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Awareness as a Behavioural Intention Predictor: Why Observability Dominates CAAD Acceptance in Nigerian Architecture Schools

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Abstract

Despite widespread scholarly consensus that perceived usefulness and ease of use are the primary antecedents of technology acceptance, this study demonstrates that in low-exposure educational environments, specifically Nigerian architecture schools, awareness of Computer-Aided Architectural Design (CAAD) supersedes all canonical Unified Theory of Acceptance and Use of Technology (UTAUT) constructs as a predictor of behavioural intention. Drawing on secondary statistical analysis, cross-tabulation re-analysis, and theoretical synthesis grounded in Rogers' (1995) Innovation Diffusion Theory (IDT), this paper argues that the observability construct operationalised here as awareness accounts for 54.2% of the variance in CAAD acceptance (R^2=0.542, β = 0.674, p = 0.044), dwarfing the contributions of performance expectancy, effort expectancy, social influence, and facilitating conditions. Chi-square analyses confirm strong dependencies between awareness and actual CAAD use (λ^2=378.74), curriculum inclusion (λ^2=28.01), AutoCAD familiarity (λ^2=16.50), and Revit familiarity (λ^2=7.80). Critically, 85% of students with awareness actively use CAAD, underscoring the near-deterministic relationship between exposure and adoption. These findings challenge the foundational assumptions of TAM and UTAUT in low-resource, low-exposure contexts and advance a reconceptualised adoption pathway in which observability must be established before utility perceptions can meaningfully function as adoption drivers. Theoretical contributions, pedagogical implications, and a proposed Awareness-First Adoption Model (AFAM) for analogous educational contexts are presented.

1. INTRODUCTION

The global architectural profession has undergone a profound digital transformation over the past three decades. Computer-Aided Architectural Design (CAAD) tools, from AutoCAD's early introduction in 1982 to the contemporary dominance of parametric platforms such as Autodesk Revit and Rhinoceros 3D, now constitute the baseline technological literacy expected of practising architects worldwide. Architectural licensing bodies, professional institutions, and global employers uniformly regard CAAD proficiency not as a supplementary competency but as a prerequisite for professional practice.

However, this global convergence conceals significant continental and regional disparities. In Sub-Saharan Africa generally, and Nigeria specifically, the penetration of CAAD into formal architectural education has remained inconsistent, fragmented, and largely peripheral to mainstream pedagogy (Bello, 2019; Adeyemi & Falaiye, 2021). While flagship universities in Lagos, Abuja, and Zaria have made appreciable strides in equipping studios with digital infrastructure, the majority of Nigerian schools of architecture continue to deliver design education predominantly through conventional, analogue methods, such as hand-drafting, physical model-making, and paper-based design iteration (Ogunmola, 2020).

Against this backdrop, this paper interrogates a theoretically anomalous but empirically robust finding from a doctoral investigation into CAAD adoption patterns across Nigerian architecture schools: that student awareness of CAAD, not perceived usefulness (performance expectancy) nor ease of use (effort

expectancy), is the singular dominant predictor of behavioural intention to adopt CAAD, explaining 54.2% of the variance in adoption intention (R^2=0.542). This finding directly challenges the theoretical primacy assigned to performance expectancy in both the Technology Acceptance Model (Davis, 1989) and the Unified Theory of Acceptance and Use of Technology (Venkatesh et al., 2003).

The theoretical resolution offered by this paper is grounded in Rogers' (1995) Innovation Diffusion Theory (IDT), specifically the observability construct, which posits that potential adopters must first observe the results and applications of an innovation before they can meaningfully evaluate it. This paper argues that, in low-exposure, resource-constrained educational contexts, observability, operationalised as awareness, constitutes a foundational prerequisite that must be established before utility-based adoption drivers can be meaningfully activated.

The remainder of this paper is structured as follows. Section 2 reviews the existing literature on CAAD adoption and relevant technology acceptance frameworks. Section 3 articulates the theoretical framework. Section 4 describes the methodology. Section 5 presents the statistical results. Section 6 discusses the findings and their implications. Section 7 proposes a contextualised Awareness-First Adoption Model (AFAM). Section 8 concludes the paper.

2. LITERATURE REVIEW

2.1 CAAD Adoption in Architectural Education

The literature on CAAD integration in architectural education is well-developed in the Global North but considerably thinner in African educational contexts. Yıldız and Güney (2017) document sustained integration of Building Information Modelling (BIM) and parametric design across European and American architecture programmes, noting that CAAD fluency is treated as a prerequisite competency by the National Architectural Accrediting Board (NAAB) in the United States and the Architects Registration Board (ARB) in the United Kingdom.

By contrast, studies addressing Sub-Saharan African contexts reveal substantial infrastructural, curricular, and attitudinal barriers to adoption (Adeyemi, 2018; Oluwole & Afolabi, 2022). Bello (2019) identifies erratic power supply, insufficient hardware procurement budgets, and the absence of CAAD-trained faculty as the principal structural barriers in Nigerian architecture schools. Ogunmola (2020) further notes that the National Universities Commission (NUC) minimum standards for architecture in Nigeria, while referencing digital tools, do not mandate demonstrable CAAD competency at graduation, an institutional gap that reduces the perceived urgency of adoption for both students and faculty.

Critically, however, neither Bello (2019) nor Ogunmola (2020) systematically investigated awareness as a distinct, measurable adoption variable, treating it instead as a subcomponent of institutional readiness. This study addresses that gap by isolating and formally testing awareness as a standalone predictor within the UTAUT framework.

2.2 The Technology Acceptance Model (TAM)

Davis' (1989) Technology Acceptance Model remains the most cited theoretical framework in technology adoption research, having generated over 10,000 empirical applications across five decades (King & He, 2006; Legris et al., 2003). TAM posits that perceived usefulness (PU), the degree to which a user believes technology will enhance performance, and perceived ease of use (PEOU), the degree to which using the technology is believed to be free of effort, are the two primary determinants of behavioural intention to use a technology.

TAM's parsimony is both its strength and its limitation. Critics have long noted that TAM's predictive power is contingent on users having sufficient prior exposure to the technology to form meaningful perceptions of its utility and usability (Bagozzi, 2007; Chuttur, 2009). In contexts where users have limited or no prior exposure, precisely the condition characteristic of CAAD in many Nigerian architecture schools, the model's foundational assumption that potential adopters can meaningfully evaluate a technology's usefulness becomes empirically untenable.

2.3 The Unified Theory of Acceptance and Use of Technology (UTAUT)

Venkatesh et al. (2003) synthesised eight competing technology acceptance models, including TAM, TAM2, the Theory of Planned Behaviour, and the Model of PC Utilisation, into the Unified Theory of Acceptance and Use of Technology. UTAUT identifies four core determinants of behavioural intention and use behaviour: Performance Expectancy (PE), Effort Expectancy (EE), Social Influence (SI), and Facilitating Conditions (FC). The model also incorporates four moderating variables: gender, age, experience, and voluntariness of use.

UTAUT's development achieved an impressive R^2 of 0.70 in its original validation sample (Venkatesh et al., 2003), substantially outperforming individual predecessor models. Subsequent applications in educational technology contexts have confirmed PE as the dominant predictor of behavioural intention across diverse settings (Teo, 2011; Al-Mamary et al., 2016). However, these validations have predominantly been conducted in developed-country contexts characterised by relatively high baseline technology exposure. Applications of UTAUT in low-infrastructure contexts have yielded more variable results, with several studies noting anomalous predictor hierarchies that the model's original formulation cannot readily explain (Osei-Frimpong & McLean, 2017).

2.4 Rogers' Innovation Diffusion Theory and Observability

Rogers' (1995) Innovation Diffusion Theory (IDT) offers an alternative conceptual lens that has proven generative in technology adoption contexts characterised by limited prior exposure. IDT identifies five innovation attributes that influence adoption rate: relative advantage, compatibility, complexity, trialability, and, critically for this paper, observability. Observability refers to the degree to which the results of adopting an innovation are visible and communicable to others.

IDT's observability construct addresses a stage in the adoption process that TAM and UTAUT largely bypass: the pre-evaluation stage, during which potential adopters first encounter an innovation and form initial impressions. Rogers argues that before relative advantage (analogous to PE) can operate as an adoption driver, potential adopters must observe the innovation in use and discern its outputs. Without observability, evaluation of relative advantage is not merely difficult, it is impossible.

This theoretical positioning resonates powerfully with the Nigerian CAAD context. Students who have never observed CAAD software in use, who have never seen a design produced, rendered, or documented using digital tools, are structurally unable to form meaningful perceptions of its usefulness or usability. In such contexts, awareness (operationalised as having observed CAAD in use) logically precedes and enables the formation of the utility perceptions on which TAM and UTAUT depend.

3. THEORETICAL FRAMEWORK

3.1 Reconceptualising the Adoption Sequence in Low-Exposure Contexts

Standard TAM and UTAUT deployments implicitly assume a pre-existing level of technology familiarity sufficient to support utility evaluation. This assumption is rarely stated explicitly in technology acceptance literature because it is rarely violated in the developed-country contexts that dominate the research base. However, when the assumption is violated, as it demonstrably is in Nigerian architecture schools, the predictive hierarchy of UTAUT breaks down.

This paper proposes that the adoption sequence in low-exposure educational contexts proceeds through three logically necessary stages:

- Stage 1 - Observational Awareness: The potential adopter first becomes aware of the technology through direct or mediated observation of its use by others. This stage activates the IDT observability construct. Without the completion of Stage 1, Stages 2 and 3 cannot proceed meaningfully.

- Stage 2 - Utility Evaluation: Having observed the technology, the adopter can form perceptions of its relative advantage (Rogers) / performance expectancy (UTAUT). This is the stage at which TAM/UTAUT constructs become operative.

- Stage 3 - Adoption Decision: Drawing on utility evaluation and contextual facilitating conditions, the adopter forms a behavioural intention and proceeds (or not) to use.

This sequential model explains why, in the Nigerian CAAD context, awareness dominates all other predictors in regression analysis: because the majority of the study population has not yet completed Stage 1, awareness variance effectively determines the boundary conditions within which Stages 2 and 3 can operate.

3.2 Operationalisation of Awareness

For the purposes of this study, awareness is operationalised as Rogers' (1995) observability, namely, whether a student has been exposed to CAAD in practice, in studio, or in educational settings, to the point of observing its outputs and applications. This operationalisation is distinct from mere nominal awareness (knowing that CAAD exists) and is more precisely defined as observational familiarity: the student has seen CAAD produce architectural drawings, models, or visualisations.

This operationalisation renders awareness a binary-adjacent construct (present vs absent) that can be meaningfully tested against behavioural outcomes through chi-square analysis and included in regression models as a predictor of behavioural intention, as was done in the doctoral study from which this paper is drawn.

4. METHODOLOGY

4.1 Research Design

This paper adopts a theoretical synthesis methodology, drawing on secondary statistical analysis and cross-tabulation re-analysis of data collected in the parent doctoral study. The doctoral investigation surveyed students across a representative sample of Nigerian architecture schools using a structured questionnaire instrument grounded in the UTAUT framework, supplemented with items operationalising Rogers' (1995) observability construct as awareness.

4.2 Data Collection and Sample

The primary data underpinning this analysis were collected through a structured survey administered to undergraduate and postgraduate architecture students at accredited Nigerian schools of architecture. The survey operationalised all four UTAUT constructs (Performance Expectancy, Effort Expectancy, Social Influence, and Facilitating Conditions) using items adapted from prior UTAUT applications in educational technology contexts (Teo, 2011). An additional five-item scale operationalised awareness/observability, drawing on items adapted from Moore and Benbasat (1991) and Rogers (1995).

4.3 Analytical Approach

The primary analysis in this paper employs multiple linear regression, with behavioural intention to adopt CAAD as the dependent variable and all five UTAUT constructs, including the awareness constructs, as independent predictors. Hierarchical entry was used, with awareness entered first to establish its incremental contribution. Chi-square tests of independence were additionally conducted to explore the association between awareness and key adoption-related outcomes: actual CAAD use, curriculum inclusion, and familiarity with specific CAAD platforms (AutoCAD and Revit). All analyses were conducted at the 95% confidence level ($\alpha = 0.05$).

5. RESULTS

5.1 Regression Analysis: Predictors of Behavioural Intention

Table 1 presents the results of the multiple regression analysis examining predictors of behavioural intention to adopt CAAD. The model was statistically significant overall ($F(5, n)=p<0.01$), explaining 54.2% of the variance in behavioural intention ($R^2=0.542$, Adjusted $R^2=0.521$).

Predictor	Beta (β)	Std. Error	t-value	p-value
Awareness (Observability)	0.674	0.319	2.112	0.044*
Performance Expectancy	0.201	0.287	0.700	0.491
Effort Expectancy	0.142	0.304	0.467	0.644
Social Influence	0.118	0.271	0.435	0.666
Facilitating Conditions	0.089	0.251	0.355	0.725

*Table 1: Regression Analysis — Predictors of CAAD Adoption Behavioural Intention ($R^2=0.542$, *p<0.05)*

The results reveal a striking and theoretically anomalous predictor hierarchy. Awareness emerged as the only statistically significant predictor of behavioural intention at the conventional 0.05 threshold (β = 0.674, p = 0.044). All four canonical UTAUT constructs, Performance Expectancy, Effort Expectancy, Social Influence, and Facilitating Conditions, failed to reach statistical significance, with p-values ranging from 0.491 to 0.725.

The standardised beta coefficient for Awareness (β=0.674) is more than three times the magnitude of the next-largest coefficient (Performance Expectancy, β=0.201), indicating that awareness exerts a dominant and disproportionate influence on adoption intention relative to all other predictors. This finding directly contradicts the expected predictor hierarchy under both TAM (PU > PEOU) and UTAUT (PE dominant).

5.2 Chi-Square Analysis: Awareness Dependencies

To further investigate the structural relationship between awareness and adoption-related outcomes, four chi-square tests of independence were conducted. Table 2 presents the results.

Cross-tabulation (Awareness vs.)	Chi-square (λ^2)	Interpretation
Actual CAAD Use	378.74	Very strong dependency
Curriculum Inclusion	28.01	Significant dependency
AutoCAD Familiarity	16.50	Moderate dependency
Revit Familiarity	7.80	Moderate dependency

Table 2: Chi-Square Analysis — Awareness vs CAAD-Related Outcome Variables

The most striking finding from the chi-square analyses is the extraordinarily strong dependency between awareness and actual CAAD use ($\lambda^2 = 378.74$). This value, which is exceptionally large for a social science chi-square test, signals a near-deterministic relationship: awareness and actual CAAD use are profoundly non-independent, consistent with the interpretation that awareness is a necessary, near-sufficient precondition for actual use in this population.

The dependency between awareness and curriculum inclusion ($\lambda^2=28.01$) indicates that students enrolled in programmes with stronger CAAD curriculum presence are significantly more likely to have developed awareness, an expected finding that validates the operationalisation of awareness as institutionally mediated observational exposure.

Moderate dependencies with AutoCAD familiarity ($\lambda^2=16.50$) and Revit familiarity ($\lambda^2=7.80$) indicate that platform-specific exposure is significantly associated with awareness, though the weaker Revit association plausibly reflects the comparatively lower penetration of parametric BIM tools relative to the more established AutoCAD in Nigerian architectural education.

5.3 Descriptive Finding: The 85% Adoption Threshold

A notable descriptive finding from the cross-tabulation analysis is that 85% of students who are aware of CAAD (in the observational familiarity sense operationalised in this study) report active CAAD use. This figure, substantially above the population-level adoption rate, provides strong descriptive confirmation of the near-deterministic relationship between awareness and adoption suggested by the chi-square results and the regression coefficients.

6. DISCUSSION

6.1 Theoretical Implications: The Failure of TAM/UTAUT in Low-Exposure Contexts

The finding that awareness accounts for 54.2% of adoption variance, far exceeding the combined contribution of all four UTAUT constructs, is theoretically significant because it does not represent a failure of UTAUT per se but rather exposes its foundational assumption. UTAUT's performance in the original validation sample ($R^2=0.70$) was achieved in organisational and educational settings where potential users had, at a minimum, observed the target technology in use. The theory's constructs assume that perception formation is possible because exposure has already occurred.

In the Nigerian architecture school context, this assumption is structurally violated for a substantial proportion of students. Where students have never observed CAAD being used to produce architecture, never seen a classmate, lecturer, or practitioner operate CAAD software, the formation of meaningful performance expectancy is not inhibited; it is impossible. One cannot meaningfully evaluate the usefulness of an unobserved phenomenon. In such cases, the awareness construct, by capturing

whether or not the precondition for evaluation has been met, necessarily dominates all downstream evaluation-based predictors.

This finding is consistent with Bagozzi's (2007) critique of TAM's assumption of sufficient cognitive elaboration capacity, which requires prior exposure to the technology for evaluation to occur. It is also consistent with Chuttur's (2009) observation that TAM's predictive power diminishes substantially in contexts where prior experience with the technology is limited or absent.

6.2 The Rogers Connection: Observability as a Gateway Construct

Rogers' (1995) conceptualisation of observability as a distinct innovation attribute has received comparatively limited empirical attention in technology acceptance research, which has tended to focus on relative advantage (analogous to PE), complexity (analogous to EE), and compatibility (analogous to subjective norm/SI). This relative neglect of observability in post-TAM adoption research may reflect the fact that, in most studied adoption contexts, observability is effectively guaranteed by the existing technology ecosystem, smartphones, social media platforms, and widely deployed enterprise systems are highly observable by definition.

CAAD in Nigerian architecture schools represents a distinctive context in which observability cannot be assumed and must be established. This makes the Nigerian CAAD adoption landscape theoretically valuable as a natural experiment: it provides conditions under which the observability evaluation pathway can be empirically identified and measured, precisely because observability varies across the study population rather than being a near-universal constant (as it would be in, say, a study of smartphone adoption in an urban Western context).

6.3 Pedagogical Implications

The practical implications of these findings are direct and actionable. If awareness, specifically, the observational familiarity that enables utility perception, is the primary gateway to CAAD adoption in Nigerian architecture schools, then intervention strategies focused on utility communication (extolling CAAD's benefits, demonstrating productivity gains, emphasising professional relevance) are likely to be substantially less effective than strategies that directly increase observational exposure.

Practical interventions consistent with these findings would include the mandatory integration of CAAD demonstrations into first-year architecture curricula (even before formal software instruction); studio-based mentoring programmes in which senior students demonstrably use CAAD in the presence of junior students; CAAD showcase events and exhibitions that increase observational opportunities; and the deliberate embedding of CAAD workflows into design studio briefs at early stages, ensuring that students cannot proceed through the studio without observing their peers using digital design tools.

Notably, these strategies do not require expensive hardware infrastructure. Observational exposure, the precondition for awareness, can be achieved through demonstrations, projections, portfolio

presentations, and peer-to-peer studio learning, even in resource-constrained environments. This makes the awareness-first intervention pathway uniquely appropriate for institutions facing the infrastructural limitations that characterise much of Nigerian architectural education.

7. THE AWARENESS-FIRST ADOPTION MODEL (AFAM)

Based on the theoretical synthesis and empirical findings presented in this paper, we propose the Awareness-First Adoption Model (AFAM) as a contextualised framework for understanding technology adoption in low-exposure educational environments. AFAM revises the standard UTAUT adoption pathway by introducing a mandatory observational awareness stage that precedes and enables the utility evaluation stage.

AFAM makes three core propositions:

- Proposition 1 (Primacy of Awareness): In low-exposure educational contexts, observational awareness of CAAD constitutes the dominant predictor of behavioural intention to adopt, accounting for a disproportionate share of adoption variance relative to UTAUT constructs.

- Proposition 2 (Enabling Function): Observational awareness operates as an enabling construct, a necessary precondition for the formation of meaningful performance expectancy. In the absence of awareness, PE cannot form and therefore cannot function as an adoption driver.

- Proposition 3 (Contextual Boundary): The primacy of awareness as an adoption predictor is a contextually bounded phenomenon. As institutional exposure increases and the majority of the population attains observational awareness, the predictor hierarchy reverts to standard UTAUT expectations, with PE regaining primacy. AFAM therefore predicts that awareness will become less important as CAAD curriculum integration matures.

AFAM is presented not as a replacement for UTAUT in all adoption contexts, but as a contextual extension of UTAUT appropriate for low-exposure settings, including, but not limited to, CAAD in developing-country architectural education, digital health technologies in rural healthcare settings, and e-government platforms in low-digital-literacy populations. Future empirical work should test AFAM's three propositions across these analogous contexts.

8. CONCLUSION

This paper has presented and theoretically grounded a counterintuitive finding from a doctoral investigation of CAAD adoption in Nigerian architecture schools: that awareness of CAAD, operationalised as observational familiarity consistent with Rogers' (1995) IDT observability construct, accounts for 54.2% of variance in adoption behavioural intention (R^2=0.542, $\beta = 0.674$, $p = 0.044$), substantially dominating all four canonical UTAUT constructs.

The theoretical resolution offered draws on the sequential logic of Rogers' adoption pathway: before potential adopters can evaluate a technology's utility, they must observe it. In the Nigerian CAAD context, where a substantial proportion of students have had no observational exposure to CAAD in use, awareness functions not merely as one predictor among many but as the gateway construct that determines whether utility evaluation is possible at all. In this reading, awareness does not compete with UTAUT constructs; it precedes them.

The empirical evidence is consistent with this interpretation. The extraordinarily large chi-square value linking awareness to actual CAAD use (λ^2=378.74) and the finding that 85% of awareness-holding students actively use CAAD together indicate a near-deterministic exposure-adoption relationship that utility-based models cannot readily accommodate.

The proposed Awareness-First Adoption Model (AFAM) offers a theoretically grounded and practically actionable framework for understanding technology adoption in low-exposure contexts. Its primary practical implication, that observational exposure interventions should precede and accompany utility-communication strategies in such contexts, is directly applicable to curriculum design, studio pedagogy, and institutional technology integration policy in Nigerian and comparable architectural education systems.

Future research should empirically validate AFAM through longitudinal study designs that track shifts in the predictor hierarchy as CAAD curriculum integration matures, and should extend AFAM testing to analogous low-exposure technology-adoption contexts beyond architectural education.

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