

## ASSESSING THE INFLUENCE OF ARCHITECTURAL TEACHING METHODS ON ADVANCING SUSTAINABLE ARCHITECTURAL PRACTICES

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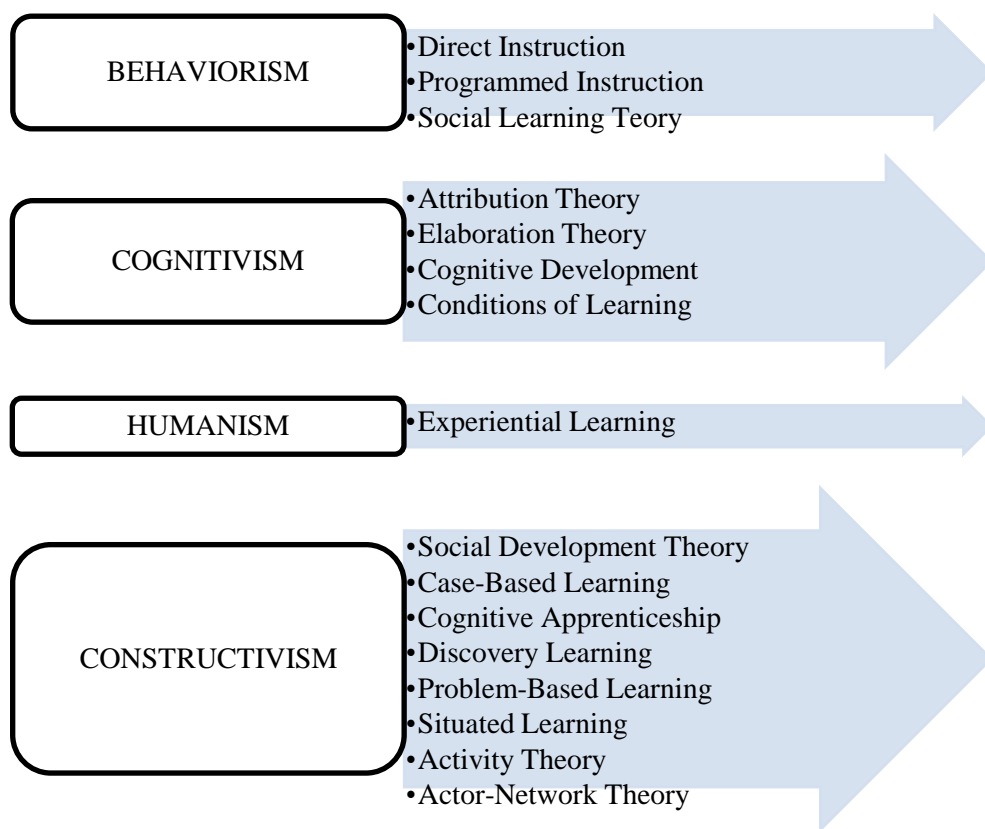
### **Abstract**

*This study investigated the role of architectural education in Nigeria in preparing professionals for sustainable architectural practice, with a particular focus on advancing Sustainable Development Goal 4 (SDG 4). It assessed the relationship between the teaching methods employed in delivery of the architecture curriculum of universities and sustainable architectural practice among professionals. Using positivism as the philosophical stance, a quantitative approach was taken. Regression analysis was employed to analyse teaching methods and its impact on architects' professional practice. Findings revealed that educators who place emphasis on meeting deadlines, employed teaching methods that are flexible enough to adapt to changing needs, and adopting the practice of professional ethics in their teaching delivery have the highest positive influence on future architectural practice of their students. On the flip side, educators who accepted submission from students that were carelessly put together, and capitalise on relationships with their students (such as favouritism) tend to negatively affect the future architectural practice of their students. This research also revealed the crucial impact of architectural education approaches on advancing sustainable architectural practices in Nigeria, aligning with the objectives of SDG 4. It underscores the importance of teaching methods and recommends constant updates of teaching methods at the faculty level so as to have products who have a highly sustainable practice.*

**Keywords:** Architectural education, Architectural practice, Sustainability, Teaching methods

### **1.0 Introduction**

There are two sets of interaction experienced through instruction. The first is Dewey's "transaction" between the student and the environment, which is governed by the curriculum and influenced by the teacher. The second is the interpersonal exchange between the teacher and student (Casey & Quennerstedt, 2020). Within the field of education, four (4) major teaching theories are behaviourism, cognitivism, humanism and constructivism within, which are sixteen (16) learning principles (Ahmad et al., 2014) (Figure 1).

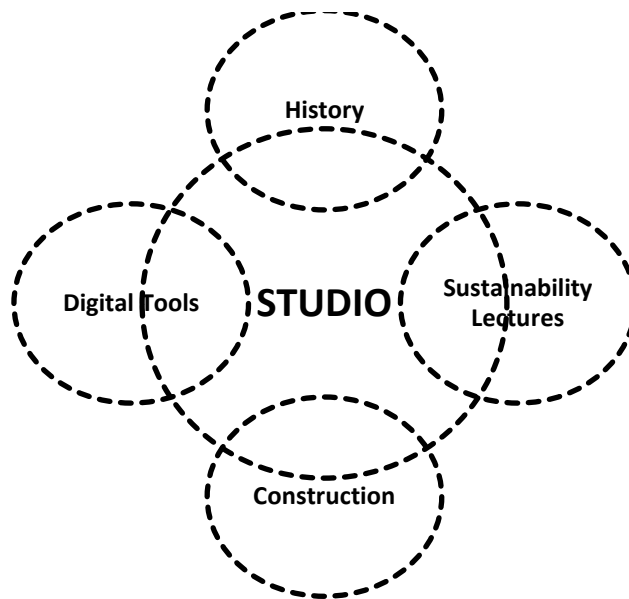


**Figure 1: Classification of Learning Theories**

**Source: Adapted from (Ahmad et al., 2014)**

Behaviourism theory deals with learning through the principle of reinforcement, behavioural change or the environment shaped behaviour (Ramani et al., 2019; O’Doherty et al., 2017). Cognitivism theory deals with the way memory and prior knowledge interact to play an important role in learning (Brieger et al., 2020). Humanism theory deals with self-determination, value and potential of the user (Sulak et al., 2017). Constructivism theory deals with the construction of knowledge through experience and learning in active process (Mani & Milan, 2020). Of the four, constructivism is the most employed in architectural education as it emphasizes that students create information rather than just absorb it (Rider, 2014). This approach, which emphasizes student

engagement and worldview repositioning, is in line with the notion of incorporating sustainability and green building concepts into formal architectural education (Rider, 2014). According to Vahabi & Hojjat, (2022) and Vrouwe & Kristek, (2022), constructivism in education emphasizes the value of student-centred teaching methods, collaboration, and interaction. It also changes the role of teachers to support learning experiences and assist students in meaningfully constructing knowledge. Furthermore, in order to produce design professionals prepared to produce architecture for a changing society, a teaching approach based on constructivist and cognitive principles is crucial (Tedre & Pajunen, 2022). Consequently, even though constructivism might not be the only philosophy used in architectural education, it plays a significant role in shaping pedagogical approaches within the field. An example of this is the lecture and studio integration model in architecture education presented by Ali, (2023) and Acıcan & Luyten, (2022). This model graphically explains the integration of architectural design studio and lecture courses, which are prepared using digital tools, history, construction, and lectures (Figure 2).



**Figure 2: Lecture and studio integration**

**Source: Adapted from La Roche, 2017**

Notably, a substantial portion of architectural education that employs constructivism theory aligns with the principles of SDG 4, as exemplified by the research of (Patil & Kudte, 2017) which emphasized student-centred learning and the importance of real-life experiences in cognitive development (Bhatnagar, 2023; MacLeod et al., 2022). Their focus on dynamic and interactive information exchange between teachers and students

resonates with constructivism's process-oriented approach to learning (Bada & Olusegun, 2015). Furthermore, the study's emphasis on students' intrinsic motivation and ownership of cognitive goals mirrors the constructivist idea of guided self-scaffolding and high student engagement (Efgivia et al., 2021). In the context of SDG4 - Quality Education, (Patil & Kudte, 2017) promoted constructivism theories as effective teaching methods that prioritize student understanding and application of knowledge, aligning with the goal of enhancing educational quality and relevance for sustainable development (Calalb, 2023). On the presented premise, there is a question of the extent to which the teaching theories employed in delivery of the architecture curriculum of universities influenced the sustainable architectural practice of professionals. Hence the research aimed to assess the influence of teaching methods employed in delivery of the architecture curriculum of universities on sustainable architectural practice among professionals.

### ***Hypothesis***

A hypothesis was devised to scrutinise the aim of the research as stated below.

$H_0$  = Teaching methods employed in architectural education have no influence on sustainable architectural practice in the study area.

$H_1$  = Teaching methods employed in architectural education have influence on sustainable architectural practice in the study area.

## **2.0 Literature Review**

### **2.1 Architectural teaching methods, students' understanding and career growth, and Sustainable Development Goal 4 (SDG 4)**

Architectural teaching methods play a crucial role in shaping students' understanding and career growth (Ali, 2023; Acican & Luyten, 2022; Bahadure et al., 2013; Sfintes, 2022). Various approaches like problem-based learning, case-based learning, and project-based learning are employed to enhance students' abilities in architecture. Implementing interpretative treatment methods over conventional teaching methods has shown to boost motivation and participation among students, leading to better comprehension and analytical skills development. Additionally, integrating experiential learning approaches, such as using parametric design and structural analysis tools, can provide a visual and interactive environment for students to grasp structural principles effectively. These diverse teaching strategies not only aid in improving students' understanding of architectural concepts but also prepare them for successful career growth in the field of architecture. Saghafi's (2020) study emphasizes linking knowledge acquisition with application in design studio projects, advocating for a multi-level approach in architecture education. Sukkar et al., (2024) focus on active teaching techniques in architectural science courses, showing that active learning strategies enhance students' comprehension and motivation. Additionally, a study by Acican & Luyten, (2022) on structural courses suggests that integrating parametric design and structural analysis tools can enhance students' understanding of structural behaviour and inform their design skills. These studies collectively contribute valuable insights into enhancing architectural pedagogy and students' learning experiences.

Sustainable Development Goal 4 (SDG 4) focuses on ensuring inclusive and equitable quality education and promoting lifelong learning opportunities for all (Smith et al., 2020). In the context of architectural education, SDG 4 serves as a guiding principle to prepare professionals who not only possess the necessary technical skills but also demonstrate a commitment to sustainability, social responsibility, and ethical practices. Education for Sustainable Development (ESD) is integral to achieving SDG 4 (Kopnina, 2020; Shulla et al., 2020). It emphasizes the importance of incorporating sustainability principles into the curriculum across all disciplines, including architecture (Boarin & Martinez-Molina, 2022). ESD encourages critical thinking, problem-solving, and a holistic understanding of environmental, social, and economic issues. Architectural education plays a crucial role in advancing the objectives of SDG 4 by equipping students with the knowledge, skills, and values needed to address sustainability challenges. By integrating sustainability principles into teaching methodologies, educators can foster a culture of environmental stewardship and social consciousness among future architects. The design of architectural curriculum and teaching methodologies should align with the principles of SDG 4. Constructivism-based approaches, such as problem-based learning, case-based learning, and cognitive apprenticeship, offer opportunities for students to engage actively in real-world challenges and develop sustainable solutions (Haynes, 2021).

Architectural teaching methods can be adapted to SDG 4, which focuses on quality education, by incorporating sustainability and the Sustainable Development Goals (SDGs) into the curriculum (Akgun et al., 2023). This can be achieved by introducing students to the theory of knowledge and critical thinking, enabling them to be competitive in global labour markets (El-Kholei & Yassein, 2023). Methods involving collaborative work among students from various disciplines and universities, engaging with local stakeholders and administration for objective discussions (Mensing-de Jong et al., 2020; Wende et al., 2020), can serve as a guideline for incorporating the SDGs into teaching practices (Delpont et al., 2023). Additionally, the findings of 4E cognition, which emphasizes embodied, embedded, enacted, and extended cognition, can be integrated into educational settings through embodied and immersive teaching, cross-disciplinary research, and experimental making and evaluation (Robinson, 2022). By incorporating these approaches, architectural education can contribute to achieving SDG 4 and promoting sustainability in the built environment.

## **2.2 Constructivism theory of teaching and learning**

This model of teaching and learning can be operated through eight different principles. These are social development theory, case-based learning, cognitive apprenticeship, discovery learning, problem-based learning, activity theory and actor-network theory.

### ***Social development theory***

This principle of cognitivism puts forth that social interaction must occur before development and that the social interaction brings about cognition (Vygotsky et al., 1978). The application of the theory results in the teacher collaborating with the student who is required to play an active role in learning. Thus, learning becomes a reciprocal experience between teacher and student (Skilton-Sylvester & Erwin, 2000).

### ***Case based learning***

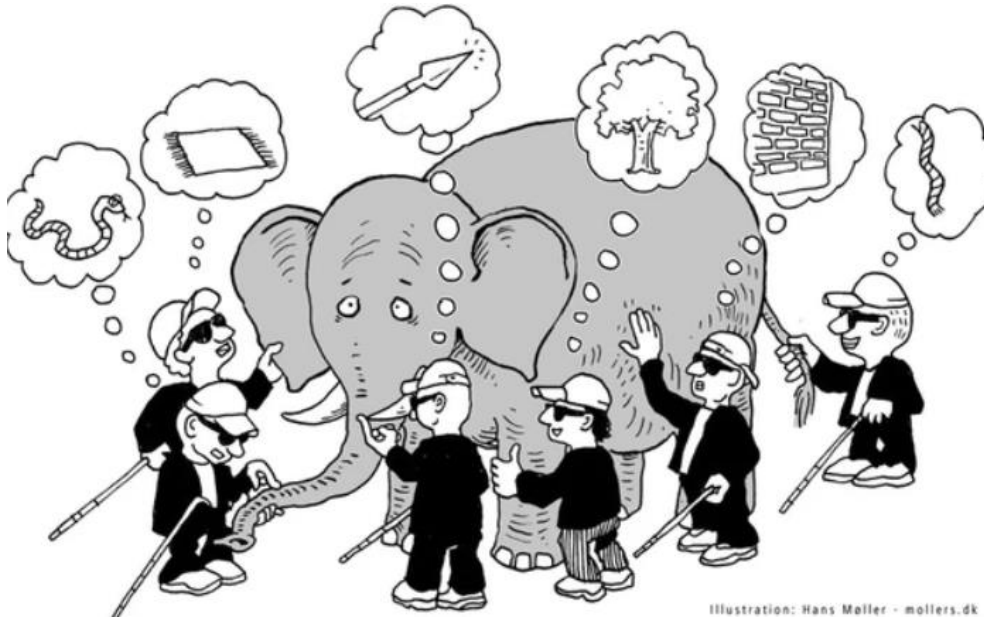
This is a learner-centred method in which students are engaged in discussing scenarios that are or resemble real life. The instructor acts as the facilitator and the students are encouraged to collaboratively analyse the problem and provide solutions, which are multiple in nature (Herreid, 2017). This method of teaching and learning gives the student insight on how practice is affected by theory, helps students with analytic techniques, develops the students analytic, communicative and collaborative skills as well as deepens their knowledge on the topic analysed (Ramberg et al., 2021).

### ***Cognitive apprenticeship***

This is a method of teaching which inspires cognitive and metacognitive skills and process using guided experience. This involves context, methods, sequence, and sociology and is considered the problem-solving process used by experts to handle complex tasks (García-Cabrero et al., 2018; Lyons et al., 2017). To facilitate cognitive apprenticeship, there must be an expert, the student, and the instructor. The expert first presents the student with conceptual models of processes required to perform a task, then the student is asked to perform that task with coaching input from the instructor. Then a comparison is carried out between the expert's solution and the students' solution (Mullen, 2020).

### ***Discovery learning***

Jerome Bruner (1915-2016) designed this principle. Being inquiry-based he puts forth that it is best for learners to discover new knowledge on their own by drawing on experiences to solve problem situations. Thus, learners discover relationships and facts for themselves which they are expected to remember more than when they have only been instructed (Sousa, 2016). Research has shown that this theory encourages active engagement, promotes motivation, autonomy, responsibility and independence. It also develops creativity and problem-solving skill and tailors the learning experience. On the downside, this form of teaching may create cognitive overload, and cause misconceptions which may not be detected by teachers (Argaw et al., 2016). Various debates exist on the effectiveness of discovery learning, as learners do not always get to know the 'full picture' of what they have discovered. This is because once a new fact is learned; the motivation to explore other dimensions is not prevalent among learners. This can be likened to the 'elephant in a room' parable by Hans Møller where blind men were asked to examine and identify an elephant. However, depending on what part was examined, each blind man gave a different interpretation (Bakker, 2018) (Figure 3). Models based on discovery learning include problem-based learning, simulated-based learning, guided discovery, incidental learning, case-based learning, and goal-based scenarios (Tapingkae et al., 2020).



**Figure 3: Elephant in room parable**

**Source: Bakker, 2018**

### ***Problem-Based Learning (PBL)***

This is a system of teaching through use of real-life problems as a stimulus for students' participation (Chiou, 2020; Nasrullah et al., 2021) that was originally introduced in medical education of the United States and later other fields such as architecture, engineering, education, social work and business (Chiou, 2020). The principle is focused on process thus making the student responsible for learning, which includes identifying learning needs, setting learning goal, planning learning activities, finding & using learning resources, and evaluating the learning achieved. An outline for PBL is therefore (Yew & Goh, 2016) explore the issue, state what is known, define the issues, research the knowledge, investigate solutions, present and support the chosen solution, review your performance (Yew & Goh, 2016). When PBL is used in professional education such as architecture education, research suggests that students transfer skills guide from independent and interdependent learning into practice (Mann et al., 2021).

### ***Activity Theory***

Activity theory was developed in the 1920's in USSR (Russia) by Lev Semyonovich Vygotsky (1896-1934) (Marques & Moschkovich, 2023). Two fundamentals in the theory are, first, knowledge is mediated through tools, artefacts and, secondly, the basic unit of analysis is the 'activity'. First generation activity theory proposes that tools, artefacts and symbols mediate between the subject and the object. The subject refers to the important actor(s) in the particular activity and the person's perspective that we are to look from. The object refers to the objective of the activity. The employment of this

theory assesses an individual activity and cannot assess group/collective activity (Pettersson, 2021). Second-generation activity builds on the work of the first generation by taking into consideration that when an activity is embarked upon, there are a set of implicit and explicit rules which should be followed or that control the activity. In addition, there is a community of actors involved in the activity and division of labour exists. Third generation activity works on the premise that there can be two activity systems, which, when they exist, the objects start to interact and, if the actors of both activities start to engage in open interaction, there is the potential for expansive learning. Expansive learning is regarded as learning beyond what the actors would have originally been capable of achieving when working separately. In the pedagogic activity system of activity theory, the subject is the teachers and learners, the rules are curriculum, personal belief and discipline norms, the community includes the teachers, learners. Division of labour takes place among teachers, learners and support staff, the object is increased learning, and the outcome is pedagogic sustainability.

### ***Actor-Network Theory (ANT)***

The Actor-Network Theory (ANT) emerged in mid-1980 as an approach to social theory and research. It is characterised by the premise that humans and non-humans are equal agents within the network. Network refers to a tool used to analyse society and nature while actor refers to a trigger or source of an action that is human or non-human (Mifsud, 2020). Therefore, ANT is a method to describe the deployment of associations like semeiotics and is a network tracing activity. However, it does not give details (Latour, 1996).

## **3. Methodology**

### ***Research design and approach***

This study utilized a quantitative research approach to investigate the relationship between architectural education teaching methods and sustainability of the professional practices of architects in Nigeria. It employed regression analysis to quantitatively analyse the impact of various teaching methods experienced on professional practices of those who studied architecture in Nigeria.

### ***Data Collection***

Simple random sampling technique was employed to select architects involved in the professional practice of architecture in Nigeria. Respondents were randomly sampled through state chapters of the Nigeria Institute of Architects (NIA). A sample size of 370 architects was calculated using a population of 10,131 which included fellows, full members, and graduate members as recorded in the NIA annual report of 2019.

A questionnaire was designed as the survey instrument. To address the aim, various attributes related to teaching methods employed in architectural education were itemised and arranged to solicit responses on their influence on the sustainable practices of architects based on the perspective of the respondents using a 5-point Likert scale. Also, the perspective of respondents on the extent to which they perceive their practice to be sustainable was obtained.



**Data and Model Description**

Backward stepwise multilinear regression method was used to get the equation of best regression. This resulted in 25 of the 35 attributes of teaching methods being the regressor variables for sustainable practice among architects in Nigeria. These regressor variables were: Teaching methods of non-architects (TMNTS); Your resource control skills (RESTS); Your interests – related to your present business/work (INTTS); Your cultural values as related to your professional practice (CULTS); Your business orientation (CRITS); Your ability to meet deadlines (MEETS); Your maintenance of a sense of urgency to meet business goals (URGTS); Your level of authority in your business/work(AUTTS); Your management skill (MGTTs); Your practice of professional ethics (PPETS); Your exposure to practice learning opportunities (EXPTS); Employment opportunities (EMPTS); Your ease of getting clients (CLITS); Your research activities (ACTTS); Your response to changing needs of the profession (NEETS); Your business strategies (BUSTS); Your business brand (BBRTS); Your communication style (COMTS); Your business management style (MGSTS); Your negotiation skills (NEGTS); Your client managerial skill (CMGTS); Your influence on co-workers and staff (INFTS); Your commitment to health and safety (CHSTS); Your commitment to spatial quality (CSPTS); and Your commitment to work (CWKTS). Sustainable Practice among architects (SPP) was the dependent variable.

**The Model:**

The least square algorithms applied to the model.

**Equation 1: Regression Model for Hypothesis**

$$SPP = \beta_0 - \beta_1TMNTS + \beta_2RESTS + \beta_3INTTS - \beta_4CULTS - \beta_5ORITS + \beta_6MEETS - \beta_7URGTS - \beta_8AUTTS + \beta_9MGTTs + \beta_{10}PPETS + \beta_{11}EXPTS + \beta_{12}EMPTS - \beta_{13}CLITS - \beta_{14}ACTTS + \beta_{15}NEETS + \beta_{16}BUSTS - \beta_{17}BBRTS + \beta_{18}COMTS + \beta_{19}MGSTS - \beta_{20}NEGTS - \beta_{21}CMGTS + \beta_{22}INFTS + \beta_{23}CHSTS + \beta_{24}CSPTS + \beta_{25}CWKTS + \epsilon$$

..... equation 1

**4.0 Data Presentation, Analysis and Discussion of Findings**

The model summary is presented in Table 1. This was generated using the regression of the independent variables which were constants against the dependent variable as itemised in the data variables and description section. R<sup>2</sup> was found to be a value of 0.698, and the adjusted R<sup>2</sup> was 0.675.

**Table 1: Model Summary**

Model	R	R Square	Adjusted Square	R	Std. Error of the Estimate
11	.835k	.698	.675		.540

Source: Field survey, 2019

The regression table is presented (Table 2) showing the unstandardised coefficients – Beta and Standardised error (SE), the standardised coefficient – Beta ( $\beta$ ), and Significance/ P-value ( $\rho$ ).

**Table 2: Regression table**

Variables	Beta	SE	$\beta$	$\rho$
Teaching methods of non-architects (TMNTS)	5.487	.043	.335	.000
Your resource control skills (RESTS)	5.713	.093	-.334	.000
Your interests – related to your present business/work (INTTS)	.303	.066	-.778	.000
Your cultural values as related to your professional practice (CULTS)	-.378	.155	1.251	.000
Your business orientation (CRITS)	-.579			
Your ability to meet deadlines (MEETS)	1.613	.137	-.898	.000
Your maintenance of a sense of urgency to meet business goals (URGTS)	-1.107			
Your level of authority in your business/work (AUTTS)	-.682	.114	-.469	.000
Your management skill (MGTTS)	.155	.080	.206	.055
Your practice of professional ethics (PPETS)	.761	.088	1.062	.000
Your exposure to practice learning opportunities (EXPTS)	.344	.104	.441	.001
Employment opportunities (EMPTS)	.460	.096	.560	.000
Your ease of getting clients (CLITS)	-.790	.107	-.967	.000
Your research activities (ACTTS)	-.311	.073	-.420	.000
Your response to changing needs of the profession (NEETS)	.932	.087	.870	.000
Your business strategies (BUSTS)	.563	.107	.561	.000
Your business brand (BBRTS)	-.760	.084	-.683	.000
Your communication style (COMTS)	.641	.143	.497	.000
Your business management style (MGSTS)	.536	.059	.546	.000
Your negotiation skills (NEGTS)	-.171	.062	-.170	.006
Your client managerial skill (CMGTS)	-.820	.112	-.735	.000
Your influence on co-workers and staff (INFTS)	.360	.102	.286	.000
Your commitment to health and safety (CHSTS)	.589	.110	.595	.000
Your commitment to spatial quality (CSPTS)	.111	.055	.086	.045
Your commitment to work (CWKTS)	-.406	.060	-.636	.000

Notes.  $R^2 = 0.698$  ( $ps > .05$ )

**Source: Field survey, 2019**

The Beta values were placed in the regression model as shown in equation 2.

$$\begin{aligned}
 \text{SPP} = & 2.137 - 0.535\text{TMNTS} + 0.510\text{RESTS} + 0.303\text{INTTS} - 0.378\text{CULTS} - \\
 & 0.579\text{ORITS} + 1.613\text{MEETS} - 1.107\text{URGTS} - 0.682\text{AUTTS} + 0.155\text{MGTTs} + \\
 & 0.761\text{PPETS} + 0.344\text{EXPTS} + 0.460\text{EMPTS} - 0.790\text{CLITS} - 0.311\text{ACTTS} + \\
 & 0.932\text{NEETS} + 0.563\text{BUSTS} - 0.760\text{BBRTS} + 0.641\text{COMTS} + 0.536\text{MGSTS} - \\
 & 0.171\text{NEGTS} - 0.820\text{CMGTS} + 0.360\text{INFTS} + 0.589\text{CHSTS} + 0.111\text{CSPTS} - \\
 & 0.406\text{CWKTS} + 0.389 \dots\dots\dots \text{equation 2}
 \end{aligned}$$

**Interpretation of results:**

The value of  $R^2$  at 0.698 shows that 69.8% of variance in sustainable practice among architects in Nigeria is explained by the impact of identified teaching methods employed in the training of architects. Therefore, indicating that 40.2% of the variance in sustainable practice among architects in Nigeria is explained by other variables not included in the model. The regression model designed, predicts the dependent variable significantly well where the adjusted  $R^2 = 0.675$ , F-test (at 339 degree of significance) = 31.298 and the P-value (level of significance) = 0.000. The P-value is less than the limit of 0.05. This therefore provides evidence to reject the null hypothesis and accept the alternate hypothesis. This suggests that the teaching methods employed in the training of architects is a good predictor for sustainable practice of architects in Nigeria. As shown in Equation 1, teaching experienced from non-architects (TMNTS) with a value of -0.535 has a negative impact on sustainable practice among architects. However, when teaching methods lay more emphasis on resource control skill (RESTS) there will be higher positive impact on sustainable practice among architects. This is because it has a  $\beta$  value of +0.510. Likewise teaching methods which lay emphasis on interests related to present business/work (INTLS) of the architect has a positive impact on sustainable practice as its value is 0.303.

Teaching methods laying emphasis on cultural values (CULTS) and business orientation (ORITS) are valued at - 0.378 and - 0.579 respectively. Therefore, the more emphasis is made on cultural values and business orientation by the teachers, the more negative the influence on sustainable practice of architects. Teaching methods laying emphasis on the ability to meet deadlines (MEETS) and response to changing needs of the profession (NEETS) have the highest positive values of +1.613 and +0.932 respectively and both have positive impact on sustainable practice of architects. However, teaching methods focusing on the maintenance of a sense of urgency to meet business goals (URGTS) and level of authority in business/work (AUTTS) do not positively impact sustainable practice as they are both valued at - 1.107 and - 0.682.

Management skill through teaching methods has a constant value of +0.115 and has positive impact on sustainable practice of architects in Nigeria. Likewise teaching methods, which expose to practice learning opportunities (EXPTS) and employment opportunities (EMPTS) have positive impact on sustainable practice with +0.344 and +0.460 as their values respectively.

The influence of teaching methods on sustainable practice in Nigeria is negative when it comes to ease of getting clients (CLITS) valued at - 0.790 constant research activities (ACTTS) valued at a constant of - 0.311, business brand (BBRTS) valued at - 0.760, negotiation skills (NEGTS) valued at - 0.171 and commitment to work (CWKTS) valued at - 0.406 constant. Sustainable practice is impacted positively through the experience of teaching methods which emphasized on practice of professional ethics (PPETS) at a constant of +0.761, business strategies (BUSTS) at a value of +0.563, communication style (COMTS) valued at +0.641 constant, business management style (MGSTS) at +0.536 constant, influence on co-workers and staff (INFTS) at a value of +0.360, commitment to health and safety (CHSTS) valued at +0.589 and commitment to spatial quality (CSPTS) at a constant value of +0.111.

#### **4.2 Implication of Findings**

An assessment of teaching methods employed by schools of architecture in Nigeria core courses revealed similarities with minimal variations. Majorities of which were carried out using variations of constructivism theory. This implies that architects are trained mainly using active process of learning through experience. The test of the hypothesis revealed that teaching methods employed in architectural education have influence on professional practice among architects in Nigeria. A look at the equation of best regression (Equation 1) showed that of the 25 attributes of teaching methods, those that had very high positive influence are teaching methods that emphasise on ability to meet deadlines, practice of professional ethics, respond to changing need, and communication styles. Teaching methods that had very high negative influence were teaching methods that emphasized too much on; maintaining a sense of urgency to meet goals (leading to rushed work) level of authority in business/work, business brand, ease of getting clients and, client managerial skill. Therefore, lecturers that emphasise on the importance of meeting deadlines imbibe in their products a respect for timely delivery of services. Likewise, lecturers with fair and principled ethics influence their students practice ethics positively. Lecturers, whose teaching methods are dynamic and respond to changing needs, impact on the sense of flexibility and willingness to explore alternatives in the course of professional practice. However, lecturers who employ teaching methods laced with an abuse of power/authority as well as poor people management skills, negatively affect/impact in some way on the professional practice of architects who have been taught by such lecturers.

#### **5.0 Conclusion**

The investigation into the relationship between architectural teaching methods and the advancement of sustainable architectural practices in Nigeria has revealed crucial insights. The research indicates a significant influence of the curriculum and teaching methodologies on the practices of architects in the country. The study also emphasizes the correlation between specific attributes of teaching methods and their impact on sustainable architectural practices. Attributes that encourage adaptability, ethical considerations, and responsiveness to changing needs exhibit a positive influence on professional practices. Conversely, an emphasis on authority, rigid structures, and

certain business-centric approaches appears to have a negative impact on sustainable architectural implementation. The findings highlight the pivotal role of architectural education in shaping the practices and approaches of professionals. The need for a dynamic, adaptable, and socially conscious curriculum is evident for the advancement of sustainable architectural practices, aligning with SDG 4 objectives.

### 5.1 Recommendations

Teaching methods employed in architectural education significantly influence the professional practice of architects. Educators who emphasize adaptability, ethical considerations, and responsiveness to changing needs positively impact the adoption of sustainable architectural practices among graduates. To enhance the effectiveness of architectural education in promoting SDG 4, continuous improvement and collaboration are essential. Faculty development programs, interdisciplinary collaborations, and industry partnerships can facilitate the integration of sustainability principles into the curriculum and promote innovative teaching methodologies. Ongoing research and innovation are vital for advancing sustainable architectural practices in alignment with SDG 4.

The following recommendations are also vital for aligning architectural education in Nigeria with global sustainability goals, particularly SDG 4, and for fostering a generation of architects committed to sustainable practices.

- i. Architectural educators should deliver their teaching from the stand point of adaptability, ethical considerations, and responsiveness to evolving needs.
- ii. Encourage a diverse range of teaching methodologies that promote problem-solving, ethical considerations, and real-life application.
- iii. Faculty development programs should focus on updating teaching methodologies, emphasizing adaptability and ethical practices within the profession.
- iv. Foster collaboration among different disciplines to bring diverse perspectives into architectural education.
- v. Strengthen ties with industry professionals to provide students with real-world exposure, encouraging a deeper understanding of practical implications. Establish a feedback loop involving practitioners to continuously evaluate and update the curriculum in alignment with industry demands.
- vi. Develop accreditation standards that emphasize sustainable practices and regularly assess architectural education programs against these standards.
- vii. Encourage ongoing research to explore the evolving needs and best practices in sustainable architectural design and practice. Ensure research outcomes are disseminated to educational institutions to influence curriculum updates.

Continual evolution and adaptation in educational methodologies will contribute to the enhancement of sustainable architectural practices in Nigeria

### References

- Acıcan, Ö., & Luyten, L. (2022). Project-based and experiment-based learning of structural behaviour and integrated design skills for architecture students. In *Structures and Architecture A Viable Urban Perspective?* (pp. 194–201). CRC Press.  
<https://www.taylorfrancis.com/chapters/edit/10.1201/9781003023555-24/project-based-experiment-based-learning-structural-behaviour-integrated-design-skills-architecture-students-ac%C4%B1can-luyten>
- Ahmad, M., Rahim, L. A., & Arshad, N. I. (2014). A review of educational games design frameworks: An analysis from software engineering. *2014 International Conference on Computer and Information Sciences (ICCOINS)*, 1–6.  
<https://ieeexplore.ieee.org/abstract/document/6868452/>
- Akgun, Y., Erdoğan Erkarşlan, Ö., & Neşeliler, P. (2023). A guide for a guide: Using UIA publications for an SDG-focused studio. *Archnet-IJAR: International Journal of Architectural Research*, 17(3), 443–458.
- Ali, H. M. (2023). Architectural Education and Targeted Skills An Evaluation study of Scientific Research influence as of Mechanisms of Teaching and Learning. *Mansoura Engineering Journal*, 48(1), 13.
- Argaw, A. S., Haile, B. B., Ayalew, B. T., & Kuma, S. G. (2016). The effect of problem based learning (PBL) instruction on students' motivation and problem solving skills of physics. *Eurasia Journal of Mathematics, Science and Technology Education*, 13(3), 857–871.
- Bada, S. O., & Olusegun, S. (2015). Constructivism learning theory: A paradigm for teaching and learning. *Journal of Research & Method in Education*, 5(6), 66–70.
- Bahadure, S., Wahurwagh, A., & Bahadure, P. (2013). Role of Interpretative Treatment Method in Teaching-Learning History of Architecture. *2013 IEEE Fifth International Conference on Technology for Education (T4e 2013)*, 170–173.  
<https://ieeexplore.ieee.org/abstract/document/6751088/>
- Bakker, A. (2018). Discovery learning: Zombie, phoenix, or elephant? *Instructional Science*, 46(1), 169–183. <https://doi.org/10.1007/s11251-018-9450-8>
- Bhatnagar, A. (2023). Establishing Critical Constructivism in Learning Teaching Through Developed Self-Assessment Framework. *Journal of South Asian Studies*, 11(1), 19–31.
- Boarin, P., & Martinez-Molina, A. (2022). Integration of environmental sustainability considerations within architectural programmes in higher education: A review of teaching and implementation approaches. *Journal of Cleaner Production*, 342, 130989.
- Brieger, E., Arghode, V., & McLean, G. (2020). Connecting theory and practice: Reviewing six learning theories to inform online instruction. *European Journal of Training and Development*, 44(4/5), 321–339.
- Calalb, M. (2023). The constructivist principle of learning by being in physics teaching. *Athens Journal of Education*, 139–152.
- Casey, A., & Quennerstedt, M. (2020). Cooperative learning in physical education encountering Dewey's educational theory. *European Physical Education*

- Review*, 26(4), 1023–1037.  
<https://doi.org/10.1177/1356336X20904075>
- Chiou, H.-H. (2020). The impact of situated learning activities on technology university students' learning outcome. *Education+ Training*, 63(3), 440–452.
- Delpont, H. E., Morkel, J., Gorman, M., & Burton, L. O. (2023). Architecture Studios for Sustainable Cities and Communities: A Radically Inclusive Perspective: A response to SDG 11: Sustainable Cities and Communities. *Leading Ethical Leaders: Higher Education Institutions, Business Schools and the Sustainable Development Goals*. [1 Ed.], 451–517.
- Efgivia, M. G., Rinanda, R. A., Hidayat, A., Maulana, I., & Budiarjo, A. (2021). Analysis of constructivism learning theory. *1st UMGESHIC International Seminar on Health, Social Science and Humanities (UMGESHIC-ISHSSH 2020)*, 208–212. <https://www.atlantispress.com/proceedings/umgeshic-ishssh-20/125961875>
- El-Kholei, A. O., & Yassein, G. A. (2023). Embedding sustainability and SDGs in architectural and planning education: Reflections from a KAP survey, Egypt. *Archnet-IJAR: International Journal of Architectural Research*, 17(3), 459–477.
- García-Cabrero, B., Hoover, M. L., Lajoie, S. P., Andrade-Santoyo, N. L., Quevedo-Rodríguez, L. M., & Wong, J. (2018). Design of a learning-centered online environment: A cognitive apprenticeship approach. *Educational Technology Research and Development*, 66(3), 813–835. <https://doi.org/10.1007/s11423-018-9582-1>
- Haynes, B. S. (2021). *The Relationship of Career and Technical Student Organizations to College and Career Readiness* [PhD Thesis, Gardner-Webb University]. <https://search.proquest.com/openview/52452b7ffb6bf1060460f73d70957df0/1?pq-origsite=gscholar&cbl=18750&diss=y>
- Herreid, C. F. (2017). Let's get personal: Putting personality into your cases. *Journal of College Science Teaching*, 46(3), 57.
- Kopnina, H. (2020). Education for the future? Critical evaluation of education for sustainable development goals. *The Journal of Environmental Education*, 51(4), 280–291. <https://doi.org/10.1080/00958964.2019.1710444>
- La Roche, P. M. (2017). *Carbon-neutral architectural design*. CRC Press. <https://www.taylorfrancis.com/books/mono/10.1201/9781315119649/carbon-neutral-architectural-design-pablo-la-roche>
- Latour, B. (1996). On actor-network theory: A few clarifications. *Soziale Welt*, 369–381.
- Lyons, K., McLaughlin, J. E., Khanova, J., & Roth, M. T. (2017). Cognitive apprenticeship in health sciences education: A qualitative review. *Advances in Health Sciences Education*, 22(3), 723–739. <https://doi.org/10.1007/s10459-016-9707-4>
- MacLeod, A., Burm, S., & Mann, K. (2022). Constructivism: Learning theories and approaches to research. In J. Cleland & S. J. Durning (Eds.), *Researching Medical Education* (1st ed., pp. 25–40). Wiley. <https://doi.org/10.1002/9781119839446.ch3>

- Mani, M., & Milan, A. K. (2020). Co-Construction of knowledge: Teaching-learning redefined in the light of constructivism. *Studies in Indian Place Names*, 40(3), 6575–6592.
- Mann, L., Chang, R., Chandrasekaran, S., Coddington, A., Daniel, S., Cook, E., Crossin, E., Cosson, B., Turner, J., Mazzurco, A., Dohaney, J., O’Hanlon, T., Pickering, J., Walker, S., Maclean, F., & Smith, T. D. (2021). From problem-based learning to practice-based education: A framework for shaping future engineers. *European Journal of Engineering Education*, 46(1), 27–47. <https://doi.org/10.1080/03043797.2019.1708867>
- Marques, P. N., & Moschkovich, D. (2023). The question of emotions and aesthetic experience: The dialogue between Vygotsky and Stanislavski around actor’s psychology. *Pro-Posições*, 34, ed0820210084.
- Mensing-de Jong, A., Racon-Leja, K., & Zdrahálková, J. (2020). LAB of inclusive urbanism as a format to educate urban designers. *Research in Urbanism Series*, 6, 151–170.
- Mifsud, D. (2020). A critical review of Actor-Network Theory (Ant) and its use in education research. *Handbook of Research on Social and Organizational Dynamics in the Digital Era*, 135–156.
- Mullen, C. A. (2020). Practices of Cognitive Apprenticeship and Peer Mentorship in a Cross-Global STEM Lab. In B. J. Irby, J. N. Boswell, L. J. Searby, F. Kochan, R. Garza, & N. Abdelrahman (Eds.), *The Wiley International Handbook of Mentoring* (1st ed., pp. 243–260). Wiley. <https://doi.org/10.1002/9781119142973.ch15>
- Nasrullah, B., Fatima, G., & e Nayab, D. (2021). Strategies Used by Public Primary School Teachers for Enhancing Students’ Curiosity in Science. *Journal of Accounting and Finance in Emerging Economies*, 7(1), 93–101.
- O’Doherty, J. P., Cockburn, J., & Pauli, W. M. (2017). Learning, Reward, and Decision Making. *Annual Review of Psychology*, 68(1), 73–100. <https://doi.org/10.1146/annurev-psych-010416-044216>
- Patil, A. M., & Kudte, S. S. (2017). Teaching learning with constructivist approach. *International Journal of Engineering Development and Research*, 5(4), 308–312.
- Pettersson, F. (2021). Understanding digitalization and educational change in school by means of activity theory and the levels of learning concept. *Education and Information Technologies*, 26(1), 187–204. <https://doi.org/10.1007/s10639-020-10239-8>
- Ramani, S., Könings, K. D., Ginsburg, S., & Van Der Vleuten, C. P. M. (2019). Twelve tips to promote a feedback culture with a growth mind-set: Swinging the feedback pendulum from recipes to relationships. *Medical Teacher*, 41(6), 625–631. <https://doi.org/10.1080/0142159X.2018.1432850>
- Ramberg, U., Edgren, G., & Wahlgren, M. (2021). Capturing progression of formal knowledge and employability skills by monitoring case discussions in class. *Teaching in Higher Education*, 26(2), 246–264. <https://doi.org/10.1080/13562517.2019.1657396>



- Rider, T. R. (2014). Reinterpreting architectural education: Exploring methods for incorporating sustainability themes. *ARCC Conference Repository*. <http://arcc-repository.org/index.php/repository/article/view/254>
- Robinson, S. (2022). How 4E cognition changes architectural design education. *Architecture, Structures and Construction*, 2(1), 17–22. <https://doi.org/10.1007/s44150-022-00028-x>
- Sfintes, A. I. (2022). Teaching architecture: Following key concepts with a social impact in design studio proposals. *AIP Conference Proceedings*, 2574(1). <https://pubs.aip.org/aip/acp/article-abstract/2574/1/040003/2829909>
- Shareef, S. S., & Farivarsadri, G. (2020). An innovative framework for teaching/learning technical courses in architectural education. *Sustainability*, 12(22), 9514.
- Shulla, K., Filho, W. L., Lardjane, S., Sommer, J. H., & Borgemeister, C. (2020). Sustainable development education in the context of the 2030 Agenda for sustainable development. *International Journal of Sustainable Development & World Ecology*, 27(5), 458–468. <https://doi.org/10.1080/13504509.2020.1721378>
- Skilton-Sylvester, E., & Erwin, E. K. (2000). Creating reciprocal learning relationships across socially-constructed borders. *Michigan Journal of Community Service Learning*, 7(1). <https://quod.lib.umich.edu/m/mjcs/3239521.0007.108?rgn=main;view=fulltext>
- Smith, N. M., Hoal, K. E. O., & Thompson, J. F. (2020). Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all. In *Mining, materials, and the sustainable development goals (SDGs)* (pp. 29–38). CRC Press. <https://www.taylorfrancis.com/chapters/edit/10.1201/9780367814960-4/ensure-inclusive-equitable-quality-education-promote-lifelong-learning-opportunities-nicole-smith-karin-olson-hoal-john-thompson>
- Sousa, D. A. (2016). *How the brain learns*. Corwin Press. [https://books.google.com/books?hl=en&lr=&id=wx9uDQAAQBAJ&oi=fnd&pg=PP1&dq=Sousa,+D.+A.+\(2017\).+How+the+Brain+Learns+\(5th+ed.\).+New+Delhi:+Corwin:+Sage&ots=yGFGoEmyHM&sig=7E-0Lj8uJDwF2T-2M3fpHwuGwuY](https://books.google.com/books?hl=en&lr=&id=wx9uDQAAQBAJ&oi=fnd&pg=PP1&dq=Sousa,+D.+A.+(2017).+How+the+Brain+Learns+(5th+ed.).+New+Delhi:+Corwin:+Sage&ots=yGFGoEmyHM&sig=7E-0Lj8uJDwF2T-2M3fpHwuGwuY)
- Sukkar, A., Yahia, M. W., Mushtaha, E., Maksoud, A., Buhashima Abdalla, S., Nasif, O., & Melahifci, O. (2024). Applying active learning method to improve teaching outcomes in architectural engineering courses. *Open House International*, 49(1), 205–220. <https://doi.org/10.1108/OHI-10-2022-0259>
- Sulak, T. N., Renbarger, R., Wilson, R. D., & Odajima, R. J. (2017). The Seven Principles of Learner-Centered Professional Education Programs. In *Reforming Teaching and Teacher Education* (pp. 35–63). Brill. <https://brill.com/downloadpdf/book/edcoll/9789463009171/BP000003.pdf>
- Tapingkae, P., Panjaburee, P., Hwang, G.-J., & Srisawasdi, N. (2020). Effects of a formative assessment-based contextual gaming approach on students' digital citizenship behaviours, learning motivations, and perceptions. *Computers & Education*, 159, 103998.

- Tedre, M., & Pajunen, J. (2022). Grand Theories or Design Guidelines? Perspectives on the Role of Theory in Computing Education Research. *ACM Transactions on Computing Education*, 23(1), 4:1-4:20.  
<https://doi.org/10.1145/3487049>
- Vahabi, S. H., & Hojjat, I. (2022). Assessing the possibility of using constructive educational implications in teaching basic architectural design courses. *Journal of Fine Arts: Architecture & Urban Planning*, 27(1), 35–50.
- Vrouwe, I., & Kristek, J. (2022). The construction studio: An integrated pedagogical approach to architecture education. In *Structures and Architecture A Viable Urban Perspective?* (pp. 186–193). CRC Press.  
<https://www.taylorfrancis.com/chapters/edit/10.1201/9781003023555-23/construction-studio-integrated-pedagogical-approach-architecture-education-vrouwe-kristek>
- Vygotsky, L. S., Cole, M., John-Steiner, V., Scribner, S., & Souberman, E. (1978). *The development of higher psychological processes*. Cambridge, MA: Harvard University Press.
- Wende, W., Nijhuis, S., Mensing-de Jong, A., & Humann, M. (2020). *Inclusive Urbanism: Advances in research, education and practice*. TU Delft OPEN Publishing.  
<https://research.tudelft.nl/en/publications/inclusive-urbanism-advances-in-research-education-and-practice>
- Yew, E. H., & Goh, K. (2016). Problem-based learning: An overview of its process and impact on learning. *Health Professions Education*, 2(2), 75–79.