
(Source: Clegg & Birch, 2007; Mycoted, 2007; Kowaltowski et al., 2010)

Method	Description/Knowledge about them
Mental Maps	Mental Map or Tree diagram is based on the potential of idea generation when structured according to initial concepts. This method is usually associated with the visual representation of ideas, to help the ''free association'' process of Brainstorming. Ideas are classified, structured and visually presented. By mapping information, rapid expansion and exploration of an idea occurs. Analogy of images may be part of this method. In design processes, this method is often identified in the drawings of architects, especially in first sketches.
Group discussions/ Design Criticism by Students	Group discussions and design criticism by students of the work of colleagues. Charrettes or concentrated short period design exercises are positive methods that may productively stimulate creativity. Group discussions permit students to think beyond their own work. The exchange of ideas can help design development mutually. Learning from others is valued as a stimulus to the divergent thought process.
Six sigma (DMAIC and DMADV)	The methodology consists of: Define process improvement goals consistent with customer demands and enterprise strategy. Measure key aspects of the current process and collect relevant data Analyse data to verify cause-and-effect relationships. Determine the relationships and ensure that all factors have been considered Improve the process based upon data analysis using techniques like design of experiments Control to correct deviations from target. Set up pilot runs to establish process capability Finally move onto production, set up control mechanisms and continuously monitor the process.
Six thinking hats	The hats represent six thinking strategies identified by Edward de Bono, consciously applied in techniques to enhance creativity. Red hat—Emotional thinking. Yellow Hat—Positive thinking. Black Hat—Critical thinking. White Hat—Facts. Green Hat—Creative thinking. Blue Hat—Big Picture.
SWOT (Strengths, Weaknesses,	A strategic planning method used to evaluate the Strengths, Weaknesses, Opportunities, and Threats involved in a project by identifying the internal and external factors that are favourable and unfavourable to achieving that objective.
Opportunities, Threats)	Synetics is a technique to generate and evaluate ideas. In the first session the problem is analysed. In the second session the problems is described and the scope of action determined. Ideas are generated (using other techniques). Idea springboards are identified to focus on the solution realm. Possible solutions are brought forward. These are analysed and a new cycle of synetics may have to begin if the solutions are rejected until a consensus is reached

the idea generation phase of design processes are Analogy, Attribute list, TRIZ, Brainstorming, Mental Mapping and Biomimicry (Jones 1970; Altshuller 1984; Gero 2000, as cited by Kowaltowski, et al., 2010).

Evidence of body of knowledge in an architectural piece can also foster creativity. The great practitioner Andres Duany in Windsor forum (2004) argues that in a school of architecture, it is important to deal with architecture in a rigorous way. And that if you look at the work of architects like Aalto and Corbusier in terms of style, it is all over the place. But the quality is very high because there is a certain rigour; there is a body of knowledge. (Table 3)

Table 3: Classification of various methods that may stimulate creativity in relation to phases of the creative process
(Source: Clegg & Birch, 2007; Mycoted, 2007)

Creative process phase	Methods
Problem definition	Assumption Busting; Assumption Surfacing; Backwards Forwards Planning Boundary Examination; CATWOE; Chunking; Six W's and Hs; Multiple Redefinition; Other Peoples View Points/Definitions; Paraphrasing Key Words; Why Why Why?
Idea generation	Analogy; Attribute Listing; Biomimicry; Mind Mapping; Morphological Analysis; Nominal Group Technique; Pictures as Idea Triggers; Pin Cards; Random Stimuli; Talking Pictures; TRIZ, Metaphor, Brainstorming
Idea selection	Advantages, Limitations/Restrictions and Unique Qualities; Anonymous Voting; Consensus Mapping; Idea Advocate; NAF; Plusses Potentials and Concerns; Sticking Dots; Unique Qualities
Idea verification	PDCA; QFD; Six sigma

Why Do We Need to Think Creatively When Considering Sustainability in Design of Buildings?

Implementing Sustainable Ideas

Thinking creatively when considering sustainability in the design of buildings will make us implement sustainability ideas satisfactorily in the design of buildings, the environment, and services to comply with the principles of social, economic, ecological, and aesthetics sustainability. This will help us avoid mediocre or poor designs and buildings which fail in terms of sustainable designs (CABE, 2007). We have to apply creativity because sustainability in buildings as Holloway (2013) finds out is not just about being green. We can either design buildings with a bunch of cool green features or we can design buildings that perform better for our clients and the generations after us. If we choose the former, sustainability advocates may be looked upon as the tin men of the 21st century who littered our cities with goofy looking dilapidated green features that we cannot stand looking at anymore. If we choose the latter, then we can take control and lead our profession to higher level of respectability and be known as the master builders that made the world a better place for future generations. In Freshome (2011), they believe that a calm, healthy home is a necessary foundation for happiness and success in the world. Thompson (2013) argues for tasteful rather than penitential sustainability which this study agrees with but goes to advocates that we need to change that notion of taste. This study argues that we can creatively have a tasteful sustainability or sustainable designs and buildings if we creatively take care of social, economic and ecological aspects to balance with the aesthetics without extra costs to have buildings and environments that are both liveable and loveable.

Creative Principles for Sustainability

SUTMUNDO (2011), relates that buildings should be like trees, whether you are designing a small house extension or a multi-million pound stadium, buildings should become true habitats for people that provide not only shelter, but also food, water and energy. So by creatively creating neighbourhoods in this way we would really be creating forests and habitats in an urban context. To achieve this, the following principles should always be a prime consideration for any development before any designer puts pen to paper or finger on mouse.

Energy – minimize energy use and help mitigate against climate change;

Ecology and Biodiversity – provide new wildlife habitats, mitigate for habitat lost through development, and provide green links or stepping stones for species movement through urban areas;

Health – greener buildings provide psychological benefits and potentially provide more contact with nature, this in tandem will bring more physiological benefits through wider air quality improvements;

Social Integration – the development should provide a sustainable link that benefits its immediate community and its surroundings;

Economic – consider the impact in the local economy (global economies depend on localized economic growth).

In conclusion therefore, we must think creatively when considering sustainability in design of buildings to have building designs when implemented will perform better for our clients and the generations after us, or else we end up designing goofy looking dilapidated buildings, cookie cutter architecture, mediocre, poor, buzz word designs, and buildings that are not sustainable in every sense of sustainability.

MATERIALS AND METHODS

The paper through exploration and critical review of literatures, telephone and emails responses from the stakeholders (academics and non-academics – practicing architects, related and non-related professionals), finds ways and methods of teaching sustainability and creativity ideas in the arch-design studio.

RESULTS AND DISCUSSION

These points should also be noted in teaching sustainable ideas in the arch-design studio: Selection 0f Participation, Exchange programmes, and Global studio initiative – Apart from the academic lecturers, the other participants to teach must be selected. According to Adeyemi (2012a), you know them the way they talk in conferences and seminars; they are experienced, flexible and have the interest to teach and not to ridicle students. Professionals with intrinsic qualities, have entrepreneurial approach to growth and new direction (Hancock, 1981; Billboard Publications, 1995). Stringer (2006) argues for stakeholders' participation to obtaining favourable outcomes. Also Christensen & Worzala (2010) emphasizes that working together in iteractive decision-making process will help students gain heightened understanding of learning. Exchange of programmes between institutions should be encouraged and global studio initiative in form of taking students overseas to participate in an advanced design studio, for example where students from Nigeria or Africa will have the opportunity to collaborate with students from other countries. Iroegbu (2010) reports the Nigerian Institute of Architects, NIA President; Tunji Bolu's statement on the celebration of NIA 50 years that schools of architecture in Nigeria should be trained to compete internationally, and this can be one of the ways to do that.

Teaching and Learning Sustainability in the Arch-Design Studio

This is learnt through reading, discussing and analysing authoritative examples. And at the early stage, studio instructors should guide students on issues related to sustainability.

Seminars are to be given by guest professionals who are experts on ecological architecture .One-to-one tutorial or seminar group, lectures and brainstorming sessions and individual research work, lectures are to be introduced in the form of well-organised presentations and projects relating to past built sustainable architecture. Students are to prepare Power Point presentations to share all such data collected. Students should be encouraged to attend various activities that pertain to their training such as exhibitions, concerts, book presentations, and conferences, comprehensive case studies/built case studies – exploration and analysis of built case studies that embody sustainable environmental design, research – research generates new and innovative solutions, students to prepare drawings up to a planning permission level, including the required schemes of structural engineering, building construction and the organisation of the construction work, accompanied by detailed drawings regarding interior design and landscape elements completed by an environmental impact study. Live project, lectures by invited guest lecturers, workshops, - seminars and workshops directly related to environmental strategies, practical investigations, as well as specific topics such as water and resources management, energy performance, advanced technologies, use of software, assessment methods, thermal, acoustic and visual comfort etc.

Analysis of case studies, visits to building sites and talks given by invited professionals could further reconcile the various disciplinary domains of the curriculum. Browsing on sustainable buildings and their performance, participation and collaboration of multi/inter/transdisciplinary teaching staff teams - consultants, practicing architects, engineers, part-time specialists, experts of cognate disciplines, etc., need to be involved in teaching and learning so as to promote a holistic and collaborative pedagogical ethos and embark on a team effort in support of education for sustainability as pursuit of greater multi/inter/transdisciplinarity can offer rich and inspiring pedagogical opportunities. Identify, compare and assess environmental impacts and performance of buildings, students should communicate their design explorations and solutions to a specialist and non-specialist audience, application of professional benchmarks and environmental standards at national and international level to design works, control of project budgets or cost implications, studies of historical and contemporary buildings and urban spaces, the potential offered by traditional and new materials and technologies to inform design, utilising local materials, manufacturers, suppliers and labour where possible.

A summation of the design requirements to be taught regarding sustainable issues in architecture are: 1) Site Inputs – Topography, and adopting two different sites with different climatic conditions for the same design scenario, 2) Land Use – Building orientation, 3) Compatibility to climate – Effects of the micro-climate on a building, 4) Energy efficiency in building – Mass/space ratio, 5) Solar control – Control of transparent surfaces (summer daytime/winter night-time), 6) Passive Heating-Cooling – Active gain system (scatter or linear mass system/compact mass system), 7) Natural ventilation – Wind and solar chimney for the temperate and cross-ventilation for the tropical, 8) Natural Lighting – Access to daylight, 9) Eco-Technology – Solar collector, 10) Reuse, Recycle and Renewable Resources – To collect rainwater and the use of rainwater for irrigation/Demolition debris through reuse and recycling, 11) EcoMaterials – The use of natural materials, 12) Sources of Sustainability in Architecture – To be read by students such as the followings: Young (2003), Bourdeau (1999), Kazi et al. (1999), Curran (1996), Steele (1997), Mendler & Odell (2000), Papanek (1995), US Green Building Council (1996), Yeang (1995) and WCED (1987), all of which summarise the main aims of sustainable architecture, 13) Acoustics, 14) Landscapping – concerned with the planning and design of outdoor space and design techniques include planting trees to shade buildings from the sun or protect them from wind, using local materials, on-site composting and chipping to reduce green waste hauling, and also may involve using drought-resistant plantings in arid areas (xeriscaping) and area of garden and landscape can also be allowed to grow wild to encourage bio-diversity, 15) Interiors. . These topics should be spread for the entire years of study, and the curriculum showing when session of them will be taught in any level of study.

To this, the following priorities should be considered by the teaching institutions:

Support a direct engagement of building practitioners (e.g. architects, engineers, project managers, quantity surveyors, etc.,) with academic teaching and learning (e.g. guest lectures, part-time tutoring, visits to exemplar case studies, monitoring of performance data, etc.);

Promote collaboration of professional practices with scientific and evidence-based research (.e.g. via the allocation of appropriate funding and/or scholarships);

Strengthen the link between practice and academia via the organisation of joint events (e.g. Seminars, exhibitions, road shows, design competitions, etc.), involving educators, students and professionals.

Educational and professional legislative frameworks that create real drivers and demands for sustainability – beyond the unique meeting of carbon-reduction targets – should be promoted, so as to also identify gaps in knowledge and build the requisite know-how, skills, and demands amongst stakeholders and actors of the building market - including public and private clients (Altomonte, 2012).

By this sustainable teaching and consequently practices we protect our planet as an indefinitely habitable home by using building materials carefully, conserving material and energy resources, favouring renewable and recyclable resources, preferring less energy-intensive materials, minimizing waste, preserving undeveloped land as a natural resource, and avoiding the pollution of land, water, and air (Edward Schwarz of Holcim Forim).

How to Foster Creative Thinking in Arch-Design Studio Teaching

Definition and Reason for Creative Thinking

From an adapted definition of John Dewey and others, creative thinking is the generation of new ideas within or across domains of knowledge, drawing upon or intentionally breaking with established symbolic rules and procedures. Creative thinking deliberately and actively engages students in:

Bringing together existing ideas into new configurations.

Developing new properties or possibilities for something that already exists.

Discovering or imagining something entirely new.

Kowaltowski et al. (2010), argue that the architectural design process is based on a creative phase where creative thinking is highly valued, and that with increased complexity in the design world, the stimulus for creative thought should no longer rely on talent alone. Creativity or creative thinking, as a concept of bringing forward new ideas, is seen by many as the driving force in the architectural design process and in variety of other fields (Horng, et al., 2005; Sternberg, 1991; Lashin-Shaw 1994 and several others as cited by Kawaltowski et al., 2010; Boden, 1999 also cited by Kowaltowski et al., 2010) warns that novelty is not sufficient to classify a solution as something creative or original. The idea has to have a specific purpose and solve a determined problem. Alecar (1996), again as cited by Kowaltowski et al. (2010) shows that relevance to a context is of extreme importance for a product to have scientific, technological, social and aesthetic value.

Therefore from the study exploration of literatures, the followings are found to be methods that may foster or stimulate creative thinking in teaching the arch-design studio:

Methods that May Foster Creativity in Teaching the Arch-design Studio

1) Restrictions – building codes, site conditions, costs, etc. 2) Brainstorming, 3) Analogy/ies, 4) Removing mental blocks, 5) Tools - like CAD, 6) Techniques - like drawing/ drafting technique, 7) Protocols of good practice, 8) Structure - good structure of design problems, 9) Cognitive - cognitive thinking, 10) Philosophy - philosophy of design methods, 11) Research, 12) Theories of Architecture ,13) Synecticts, 14) Morphological Charts, 15) Criticism, 16) Historical Drawing, 17) Model making, 18) Attribute Listing, 19) Axiomatic design method, 20) Bio-Mimeticry, 21) Browsing, 22) Precedents, 23) Architectural Values, 24) Charrettes, 25) Component Detailing, 26) Do Nothing, 27) Doodling, 28) Testing activities, 29) Exaggeration, 30) Excursions, 31)First Principle, 32) Focus/Focus Groups, 33) Mind Mapping, 34) Other Peoples Viewpoints, 35) TRIZ, 37) Think Tank, 38) Using Crazy Ideas, 39) Using Experts, 40) Visual Brainstorming, 41) Visualizing a Goal, 42) Doing Sketches, 43) Working with Dreams and Images, 44) Repertoire learning, 45) Computer screens, 46) The Creative Pause, 47) Outputs, 48) Chanllenge, 49) Alternatives, 50) The Concept Fan, 51) Concepts, 52) Provocations/Setting Up Provocations, 53) Movement, 54) Phototyping, 55) The Random Input, 56) Sensitizing Techniques, 57) Using Experts, 58) Visualizing a Goal, 59) And having a critical knowledge and application of structures, materials, colours, light, shadow, lines, planes, masses, space, etc., can result to creativity too (Asasoglu et al. 2010).

Many of these methods are traditionally part of the design process, such as Charrettes, and those that emphasize visualization of ideas (Goldschmidt & Smolkov, 2006; van der Lugt, 2005, cited by Kowaltowski et al., 2010). Buchanan (2012) recommends a learning design project involving architectural, structure, planning and approval, costing and construction in one of the years or semester of study. The teaching staff should have physical building experience, and learning should be towards the cities, as not only where they eventually work but for inspiration and exploration for themselves. Low student number stimulates learning as students will have the opportunity for learning from each other. The teacher must be talented at crit and the participation of the practitioners should be a selection of the interested and experienced, who have actually designed and built projects. Students can be asked to demonstrate their analyses as sketches, models, scenario discussions, posters, 2D and 3D, initial site plan drawings and physical models to be completed on a small scale (Bala, 2010).

CONCLUSION

The explored creative works of authors and scholars cited in this study, the experiences and very argueable opinions expressed in the various debates and conferences (IAES, Windsor, Viseu, etc) to improve ways and methods via sustainability and creativity ideas are used in contending for a sustainable and creative teaching of the architectural design studio. The outcomes of this research study can be summarised thus:

Selection and Participation – selecction of the right calibre of professionals and inter/multi disciplinary participation.

Integration of other related building professionals in teaching the design studio (no teamwork hence much criticisms on sustainability and creativity) and more awareness on health, safety and welfare, formal incorporation of sustainability/ creativity ideas in the curriculum. Federal Republic of Nigeria /Building Code, Windsor and Boyer & Mitgang's Report.

Exposition of improved ways and methods of teaching sustainability and creativity ideas in the architectural design studio.

Benefits of sustainability and creativity ideas' application in teaching the arch-design studio – better homes/buildings, places/environments, and planet for us now and the future generations.

Strategies of awareness to the government and institutions for more support.

REFERENCES

Adeyemi, E. A. (2000). *Lest we forget; Text of a keynote address at the annual general meeting of the Association of*

Architectural Educators in Nigeria, at FUT, Akure, 24-27 Feb.

Adeyemi, E. A. (2012a). *1st Phone Call Discussion*. January, 2012.

Adeyemi, E. A. (2012b). *2nd Phone Call Discussion.* April, 2012.

Alencar, E.M.L.S. & Fleith, D.S. (2004). Inventario de Praticas docentes que favorecem a criatividade no Ensino Superior. *Psicologia Reflexiva e Critica*. 17(1), 105-110.

Al-Hassan, A. (2009). *Sustainable Architectural Education: environmental content of architectural curriculum.* Ph.D. Thesis, SAPL, Newcastle University, UK.

Allwood, J. M., Cullen, J. M., Carruth, M. A., Cooper, D. R., McBrien, M., Milford, R. L., ... & Patel, A. C. (2012). *Sustainable materials: with both eyes open.* Cambridge: UIT Cambridge.

Altomonte, S. Ed. (2012). *Sustainable Architectural Education: EDUCATE – Environmental Design in University Curricula and Architectural Training in Europe.* EDUCATE Press, UK.

ARUP. (2012). *Sustaainable Buildings Design; A global firm of consulting engineers, designers*, ... Retreived April,2, 2013 from www.arup/Services/Sustainable Buildings Design. aspx.

Asasoglu, A., Gur, S. O., & Erol, S. Y. (2010). Basic design dilemmas in architectural education. *Scientific Research and Essays*, 5(22), 3538-3549.

Baird, G. (2011). *Sustainability Scrutinized: Criticism Arises in Academic and Professional Discourses*. August 2011.

Bala, H. A. (2010). Sustainability in the Architectural Design Studio: A Case Study of Designing On□Campus Academic Staff Housing in Konya and Izmir, Turkey. *International Journal of Art & Design Education*, 29(3), 330-348.

Baosol. (2013). *Sustainable Building Consulting.* Retrieved November, 2 , 2013 from www.baosol.com.

Billboard Publications. (1995). *Interiors.* Vol. 154, Billboard Publications Incorporated.

Borden, I. (2008). Sustainability and architectural design. *Space*, (492), 20-23.

Bourdeau, L. (1999). Sustainable development and the future of construction: a comparison of visions from various countries. *Building Research & Information,* 27(6), 354-366.

Boyer, E. L., & Mitgang, L. D. (1996). *Building Community: A New Future for Architecture Education and Practice.* A Special Report. California Princeton Fulfillment Services; 1445 Lower Ferry Road, Ewing, NJ 08618.

Bruner, J. S., & Lufburrow, R. A. (1963). The process of education. *American Journal of Physics*, 31(6), 468-469.

Buchanan, P. (2012). *What is wrong with architectural education? Almost everything.* The Architectural Review. Retrieved April, 2, 2013 from http://www.architectural-review.com/today/1989-july-whats-wrong-with-architectural-education-almost-everything/8637977.article.

CABE. (2007). *Sustainble design, climate change and the built environment.* Retrieved November, 2, 2013.

Charalambous, N. & Hadjisoteriou, M. (2009). *Introductory Architectural Design Studio: (re) Searching a New Approach.* EAAE, 35.

Christensen, P., & Worzala, E. (2010). Teaching Sustainability: Applying studio pedagogy to develop an alternative post-hurricane housing solution using surplus shipping containers. *Journal of Sustainable Real Estate,* 2(1), 335-360.

Clegg, B., & Birch, P. (2007). *Instant creativity: Simple techniques to ignite innovation & problem solving*. London, UK: Kogan Page.

Conway, H., & Roenisch, R. (2005). *Understanding Architecture.* 2nd Edition, Routledge.

Crul, M. R. M., & Diehl, J. C. (2006). *Design for sustainability: A practical approach for developing economies.* UNEP/Earthprint.

Curran, M. A. (1996). Environmental life-cycle assessment. *The International Journal of Life Cycle Assessment,* 1(3), 179-179.

Demirbaş, O. O., & Demirkan, H. (2003). Focus on architectural design process through learning styles. *Design Studies*, 24(5), 437-456.

Federal Republic of Nigeria/National Building Code. (2006). First Edition, LexisNexis, Butterworths.

Freshome. (2011). *Think Green*: 10 Best Sustainable Homes of 2010. Freshome Design & Architecture. Retreived January, 2, 2013 from http://freshome.com/2011/01/17/think-green-10-best-sustainable-homes-of-2010/.

GOETHE INSTITUTE. (2013). *Think ahead for sustainability – a conversation with Rainer Hascher, Architecture – Green Building*. Retrieved November, 2, 2013, from http://www.goethe.de/ins/al/tir/kuenste/architektur/eokologie/sq10084285.htm.

Green Enterprise. (2012). *Why lovable places matter to sustainability.* Posted February 14, 2012 in Green Enterprise, Living Sustainably.

Gross, M. D., & Do, E. Y. L. (1997). *The design studio approach: Learning design in architecture education. In Design Education Workshop. Georgia Institute of Technology* (Vol. 8).

Gurel, M.O. (2010). Explorations in Teaching Sustainable Design: A Studio Experience in Interior Design/Architecture. *International Journal of Art & Design Education*, 29(2), 84-199.

Hancock, J. E. (Ed.). (1981). *History in, of, and for architecture: papers from a symposium "History in architectural education",* Cincinnati, Ohio, May 30 and 31, 1980. University of Cincinnati.

Holloway, L. (2013). *Eco Design – It's Not Just About Being Green.* Newcastle Institute for Research on Sustainability.

Horng, J. S., Hong, J. C., ChanLin, L. J., Chang, S. H., & Chu, H. C. (2005). Creative teachers and creative teaching strategies. *International Journal of Consumer Studies,* 29(4),

352-358.

IAES. (2011). *International Architectural Education Summit* held 10 June 2011 in Spain. Retrieved December, 8, 2011, from www.e-architect.co.uk.

Iashin-Shaw, I. (1994). Cognitive structures of creativity: Implications for instructional design. *European Journal for High Ability*, 5, 24-28.

Iroegbu, O. (2010). Architects celebrate 50 years with push for material policy. *The Nation-Building & Properties. Accessed,* 12(08), 2011.

Jeffries, K.K. (2007). Diagnosing the creativity of designers: Individual feedback within mass higher education. *Design Studies,* 10(5), 485-497.

Kazi, A. S., Hannus, M., & Charoenngam, C. (1999). *An exploration of knowledge management for construction.* CIB REPORT, 247-256.

Koutsoumpos, L. (2007). *Confirming Conformity?* Revisiting Creativity in the Design Studio. Creativity/ Conformity Conference.

Kowaltowski, D. C., Bianchi, G., & De Paiva, V. T. (2010). Methods that may stimulate creativity and their use in architectural design education. *International Journal of Technology and Design Education,* 20(4), 453-476.

Lafarge Holcim Foundation. (2013). *Sustaianable construction.* Retrieved November, 2, 2013, from http://www.lafargeholcim-foundation.org/.

Mendler, S., & Odell, W. (2000). *The HOK guidebook to sustainable design.* John Wiley & Sons.

Moffett, M., Fazio, M. W., & Wodehouse, L. (2003). *A world history of architecture.* Laurence King Publishing.

Morrow, R., Parnell, R., & Torrington, J. (2004). Reality versus Creativity?. *CEBE Transactions.* 1(2), 91-99(9)

Mycoted. (2007). *Creativity and innovation,* science and technology: Tools, techniques books, discussions. Retrieved November,02, 2013, from http://www.mycoted.com/.

NIA. 2011. Nigerian Institute of Architects.

Olotuah, A. O. (2001). The Cross-Roads of Architectural Education in Nigeria. *Journal of Environmental Technology*, 1&2.

Olotuah, A. O. (2012). *Face to face discussion with Prof.* Olotuah in FUTA, Akure, Nigeria.

Olotuah, A. O., & Adesiji, O. S. (2005). *An appraisal of architectural education in Nigeria.* In Papers and Programme of Built Environment Education Conference, CEBE, September 2005.

Panchuk, I. (2013). *Sustainability through creative design and architecture.* Retrieved April, 2, 2013 from http://www.globalrealestateexperts.com/2013/02/sustainability-through-creative-design-and-architecture/.

Papanek, V. J. (1995). *Green imperative.*

Parashar, S. (2010). *Basic Design Studio. An Ongoing Research,* BKPS College of Architecture, Pune, India. Retrieved April, 2, 2013, from www.aia.org/aiaucmp/.../aiab087198.pdf.

Steele, C. M. (1997). A threat in the air: how stereotypes shape intellectual identity and performance. *American psychologist,* 52(6), 613.

Sternberg, R.J. (1991). *A theory of creativity.* In Proceedings of XIV ISPA Colloquium. Braga, Portugal.

Stringer, L. C. (2006). Unpacking "Participation" in the Adaptive Management of Social- ecological Systems: a Critical Review. *Ecology and Society*, 11 (2): 39.

SUTMUNDO. (2011). *Impact of Buildings on Global Resource and Sustainability.* Sustainability+Urbanism+Technology=Green Planet. Retrieved November, 2, 2013.

Thompson, .H. (2013). *Landscape and Utopias*. SAPL Research Seminar, Newcastle University, UK. 8th February 2013.

Ughamadu, K.A. & Okoye, N.S. (1998). *Principles, Methods and Strategies for Effective Teaching.* KMENSUO Educational Publishers, Onitsha/Agbor, Nigeria.

UIA/ UNESCO. (2002). Validation system for architectural education. Text adopted by the XX11 UIA General Assembly (Berlin, July 2002).

UIA/UNESCO. (2003). Work programme education. UIA/UNESCO charter for architectural education.

US Green Building Council. (1996). LEED (buildings: leadership in energy and environmental design). Environmental building rating system criteria. Third Ballot Draft, Appendix, 1.

WCED, U. (1987). Our common future. World Commission on Environment and Development Oxford University Press.

Windsor Forum/Viseu. (2004). *Forum on Design Education: Toward an Ideal Cirriculum to Reform Architectural Education.* Vero Beach, Florida, April 12-14, 2002. New Urban Press, Miami, FL.

Yeang, K. (1995). *Designing with nature: the ecological basis for architectural design.* New York: McGraw-Hill.

Young, W. (2003). Problems and Solution: To Training Disaster Organizations on the Use of PV. *In Proceedings of the Solar Conference* (pp. 463-468). American Solar Energy Society; American Institute Of Architects.