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Digital Literacy Stratification: Analyzing how Prior Technology Experience Moderates Intrinsic Motivation on Mobile Gaming

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Abstract. This study investigates how digital literacy moderates the relationships among intrinsic motivation, Technology Acceptance Model (TAM) perceptions, and mobile gaming adoption among African university students, addressing whether technology acceptance pathways operate uniformly across users with varying technological backgrounds. Combining TAM with Self-Determination Theory, the research conceptualized digital literacy as a fundamental moderator shaping how competency, relatedness, and autonomy influence perceived usefulness, perceived ease of use, behavioral intention, and actual usage. Using a quantitative cross-sectional design, data were collected from 310 Nigerian university students and analyzed through multi-group structural equation modeling. Participants were classified into high (34.8%), moderate (45.2%), and low (20.0%) digital literacy groups based on technology experience profiles across seven platforms. The findings reveal substantial literacy-contingent variation in adoption pathways. Competency effects on perceived ease of use were markedly stronger among low-literacy users, while autonomy significantly predicted perceived usefulness only among digitally experienced users. Perceived ease of use consistently dominated the formation of behavioral intention across all literacy levels. However, actual usage remained constrained by infrastructure and economic barriers, irrespective of user expertise. These findings challenge foundational assumptions within TAM and Self-Determination Theory about the universal applicability of

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adoption processes, demonstrating instead that motivational hierarchies are conditional on users' digital proficiency. Hence, the results foreground the need for literacy-sensitive theoretical models and adaptive technology designs that align competency scaffolding, autonomy features, and social integration with users' digital capacities and proficiency level. Policy interventions that address structural constraints are also necessary to translate adoption intentions into sustained usage within African higher education settings.

Keywords: digital literacy stratification; technology acceptance model; self-determination theory; mobile gaming adoption; multi-group analysis

1. Introduction

The rapid expansion of mobile gaming across African universities represents a significant dimension of the continent's broader digital transformation. Once regarded primarily as entertainment, mobile games have evolved into complex platforms that aid cognitive development, social interaction, and, to a very large extent, educational experiences (Oni et al., 2025). This growth occurs in an environment of rising smartphone penetration and projected increases in mobile internet usage across Sub-Saharan Africa. (Ndibalema, 2025). Despite this expansion, scholarly understanding of the factors that stir the adoption of mobile gaming among African university students remains limited. Much of the existing research applies technology acceptance frameworks developed in Western settings without adequately accounting for the digital literacy stratification that characterizes African student populations (Oni et al., 2025).

Digital literacy has become an important competency for navigating modern, technology-mediated educational environments. However, recent systematic reviews show substantial disparities in the technological competencies of students across African higher education institutions. Many students arrive at universities with minimal prior exposure to computers, the Internet, or digital productivity tools (Ndibalema, 2025). Ajani et al. (2025) examined how undergraduate students experienced Learning Management Systems at a rural South African university and discovered that students who lack digital proficiency struggled to engage meaningfully with online platforms, which limited their educational opportunities and outcomes. The study highlights digital literacy as a critical determinant of technology adoption, influenced by infrastructural, instructional, and socio-cultural factors.

These literacy gaps create heterogeneous user populations, where some students navigate digital environments with expert proficiency while others encounter significant barriers in their engagement with technology. Students from urban or economically advantaged backgrounds often have prior experience with smartphones, accessing the Internet, and using computers for schoolwork before gaining admission to the university, whereas students from rural areas or economically disadvantaged backgrounds may encounter digital technologies for the first time at the university (Chasubuta et al., 2024). This stratification creates cohorts with radically different starting points, thereby challenging the abilities of

universities to provide one-size-fits-all technology training or assume standard baselines of competency.

The Technology Acceptance Model, originally proposed by Davis (1989), has served as the dominant theoretical framework for understanding technology adoption in diverse settings. TAM posits that perceived usefulness and perceived ease of use are primary determinants of technology acceptance, which in turn influences behavioral intentions and actual usage. However, several scholars have argued that TAM alone cannot fully capture the behavioral complexities that influence the adoption of recreational technology, especially in settings where hedonic and social motivations play central roles (Oluwajana, et al 2019). Consequently, recent extensions of TAM have incorporated elements from Self-Determination Theory, which emphasizes intrinsic motivational factors such as competency, relatedness, and autonomy as fundamental psychological needs driving human behavior (Ryan & Deci, 2000; Oni et al, 2025). Still, few studies have examined how these motivational constructs interact with TAM perceptions differently among users with varying levels of digital literacy.

Mobile gaming serves as a compelling case for examining literacy-stratified technology acceptance because games sit at the intersection of entertainment, social interaction, and, to a large extent, education (Papadakis et al., 2018). Unlike utilitarian technologies adopted primarily for productivity, games are adopted for intrinsic enjoyment, social connection, and personal achievement (Shi et al., 2024). This hedonic orientation means that motivational factors such as competence (mastering game mechanics), relatedness (experiencing social connection through gaming), and control (autonomy over the gaming experience) may play prominent roles in determining adoption decisions (Moller et al., 2024). Research that includes Self-Determination Theory with TAM in educational settings has shown that intrinsic motivation significantly influences the intentions of users to adopt and utilize technologies, with competence, autonomy, and relatedness serving as key predictors of continued engagement (Rosli & Saleh, 2022). However, whether these motivational effects vary systematically by digital literacy level remains unexamined.

Furthermore, the African gaming environment operates under structural constraints that may weaken the link between adoption intentions and actual usage. Constraints such as high data costs, unstable network connectivity, limited device capabilities, and cultural perceptions of gaming as either a frivolous distraction or a legitimate leisure activity create external barriers that can disrupt the intention-behavior link central to TAM. Oni et al. (2025) report that while students expressed strong intentions to engage with mobile games, actual usage remained constrained by economic factors such as high data costs, infrastructure limitations, including unstable network connectivity, and cultural perceptions that sometimes frame gaming as an unproductive distraction from academic responsibilities. These structural impediments raise questions about the extent to which favorable perceptions of usefulness and ease of use translate into sustained engagement in resource-constrained contexts.

Against this backdrop, this study addresses these gaps by investigating how digital literacy levels moderate the relationships among intrinsic motivation, TAM perceptions, and mobile gaming adoption among African university students. Specifically, the study extends TAM by incorporating competency, relatedness, and control as intrinsic motivational antecedents, then examines whether the pathways from these motivational factors to perceived usefulness, perceived ease of use, behavioral intention, and actual usage differ systematically among high, moderate, and low digital literacy groups.

Also, this study contributes to ongoing efforts to contextualize technology acceptance theories for African populations, as much of the TAM literature relies on data from developed economies where digital infrastructure is ubiquitous and digital literacy is relatively uniform. Therefore, by examining TAM pathways within an environment characterized by heterogeneous digital competence and infrastructural constraints, this research tests the cross-cultural validity of the theory while identifying necessary adaptations for settings that are constrained in terms of resources.

Objectives of the Study

- To identify and validate distinct digital literacy groups among African university students based on their technology experience profiles and their demographic characteristics.
- To examine how intrinsic motivation factors differentially influence Technology Acceptance Model perceptions in digital literacy levels.
- To assess whether the relationships between TAM perceptions and behavioral outcomes vary systematically in high, moderate, and low digital literacy groups.
- To quantify the magnitude of digital literacy moderation effects through effect size analysis and mediation pathways, to provide evidence-based knowledge for adaptive mobile game design and targeted digital literacy interventions in African higher education.

1.1 Digital Literacy in African Higher Education: Contexts, Challenges, and Stratification

Digital literacy extends beyond technical competence with digital devices; it encompasses the knowledge, skills, attitudes, and behaviors required to engage effectively and critically with digital technologies for learning, communication, information access, problem-solving, and social participation (UNESCO, 2018). In African higher education settings, digital literacy is a key determinant of academic success, graduate employability, lifelong learning capacity, and social inclusion in increasingly digitized economies and societies (World Bank, 2020). However, digital literacy levels vary widely among African university students due to heterogeneous prior technology exposure determined by socioeconomic background, geographic location, school quality, household resources, gender, and cultural factors (Ndibalema, 2025).

Ndibalema's (2025) systematic review of digital literacy in Sub-Saharan African higher education combined findings from fourteen empirical studies published

between 2016 and 2023, thereby showing recurring challenges that constrain digital literacy development across the continent. Infrastructure limitations such as unreliable electricity supply, insufficient internet bandwidth, inadequate computer laboratory facilities, and limited device availability create major barriers to developing digital competencies through consistent practice and exploration (Ndibalema, 2025). Beyond infrastructure, inadequate faculty digital competencies limit effective inclusion of technology into teaching and learning, with many instructors possessing minimal training in instructional uses of digital technologies. Insufficient curricular integration of digital literacy means that universities often assume that incoming students possess foundational skills without providing systematic instruction; an assumption frequently contradicted by evidence of substantial skill gaps.

Digital inequality in African higher education manifests across multiple interrelated dimensions, which therefore creates complex forms of stratification. Geographic disparities systematically disadvantage rural students who majorly experience severely limited access to technology compared to their urban counterparts. In this line, Mavutha and Mabotja (2024) examined digital literacy among South African students from rural backgrounds and found that the transition to technology-intensive higher education environments posed substantial adaptation challenges. These students encountered substantial adaptation challenges in technology-intensive learning environments as a result of minimal prior exposure, necessitating remedial support before meaningful engagement could occur.

Socioeconomic status further stratifies the development of digital literacy. Ideally, students from affluent families possess personal devices (smartphones, tablets, laptops), stable internet access, and informal learning opportunities to develop digital skills prior to university enrollment. In contrast, economically disadvantaged students may share limited devices, rely on expensive mobile data, and lack private spaces for digital experiences (Kajee & Balfor, 2011). These disparities create cumulative advantage effects, wherein students entering university with strong digital foundations rapidly expand their competencies through technology-rich learning opportunities, while students entering with minimal digital experience struggle to catch up while simultaneously navigating demanding academic content (Pierce & Cleary, 2024).

Gender is another salient aspect of the digital divide in African higher education, as research across multiple African countries has shown persistent gender gaps in access to technology, digital skills, and confidence in using digital technologies (GSMA, 2023). These gaps indicate how interwoven factors including gendered patterns of household technology allocation that favor male children, cultural norms that position technology as a masculine domain, differential encouragement and support for technology usage, and stereotypes undermining the technology self-efficacy of women (Randle & Kayode, 2025). Therefore, while gender gaps in basic technology access have narrowed as smartphones have proliferated, there still exist gaps in advanced digital competencies and confident and autonomous technology use.

Infrastructure constraints are also a pervasive barrier to the development of digital literacy in African higher education, though there is substantial variation both between and within countries. Krönke's (2020) analysis of Afrobarometer data collected from 31 African countries showed that while mobile phone ownership has increased substantially, reliable internet connectivity and access to electricity remain inconsistent, especially in rural areas. Many university students experience intermittent connectivity that requires careful data management, limiting opportunities for technology exploration and skill development, while unstable power supply forces students to manage device charging carefully, thereby limiting opportunities for exploration, experimentation and advanced digital engagement, which reduces the range of digital activities accessible for learning (Baidoo-Anu et al., 2023).

Recent research has examined the interaction of digital literacy with specific academic practices and results. In this regard, Akakpo et al. (2025) investigated digital and information literacies among Ghanaian university students, and they discovered strong positive relationships between digital literacy competencies and effective information-seeking, evaluation, and ethical use behaviors. Students with higher digital literacy showed greater sophistication in using digital information environments, critically evaluating online sources, distinguishing credible from non-credible information, and appropriately citing digital materials. These findings imply that digital literacy serves as a foundational capability enabling advanced academic practices rather than merely a technical skill (Akakpo et al., 2025).

1.2 Digital Literacy as Moderator: Theoretical Rationale and Empirical Precedents

While extensive research has examined digital literacy as an outcome variable, considerably less attention has focused on its role as a moderating variable, which importantly alters how other factors influence technology adoption and usage. Moderation occurs when the strength, direction, or form of the relationship between an independent and dependent variable depends systematically on the level of a third variable (Baron & Kenny, 1986). In terms of technology adoption, digital literacy may moderate relationships between motivational factors (such as intrinsic motivation constructs) and technology acceptance constructs (such as perceived usefulness and ease of use), with motivational drivers exerting differential influences depending on users' prior technology experience and competencies (Kabakus et al., 2023).

The theoretical rationale for digital literacy moderation stems from the consideration of how prior technology experience affects users' cognitive frameworks, mental models, and schemas for evaluating new technologies. Users who possess extensive technology experience develop rich, elaborated mental models of how digital systems typically operate, including common interface conventions, patterns of control, interaction paradigms, and functional designs (Venkatesh et al., 2012). These mental models enable experienced users to efficiently transfer knowledge from familiar technologies to novel applications through analogical reasoning, pattern recognition, and schema application. Consequently, experienced users can form accurate perceptions of usefulness and

ease of use with minimal exposure (Akbulut et al, 2025). On the other hand, users with minimal prior technology experience lack these elaborated mental models and referent frameworks and require more extensive direct experience and explicit instruction before forming stable beliefs about usefulness and ease of use. Recent technologies may appear more complex, unpredictable, and potentially threatening to users who lack confident mastery of digital environments, as these users may require different forms of support, motivation, and scaffolding to adopt new technologies successfully, compared to their digitally literate counterparts. Understanding these differences among digital literacy strata becomes essential for designing inclusive technologies that do not privilege digitally advantaged users.

The concept of digital literacy moderation aligns with established research on individual differences in technology adoption. Venkatesh and Bala (2008) proposed TAM3, which is an advanced version that includes numerous individual difference variables as antecedents of perceived usefulness and ease of use. Their model included computer self-efficacy (beliefs about one's capabilities to perform technology-related tasks), computer anxiety (apprehension about using computers), and prior experience as factors that significantly predict technology acceptance. Computer self-efficacy research offers highly relevant precedents for understanding the moderation of digital literacy.

Compeau and Higgins (1995) developed measures of computer self-efficacy and showed that self-efficacy beliefs significantly predicted both adoption intentions and actual usage among diverse user populations. Importantly, subsequent research showed that self-efficacy moderates responses to system characteristics: high self-efficacy users perceive complex features as opportunities for skill demonstration, while low self-efficacy users perceive identical features as overwhelming barriers (Marakas et al., 1998). This moderation pattern suggests that users with different efficacy beliefs and by extension, different digital literacy levels may respond qualitatively differently to identical technology characteristics.

Similarly, studies of experience as a moderator show that experienced users rely more on direct attitudes, while inexperienced users depend more on social influence and facilitating conditions (Thompson et al., 2006; Venkatesh et al., 2003). However, much of this literature treats experience as a continuous variable, leaving adoption processes across distinct digital literacy strata underexplored.

1.3 Theoretical Underpinning

1.3.1 The Technology Acceptance Model

The Technology Acceptance Model (TAM), originally conceptualized by Davis (1989), is one of the most influential and extensively validated theoretical frameworks in information systems research. Grounded in the Theory of Reasoned Action (Fishbein & Ajzen, 1975) and the Theory of Planned Behavior (Ajzen, 1991), TAM proposes a parsimonious explanation of technology adoption behaviors by positing two core cognitive beliefs as the model posits that two fundamental cognitive beliefs – perceived usefulness (PU) and perceived ease of

use (PEOU) – as primary determinants of behavioral intention and actual system usage (Davis, 1989).

Davis (1989) operationally defined perceived usefulness as the extent to which an individual believes that using a system enhances performance, and perceived ease of use as the extent to which system use is free of effort. These definitions, which are rooted in expectancy-value theories of human behavior, indicate an instrumental perspective wherein technology adoption decisions emerge from rational cost-benefit calculations as it has to do with performance enhancement and effort expenditure. The elegant simplicity of TAM's core propositions, combined with its detailed predictive validity across diverse technological settings, has generated over three decades of empirical research, which establishes it as the dominant paradigm in technology acceptance studies.

Despite its strengths, TAM has also been subject to critical scrutiny for its limitations. Turner et al. (2010) conducted a systematic literature review examining whether TAM predicts actual usage, rather than behavioral intentions. Analyzing 79 empirical studies across 73 articles, they found that while behavioral intention correlates strongly with actual usage, the direct relationships between perceived usefulness, perceived ease of use, and actual usage were considerably weaker than commonly assumed. This finding suggests a potential "intention-behavior gap" wherein favorable attitudes and strong intentions do not automatically translate into sustained usage, particularly when external barriers intervene. Such findings underscore the importance of considering contextual facilitators and barriers that mediate the translation of psychological constructs into behavioral outcomes.

1.3.2 Self-Determination Theory

Self-Determination Theory (SDT), comprehensively articulated by Ryan and Deci (2000, 2017), represents a macro-theory of human motivation, personality development, and psychological wellness grounded in organismic-dialectical metatheoretical assumptions about human nature. SDT conceptualizes humans as inherently active and growth-oriented organisms that possess natural propensities toward psychological development, social integration, and behavioral self-regulation. Central to SDT is the distinction between intrinsic and extrinsic motivation: intrinsic motivation is defined as engaging in activities for inherent satisfaction and extrinsic motivation is driven by external rewards or pressures. (Ryan & Deci, 2000).

SDT posits that three fundamental psychological needs are essential for optimal motivation and functioning. They are competence, relatedness, and autonomy. Competence refers to feeling effective in one's interactions with the social environment and experiencing opportunities to exercise and express one's capacities (Ryan & Deci, 2000). Individuals seek to produce desired outcomes and prevent undesired ones, experiencing a sense of competence when they successfully handle challenges that stretch but do not overwhelm their capabilities. Relatedness involves feeling connected to others, caring for and being cared for by others, and experiencing a sense of belonging within social groups

and communities (Ryan & Deci, 2000). The relatedness need shows humans' fundamental social nature and the importance of secure, satisfying interpersonal relationships for psychological wellness. Autonomy involves experiencing volition and psychological freedom in initiating and regulating one's own actions, feeling that behaviors originate from one's authentic self than from external pressures, controls, or contingencies (Ryan & Deci, 2000).

These two theories, the Technology Acceptance Model (TAM) and Self-Determination Theory (SDT), offer complementary explanatory perspectives on technology adoption. TAM provides the structural pathway from perceptions to behavioral intentions and actual usage, while SDT supplies the motivational antecedents that determine these perceptions. In this study, digital literacy is positioned as a moderating variable that conditions how SDT's motivational factors influence TAM's perceptual constructs, thereby creating expertise-dependent adoption pathways.

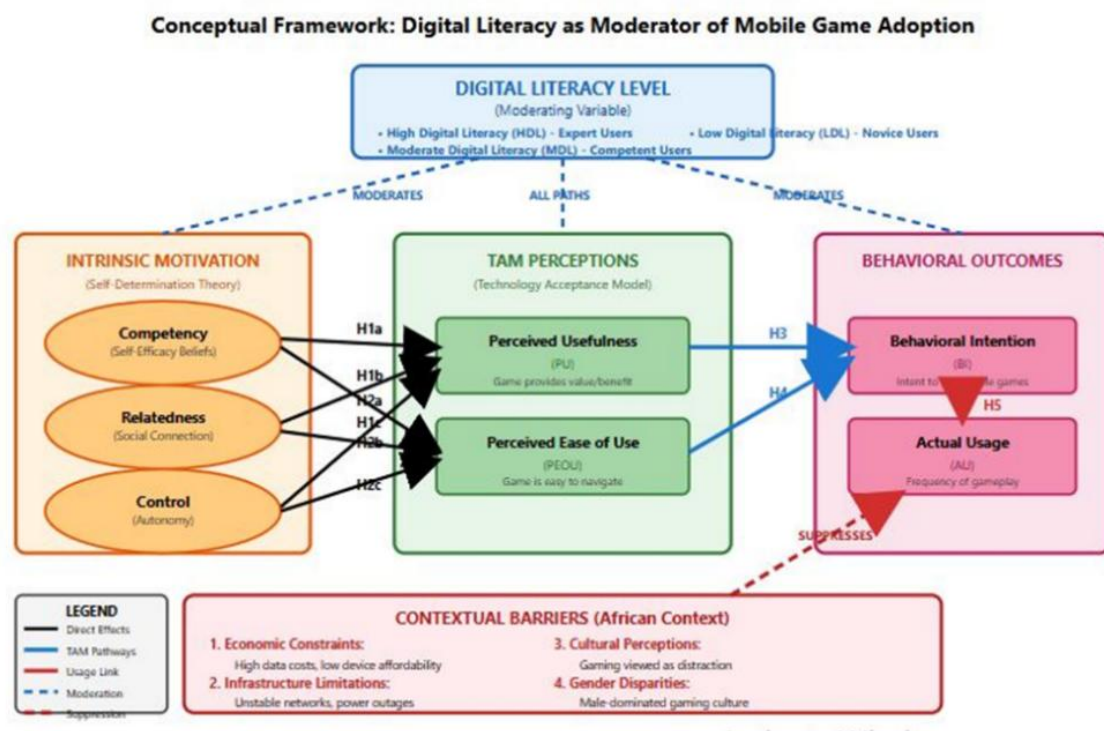


Figure 1: Conceptual Framework Diagram

2. Hypotheses Development

Building on the integrated Technology Acceptance Model and Self-Determination Theory framework, with digital literacy as the central moderating variable, this study formulated specific hypotheses to test relationships among intrinsic motivation factors, TAM perceptions, and mobile gaming adoption results in literacy strata.

2.1 Intrinsic Motivation → Perceived Usefulness Hypotheses

H1a: Competency positively influences perceived usefulness of mobile games, with a significant variation of the strength of this relationship in digital literacy levels (high, moderate, and low).

H1b: Relatedness positively influences perceived usefulness of mobile games, with the strength of this relationship varying significantly in digital literacy levels.

H1c: Control (autonomy) positively influences perceived usefulness of mobile games, with the strength of this relationship varying significantly among digital literacy levels.

2.2 Intrinsic Motivation → Perceived Ease of Use Hypotheses

H2a: Competency positively influences perceived ease of use of mobile games, with the strength of this relationship varying significantly in digital literacy levels.

H2b: Relatedness positively influences perceived ease of use of mobile games, with the strength of this relationship varying in digital literacy levels.

H2c: Control (autonomy) positively influences perceived ease of use of mobile games, with the strength of this relationship varying significantly in digital literacy levels.

2.3 TAM Perceptions → Behavioral Intention Hypotheses

H3: Perceived usefulness positively influences behavioral intention to use mobile games, with potential variation in relationship strength in digital literacy levels.

H4: Perceived ease of use positively influences behavioral intention to use mobile games, with potential variation in relationship strength in digital literacy levels.

H5: Behavioral intention positively influences actual usage of mobile games.

However, this relationship will be significantly suppressed by contextual barriers which include economic constraints (data costs, device affordability), infrastructural limitations (network instability, connectivity issues), and cultural factors (gaming stigmatization, academic pressure) that operate uniformly in digital literacy levels as literacy-blind suppressors.

3. Methodology

3.1 Research Design

This study employed a quantitative research design to investigate how digital literacy levels moderate the relationships among intrinsic motivation factors, Technology Acceptance Model perceptions, and mobile gaming adoption among African university students. The quantitative approach was selected because it enables the systematic measurement of constructs, statistical testing of hypothesized relationships, and generalization of findings to broader populations (Hair et al., 2019). The research utilized a cross-sectional survey design, collecting data at a single point in time from a sample of university students.

3.2 Research Design

The target population consisted of undergraduate students enrolled in computer science and management information systems programs at the selected Nigerian university. This population was chosen because these students regularly encounter technology adoption decisions in both academic and personal contexts,

making them appropriate participants for research on digital technology acceptance. Additionally, their enrollment in technology-related programs suggests baseline interest in digital systems, though not necessarily advanced digital literacy, allowing examination of adoption processes among motivated but variably skilled users.

A multi-stage sampling technique was employed to select participants systematically while ensuring representation across academic levels and programs. In the first stage, stratified sampling grouped the university's schools into faculties by academic discipline. In the second stage, simple random sampling selected two departments from each faculty, ensuring that both computer science and management information systems programs were included. In the final stage, purposive sampling recruited participants who met specific inclusion criteria designed to ensure relevance to the research objectives and comparability of gaming experiences.

3.3 Sample Size Determination

The minimum required sample size was calculated using Cochran's (1977) formula for large populations, which yielded a minimum sample size of 384 respondents. To account for potential non-response and incomplete questionnaires, the target was set at 400 respondents. However, the introduction of a mandatory game-familiarization requirement (described below) reduced the final sample to 350 participants, of whom 310 provided complete, valid responses, resulting in an 86% valid response rate. This sample size exceeds the minimum requirements for structural equation modeling, which typically recommends at least 200 observations for complex models (Hair et al., 2019) and provides adequate statistical power for multi-group analyses with groups ranging from 62 to 140 participants.

Participants were included if they: (1) were currently enrolled as undergraduate students at the selected university; (2) were aged 16 years or older to avoid parental consent requirements; (3) owned or had regular access to smartphones, tablets, or laptops capable of running mobile games; (4) were willing to engage with a designated mobile game as part of the study; and (5) had some prior exposure to mobile gaming within the three months preceding the study to ensure basic familiarity with digital gaming environments.

Students were excluded if they: (1) had no prior experience with any form of mobile gaming, as complete novices would lack reference points for evaluating gaming platforms; (2) had visual or motor impairments that would significantly impair gameplay; or (3) were unwilling or unable to participate in the game familiarization exercise. These criteria ensured that participants could meaningfully evaluate mobile games based on direct experience while varying sufficiently in digital literacy to enable stratification analyses.

3.4 Instrumentation

3.4.1 Mobile game selection and familiarization

To ensure consistency in participants' reference points when evaluating perceptions of mobile gaming, all participants were introduced to a common mobile game: Awale, a traditional African strategy board game adapted for mobile devices. Awale was selected because it: (1) reflects African cultural heritage, enhancing relevance for the study population (Randle, 2024); (2) has relatively simple rules accessible to novice players while offering strategic depth for experienced gamers; (3) runs efficiently on low-end devices, ensuring accessibility across the sample; (4) requires minimal data connectivity, addressing infrastructure constraints; and (5) includes both single-player and social modes, enabling assessment of relatedness factors.

Before completing the survey, participants attended a structured familiarization session during which research assistants showed Awale's interface, explained the gameplay rules, and allowed students to play several practice rounds. This familiarization process typically took 15-20 minutes and ensured that all participants had direct, comparable experiences with the game when subsequently evaluating constructs such as perceived ease of use, competency, and behavioral intention. This methodological decision addresses a common limitation in technology acceptance research where participants evaluate systems with highly variable prior exposure, introducing confounding variation (Venkatesh & Bala, 2008).

3.4.2 Questionnaire Development

The primary data collection instrument was a structured questionnaire comprising multiple sections designed to measure the study's key constructs. The questionnaire employed exclusively closed-ended items using five-point Likert scales (1 = Strongly Disagree, 5 = Strongly Agree) to ensure standardization and facilitate quantitative analysis. All measurement scales were adapted from previously validated instruments used in established technology acceptance and motivation research, with minor wording modifications to contextualize items for mobile gaming.

3.4.2.1 Demographic Section

Collected information on gender, age, academic program, year of study, and technology experience across seven platforms: mobile cell phones, tablet computers, Google Maps, shared economy apps (e.g., Uber), GPS navigation, SMS, email, and phone calls. For each technology, participants indicated their experience level as novice, competent, or expert. These technology experience items served dual purposes: characterizing the sample and enabling digital literacy segmentation.

Intrinsic Motivation – Competency: Three items adapted from Ryan and Deci's (2000) competency subscale measured students' perceptions of their capability and effectiveness when playing mobile games. Example item: "I feel confident in my ability to play mobile games successfully."

Intrinsic Motivation - Relatedness: Five items adapted from relatedness measurement scales assessed students' experiences of social connection through mobile gaming. Example item: "Mobile games help me feel connected to other players."

Intrinsic Motivation - Control/Autonomy: Five items measured students' perceptions of self-direction and choice in mobile gaming experiences. Example item: "I feel in control of my mobile gaming experiences."

Perceived Usefulness: Four items adapted from Davis's (1989) original TAM instrument assessed students' beliefs about the value and benefits of mobile games. Example item: "I find mobile games useful for relaxation and stress relief."

Perceived Ease of Use: Four items from Davis's (1989) TAM measured students' perceptions of mobile games' accessibility and learnability. Example item: "Learning to play mobile games is easy for me."

Behavioral Intention: Three items assessed students' intentions to use mobile games, adapted from Venkatesh and Bala (2008). Example item: "I intend to continue playing mobile games regularly." Note: One item (BI1) was subsequently removed during measurement model assessment due to inadequate factor loading.

Actual Usage: Two items measured students' self-reported frequency and duration of mobile gaming. Example item: "I frequently play mobile games." Note: One item (AU3) was removed during measurement model assessment, and AU2 had borderline factor loading (0.692) but was retained to avoid single indicator construct limitations.

3.5 Digital Literacy Scoring and Segmentation

Participants were classified into digital literacy groups based on composite scores derived from self-reported expertise across seven technology platforms (mobile phones, tablets, Google Maps, shared economy apps, GPS, SMS, email, and phone calls), with responses coded as novice=1, competent=2, expert=3. Groups were formed using tertile splits of total scores, yielding High (n=108, 34.8%), Moderate (n=140, 45.2%), and Low (n=62, 20.0%) digital literacy segments.

4. Data Analysis

Data analysis proceeded in multiple stages using SmartPLS 4.0 software, which implements partial least squares structural equation modeling (PLS-SEM), which is well-suited for complex models with multiple constructs, relatively modest sample sizes, and exploratory research settings (Hair et al., 2019). Initial screening examined response completeness, outliers, and normality. Questionnaires with more than 10% missing data were excluded, as were those exhibiting straight-lining (identical responses in all items). Outlier analysis using Mahalanobis distance identified no multivariate outliers that require removal. Normality tests showed some non-normal distributions typical of Likert-scale data, supporting the use of PLS-SEM, which does not assume multivariate normality (Sarstedt et al., 2019).

Data analysis was conducted using SmartPLS 4.0 for partial least squares structural equation modeling (PLS-SEM). Descriptive statistics, including means, standard deviations, and frequency distributions, were used to summarize the demographic characteristics and technology experience profiles of study participants both overall and by digital literacy groups. Partial least squares SEM was employed to examine the relationships among the study variables across high, moderate, and low digital literacy strata. The use of PLS-SEM was warranted because it allowed for the analysis of complex relationships among latent constructs, could test for mediation and moderation effects simultaneously, and did not require multivariate normality assumptions (Hair et al., 2019).

The assessment of the measurement model included tests for validity and reliability using confirmatory factor analysis, with indicator reliability evaluated through factor loadings, internal consistency assessed via Cronbach's alpha and composite reliability, convergent validity examined through average variance extracted, and discriminant validity confirmed using the Fornell-Larcker criterion. The structural model was evaluated using path coefficients generated through 5,000 bootstrap resamples and R-squared values to indicate the variance explained in the endogenous constructs. Using chi-square statistics, multi-group analysis was conducted to test differences between groups, while Cohen's f^2 effect sizes quantified the practical magnitude of relationships across digital literacy levels.

Common method bias was assessed using Harman's single-factor test. The first unrotated factor accounted for 38.7% of the total variance, which is below the 50% threshold, pointing to the fact that common method bias did not substantially threaten the validity of the findings.

For example: According to Fajrie et al. (2024),

“The ICF enhances our comprehension of how individuals with various disorders function and participate in activities, as well as how contextual factors can either facilitate or adversely affect their functioning” (p. 97).

For indented quotations, use the *Indented Quotes* style:

“Indented quotations must be opened and closed with double quotation marks. Quotes of more than 40 words must be indented. However, where shorter excerpts of participant narratives are presented, these may also be indented. Where a citation follows an indented quotation, this must not be italicised and must follow the punctuation and closing quotation mark.” (Smith, 2020, p. 5)

“There must be a space between subsequent indented quotations. Follow the APA guidelines strictly in terms of copyright for long quotations.” (Participant 5)

Do not end a section with an indented quotation. Always conclude with the relevant concluding sentence.

4. Results

Table 1: Demographic Characteristics of Respondents by Digital Literacy Groups

Characteristic	Total Sample (N=310)	High Digital Literacy (n=108, 34.8%)	Moderate Digital Literacy (n=140, 45.2%)	Low Digital Literacy (n=62, 20.0%)	χ^2/F	p-value
Gender					8.42	0.015*
Male	189 (61.0%)	74 (68.5%)	84 (60.0%)	31 (50.0%)		
Female	121 (39.0%)	34 (31.5%)	56 (40.0%)	31 (50.0%)		
Age Group					12.67	0.013*
17-18 years	98 (31.6%)	28 (25.9%)	45 (32.1%)	25 (40.3%)		
19-20 years	76 (24.5%)	24 (22.2%)	35 (25.0%)	17 (27.4%)		
21-25 years	136 (43.9%)	56 (51.9%)	60 (42.9%)	20 (32.3%)		
Program					6.89	0.032*
Computer Science	217 (70.0%)	82 (75.9%)	98 (70.0%)	37 (59.7%)		
MIS	93 (30.0%)	26 (24.1%)	42 (30.0%)	25 (40.3%)		
Year of Study					15.34	0.004**
First Year	102 (32.9%)	25 (23.1%)	48 (34.3%)	29 (46.8%)		
Third Year	122 (39.4%)	48 (44.4%)	54 (38.6%)	20 (32.3%)		
Fourth Year	86 (27.7%)	35 (32.4%)	38 (27.1%)	13 (21.0%)		

*Note: χ^2 = Chi-square test statistic; * $p < 0.05$, ** $p < 0.01$

The demographic analysis shows identifiable heterogeneity among digital literacy groups. Gender disparities are pronounced, with males constituting 68.5% of the High Digital Literacy (HDL) group compared to only 50.0% of the Low Digital Literacy (LDL) group ($\chi^2=8.42$, $p=0.015$). This 18.5 percentage-point gap shows regular digital divides that is based on gender in African higher education settings, which is in alignment with existing literature on technology access inequities (Owiti, 2016).

Table 2: Technology Experience Profile by Digital Literacy Groups

Technology Platform	High Digital Literacy (n=108)	Moderate Digital Literacy (n=140)	Low Digital Literacy (n=62)	χ^2	p-value
Mobile Cell Phone				86.23	<0.001***
Novice	0 (0.0%)	2 (1.4%)	6 (9.7%)		
Competent	8 (7.4%)	35 (25.0%)	29 (46.8%)		
Expert	100 (92.6%)	103 (73.6%)	27 (43.5%)		
Tablet Computer				78.45	<0.001***
Novice	0 (0.0%)	3 (2.1%)	8 (12.9%)		
Competent	15 (13.9%)	52 (37.1%)	40 (64.5%)		
Expert	93 (86.1%)	85 (60.7%)	14 (22.6%)		
Google Maps				92.17	<0.001***
Novice	0 (0.0%)	12 (8.6%)	28 (45.2%)		
Competent	28 (25.9%)	76 (54.3%)	37 (59.7%)		
Expert	80 (74.1%)	52 (37.1%)	3 (4.8%)		
Shared Economy (Uber/Taxify)				105.34	<0.001***
Novice	2 (1.9%)	28 (20.0%)	47 (75.8%)		
Competent	42 (38.9%)	76 (54.3%)	26 (41.9%)		
Expert	64 (59.3%)	36 (25.7%)	14 (22.6%)		
GPS Navigation				98.67	<0.001***
Novice	1 (0.9%)	22 (15.7%)	45 (72.6%)		
Competent	34 (31.5%)	82 (58.6%)	40 (64.5%)		
Expert	73 (67.6%)	36 (25.7%)	2 (3.2%)		
SMS				71.23	<0.001***
Novice	0 (0.0%)	4 (2.9%)	8 (12.9%)		
Competent	22 (20.4%)	60 (42.9%)	39 (62.9%)		
Expert	86 (79.6%)	76 (54.3%)	15 (24.2%)		
Email				68.94	<0.001***
Novice	0 (0.0%)	3 (2.1%)	7 (11.3%)		
Competent	25 (23.1%)	61 (43.6%)	40 (64.5%)		
Expert	83 (76.9%)	76 (54.3%)	15 (24.2%)		
Phone Calls				83.56	<0.001***
Novice	0 (0.0%)	2 (1.4%)	10 (16.1%)		
Competent	10 (9.3%)	36 (25.7%)	34 (54.8%)		
Expert	98 (90.7%)	102 (72.9%)	18 (29.0%)		

*Note: χ^2 = Chi-square test for independence across literacy groups; ** $p < 0.001$

The technology experience profiles validate the digital literacy stratification with highly significant differences in all platforms (all $p < 0.001$). As shown in the table, basic communication technologies (mobile phones, SMS, phone calls) show relatively higher levels of competency even in the LDL group (43.5% expert on mobile phones, 29.0% expert on phone calls), whereas emerging digital platforms show wider gaps. For shared economy apps, 75.8% of LDL users indicated novice status when compared to only 1.9% of HDL users; a 73.9 percentage point chasm. This dual division shows that economic barriers (ridesharing requires disposable income) and infrastructural dependencies (GPS requires stable data connectivity) create upward learning curves than basic communication functions.

Table 3: Descriptive Statistics and Correlations of Study Variables by Digital Literacy Groups

Variable	High Digital Literacy (n=108)	Moderate Digital Literacy (n=140)	Low Digital Literacy (n=62)	F-statistic	p-value
Intrinsic Motivation: Competency				42.67	<0.001***
Mean (SD)	4.21 (0.52)	3.78 (0.61)	3.21 (0.74)		
Min - Max	2.67 - 5.00	2.33 - 5.00	1.67 - 4.67		
Intrinsic Motivation: Relatedness				18.34	<0.001***
Mean (SD)	3.92 (0.58)	3.68 (0.64)	3.45 (0.71)		
Min - Max	2.40 - 5.00	2.00 - 5.00	1.80 - 4.80		
Intrinsic Motivation: Control				28.91	<0.001***
Mean (SD)	4.05 (0.61)	3.71 (0.68)	3.34 (0.79)		
Min - Max	2.40 - 5.00	2.00 - 5.00	1.60 - 4.80		
Perceived Usefulness				12.45	<0.001***
Mean (SD)	3.98 (0.64)	3.81 (0.59)	3.52 (0.68)		
Min - Max	2.25 - 5.00	2.50 - 5.00	2.00 - 4.75		
Perceived Ease of Use				38.72	<0.001***
Mean (SD)	4.18 (0.55)	3.72 (0.62)	3.15 (0.76)		
Min - Max	2.75 - 5.00	2.25 - 5.00	1.50 - 4.50		
Behavioral Intention				15.67	<0.001***
Mean (SD)	4.12 (0.68)	3.89 (0.71)	3.58 (0.82)		
Min - Max	2.50 - 5.00	2.00 - 5.00	1.50 - 5.00		
Actual Usage				8.23	<0.001***
Mean (SD)	3.45 (0.91)	3.28 (0.87)	2.98 (0.94)		
Min - Max	1.00 - 5.00	1.00 - 5.00	1.00 - 4.50		

*Note: All variables are measured on a 5-point Likert scale (1=Strongly Disagree to 5=Strongly Agree). F-statistics from one-way ANOVA; Post-hoc Tukey HSD tests show all pairwise group differences significant at $p < 0.05$ unless otherwise noted. $**p < 0.001$

The descriptive statistics show systematic mean differences among all TAM constructs as a function of digital literacy level, with HDL consistently showing the highest means and LDL the lowest (all $F > 8.0$, $p < 0.001$). These patterns provide preliminary evidence that digital literacy moderates both motivational antecedents and technology acceptance results.

Table 4: Measurement Model Assessment by Digital Literacy Groups

Construct	Indicators	High Digital Literacy (n=108)	Moderate Digital Literacy (n=140)	Low Digital Literacy (n=62)
Intrinsic Motivation: Competency				
Factor Loadings	IMC1-IMC3	0.882-0.908	0.871-0.895	0.845-0.912
Cronbach's α		0.863	0.852	0.821
Composite Reliability (ρ_c)		0.915	0.909	0.894
AVE		0.782	0.769	0.739
Intrinsic Motivation: Relatedness				
Factor Loadings	IMR1-IMR5	0.741-0.869	0.738-0.862	0.715-0.849
Cronbach's α		0.867	0.858	0.834
Composite Reliability (ρ_c)		0.903	0.898	0.879
AVE		0.648	0.638	0.598
Intrinsic Motivation: Control				
Factor Loadings	IMCI1-IMCI5	0.718-0.912	0.721-0.908	0.698-0.895
Cronbach's α		0.923	0.917	0.889
Composite Reliability (ρ_c)		0.962	0.957	0.941
AVE		0.758	0.747	0.718
Perceived Ease of Use				
Factor Loadings	PEU1-PEU4	0.798-0.934	0.784-0.929	0.762-0.918
Cronbach's α		0.921	0.916	0.892
Composite Reliability (ρ_c)		0.945	0.941	0.928
AVE		0.728	0.717	0.689
Perceived Usefulness				
Factor Loadings	PU1-PU4	0.801-0.872	0.789-0.864	0.778-0.849
Cronbach's α		0.871	0.865	0.839
Composite Reliability (ρ_c)		0.912	0.908	0.893
AVE		0.718	0.708	0.678
Behavioral Intention				
Factor Loadings	BI2-BI3	0.956-0.961	0.951-0.959	0.945-0.954
Cronbach's α		0.912	0.908	0.894
Composite Reliability (ρ_c)		0.957	0.955	0.945

AVE		0.918	0.914	0.898
Actual Usage				
Factor Loadings	AU1-AU2	0.976, 0.701	0.971, 0.695	0.962, 0.678
Cronbach's α		0.925	0.921	0.908
Composite Reliability (ρ_c)		0.835	0.829	0.813
AVE		0.718	0.709	0.689

Note: All factor loadings significant at $p < 0.001$. Recommended thresholds: Factor loadings ≥ 0.70 , Cronbach's $\alpha \geq 0.70$, Composite Reliability ≥ 0.70 , AVE ≥ 0.50 (Hair et al., 2019)

The measurement model shows detailed psychometric properties in all three digital literacy groups, with all reliability and validity indices exceeding conventional thresholds (Cronbach's $\alpha > 0.82$, composite reliability > 0.81 , AVE > 0.59). This cross-group consistency validates that the extended TAM constructs operate equivalently among the digital literacy groups, which therefore enables meaningful multi-group comparisons.

Table 5: Discriminant Validity Assessment (Fornell-Larcker Criterion) by Digital Literacy Groups
High Digital Literacy Group (n=108)

Construct	1	2	3	4	5	6	7
1. Actual Usage	0.847						
2. Competency	0.142	0.884					
3. Control	0.178	0.534	0.871				
4. Ease of Use	0.098	0.698	0.612	0.853			
5. Intention	0.123	0.589	0.768	0.672	0.958		
6. Relatedness	0.187	0.542	0.538	0.498	0.512	0.805	
7. Usefulness	0.109	0.712	0.523	0.682	0.598	0.588	0.847

Moderate Digital Literacy Group (n=140)

Construct	1	2	3	4	5	6	7
1. Actual Usage	0.842						
2. Competency	0.098	0.877					
3. Control	0.121	0.521	0.864				
4. Ease of Use	0.067	0.689	0.598	0.847			
5. Intention	0.089	0.576	0.754	0.658	0.956		
6. Relatedness	0.156	0.528	0.524	0.481	0.498	0.799	
7. Usefulness	0.078	0.698	0.508	0.671	0.581	0.574	0.841

Low Digital Literacy Group (n=62)

Construct	1	2	3	4	5	6	7
1. Actual Usage	0.830						
2. Competency	0.067	0.860					
3. Control	0.089	0.498	0.847				
4. Ease of Use	0.045	0.712	0.567	0.830			
5. Intention	0.078	0.598	0.723	0.634	0.948		
6. Relatedness	0.134	0.512	0.498	0.456	0.478	0.773	
7. Usefulness	0.056	0.723	0.476	0.687	0.567	0.558	0.823

Note: Diagonal elements (bold) represent the square root of AVE. Off-diagonal elements are inter-construct correlations. Discriminant validity is established when diagonal values exceed all corresponding row and column values (Fornell & Larcker, 1981).

Discriminant validity is fully established among all three digital literacy groups, with the square root of AVE for each construct exceeding all inter-construct correlations in its respective row and column. This confirms that the seven latent variables capture distinct psychological phenomena instead of overlapping or redundant content, which validates the theoretical distinctiveness of intrinsic motivation components (competency, relatedness, control) from TAM perceptions (usefulness, ease of use) and behavioral outcomes (intention, actual usage).

Table 6: Structural Model Results – Multi-Group Analysis Across Digital Literacy Levels

Hypothesis Path	High Digital Literacy (n=108)	Moderate Digital Literacy (n=140)	Low Digital Literacy (n=62)	χ^2 Difference Test
	β (SE)	t-value	p	R ²
H1a: Competency → Usefulness	0.389 (0.098)	3.97	<0.001***	
H1b: Relatedness → Usefulness	0.295 (0.091)	3.24	0.001**	
H1c: Control → Usefulness	0.261 (0.096)	2.72	0.007**	0.612
H2a: Competency → Ease of Use	0.314 (0.102)	3.08	0.002**	
H2b: Relatedness → Ease of Use	0.126 (0.095)	1.33	0.184	
H2c: Control → Ease of Use	0.387 (0.099)	3.91	<0.001***	0.653
H3: Usefulness → Intention	0.198 (0.089)	2.22	0.026*	
H4: Ease of Use → Intention	0.512 (0.092)	5.57	<0.001***	0.547
H5: Intention → Actual Usage	0.123 (0.145)	0.85	0.395	0.015

*Note: β = standardized path coefficient; SE = standard error; R² = variance explained in endogenous variable; χ^2 Difference Test assesses between-group path coefficient equality (df=2); *p < 0.05, **p < 0.01, ***p < 0.001. *Bootstrap samples = 5,000.*

The multi-group structural model shows profound digital literacy moderation effects on TAM pathways, with systematic and theoretically meaningful variations across HDL, MDL, and LDL groups. Several important patterns emerge that majorly affect the understanding of technology acceptance in stratified user populations.

Table 7: Mediation Analysis – Indirect Effects Through TAM Perceptions

Indirect Path	High Digital Literacy (n=108)	Moderate Digital Literacy (n=140)	Low Digital Literacy (n=62)
	β (SE)	95% CI	p
Competency → Usefulness → Intention	0.077 (0.038)	[0.015, 0.162]	0.042*
Competency → Ease of Use → Intention	0.161 (0.056)	[0.067, 0.287]	0.004**
Relatedness → Usefulness → Intention	0.058 (0.029)	[0.012, 0.127]	0.046*
Relatedness → Ease of Use → Intention	0.065 (0.051)	[-0.025, 0.178]	0.202
Control → Usefulness → Intention	0.052 (0.023)	[0.014, 0.106]	0.024*
Control → Ease of Use → Intention	0.198 (0.058)	[0.099, 0.327]	0.001**
Total Indirect Effect (All Paths)	0.611 (0.089)	[0.451, 0.798]	<0.001***

*Note: β = standardized indirect effect; SE = standard error from bias-corrected bootstrap (5,000 resamples); 95% CI = bias-corrected confidence interval; *p < 0.05, **p < 0.01, ***p < 0.001. Mediation is considered significant when CI excludes zero.

The mediation analysis shows the digital literacy-dependent pathways through which intrinsic motivation influences behavioral intentions, with perceived ease of use showing up as the dominant mediator among all the groups while perceived usefulness shows stratified mediation strength.

Table 8: Moderating Effect of Digital Literacy on Key Relationships – Effect Size Comparison

Relationship	Effect Size (Cohen's f^2)	Between-Group Difference	Practical Interpretation
	HDL	MDL	LDL
Competency → Usefulness	0.198	0.378	0.624
Competency → Ease of Use	0.112	0.367	0.841
Relatedness → Usefulness	0.095	0.053	0.025
Control → Usefulness	0.076	0.008	0.002
Control → Ease of Use	0.174	0.098	0.026
Usefulness → Intention	0.048	0.074	0.119
Ease of Use → Intention	0.349	0.327	0.277
Intention → Actual Usage	0.015	0.008	0.006

Note: Cohen's f^2 effect size calculated as $R^2_{included} / (1 - R^2_{included})$; Interpretation: $f^2 < 0.02$ =negligible, $0.02-0.15$ =small, $0.15-0.35$ =medium, >0.35 =large (Cohen, 1988). Max Δf^2 = maximum difference in f^2 between any two literacy groups.

The effect size analysis quantifies digital literacy's moderating magnitude, thereby showing that certain TAM relationships are profoundly stratified (competency→ease: 7.5x effect size difference) while others remain relatively stable (ease→intention: 1.26x difference), which therefore clarifies where adaptive interventions are essential versus where universal strategies suffice.

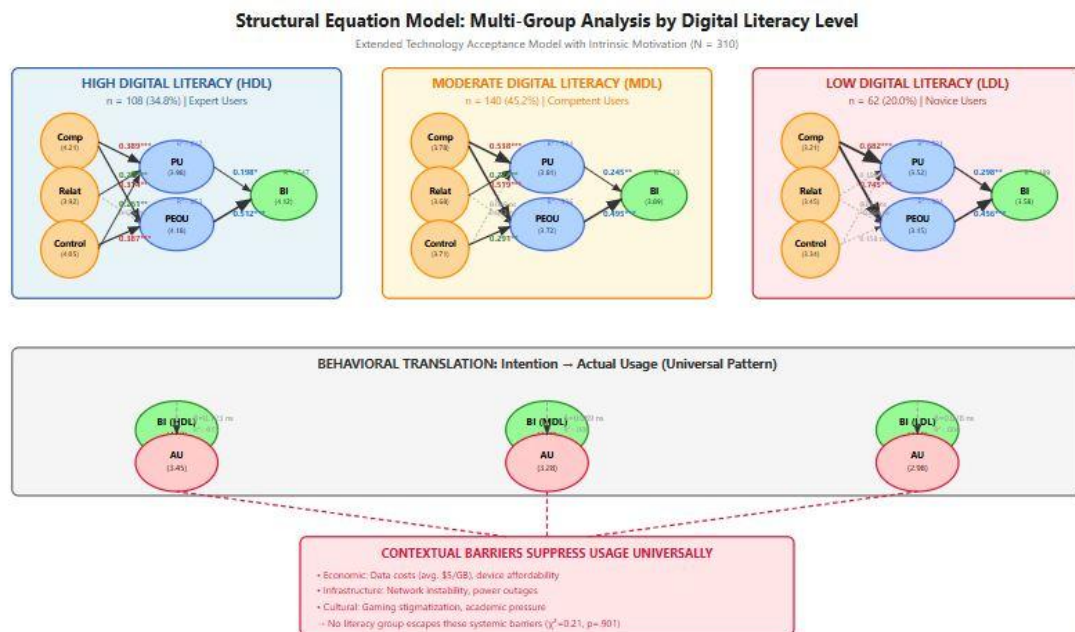


Figure 2: Structural Equation Model: Multi-Group Analysis Literacy Level

5. Discussion

This study shows great heterogeneity in digital literacy among African university students, with distinct high (34.8%), moderate (45.2%), and low (20.0%) literacy segments which challenges widespread assumptions about digital homogeneity in higher education. The loud gender disparity, where males constitute 68.5% of high-literacy users versus only 50% of low-literacy users is a reflection of structural inequities ingrained in differential childhood technology exposure, societal discouragement of female technical engagement, and gaming cultures dominated by males (Baidoo-Anu et al., 2023).

Furthermore, the age distribution contradicts the “digital native” myth, as younger students (17-18 years) were overrepresented among low-literacy users, while older students dominated high-literacy groups. This implies that the development of digital competence occurs through sustained, intentional engagement instead of automatic generational diffusion, which directly challenges deterministic frameworks that presume that young people inherently acquire digital skills through environmental exposure (Pierce & Cleary, 2024). These findings place digital literacy as not just an individual trait but as a socially structured result that is determined by economic systems, educational policies, infrastructure quality, and cultural norms.

Very striking is the finding regarding how digital literacy majorly affects the relationship between intrinsic motivation and technology acceptance. Competency beliefs showed an inverse gradient in predicting perceived usefulness, with effects strengthening systematically from high-literacy users ($\beta=0.389$) to low-literacy users ($\beta=0.682$), representing a 75% amplification that contradicts the assumption of Self-Determination Theory of universal need importance (Ryan & Deci, 2020). This act implies hierarchical need activation where competency dominates for novices but recedes once satisfied, thereby allowing autonomy to emerge as the primary driver.

Indeed, autonomy notably predicted usefulness exclusively among digitally experienced users ($\beta=0.261$) while remaining non-significant for novices, revealing that autonomy features become cognitive burdens and not liberating affordances for users struggling with basic operations (Schwartz, 2004; Akbulut et al., 2025). This directly challenges orthodox Self-Determination Theory interpretations emphasizing autonomy as universally significant and suggests that theoretical frameworks validated in Western, technology-rich settings may mischaracterize motivational dynamics in settings where users have different digital foundations.

The competency-ease relationship showed an intriguing stratification, with effect sizes amplifying 137% from experts ($\beta=0.314$) to novices ($\beta=0.745$). The coefficient magnitude among low-literacy users approaches thresholds implying phenomenological collapse, where competence feelings and ease perceptions become psychologically indistinguishable (Kruger & Dunning, 1999). This shows that novices lack metacognitive sophistication to differentiate personal capability limitations from system design flaws, attributing challenges to personal inadequacy through fundamental attribution error processes. Relatedness effects showed systematic attenuation in literacy levels, remaining significant only for high-literacy users ($\beta=0.295$) and declining to non-significance among low-literacy users ($\beta=0.158$).

This contradicts prevailing assumptions in gamification studies about relatedness as a universal motivator (Li et al., 2024) and instead supports cognitive capacity frameworks where social engagement requires executive function resources that novices must allocate to mechanical operations (Conway et al., 2005; Schneider & Shiffrin, 1977). The practical implications challenge current social gaming practices that foreground multiplayer elements, suggesting a staged social integration where initial experiences emphasize solo engagement for mechanical skill development.

Perceived ease of use emerged as the dominant predictor of behavioral intention in all literacy groups ($\beta=0.456-0.512$), with effects exceeding usefulness by 2-2.5 \times and showing no significant between-group variation. This reconfirms that intuitive design dominates adoption decisions regardless of expertise and challenges Technology Acceptance Model extensions that posit that usefulness should dominate for hedonic technologies (Venkatesh & Bala, 2008). However, the study's most consequential finding concerns the complete collapse of the

intention-behavior link, which remained non-significant in all literacy groups ($\beta=0.078-0.123$, $R^2=0.006-0.015$). Despite validated intentions formed through positive usefulness and ease perceptions, structural barriers; data costs, device limitations, network instability, and cultural stigmatization, prevented actualization equally in expertise levels, functioning as literacy-blind suppressors. This universal failure majorly challenges TAM's core principle where behavioral intention serves as the proximal predictor of actual usage (Davis, 1989), showing that in resource-constrained settings, volitional control assumptions fail.

This pattern diverges from TAM research in developed economies where intention-behavior relationships clearly explain notable usage variance ($R^2=0.20-0.40$) (Venkatesh & Bala, 2008), exposing the context-dependency of TAM pathways and challenging the model's presumed universal applicability. The findings resonate with Baidoo-Anu et al.'s (2023) evidence that African students face infrastructural barriers (unstable connectivity, power supply constraints, bandwidth limitations) that render psychological models insufficient for predicting actual technology use. This implies that behavioral prediction in constrained settings requires explicit modeling of facilitating conditions as necessary preconditions instead of just moderators (Dwivedi et al., 2020; Venkatesh et al., 2003).

Mediation analyses showed that intrinsic motivation factors influence behavioral intentions primarily through perceived ease instead of usefulness, with this pattern intensifying for novices. Competency's indirect effect through perceived ease of use increased systematically from high-literacy ($\beta=0.161$) to low-literacy users ($\beta=0.340$), while usefulness mediation showed smaller magnitudes across groups. This challenges frameworks that emphasize utility evaluations as primary adoption drivers and show compensatory equifinality: experts rely on autonomy-mediated ease pathways, while novices rely on competency-mediated pathways; yet both achieve comparable adoption intentions through qualitatively different psychological processes (Vansteenkiste et al., 2020). The findings imply that interventions should match pathway emphasis to user literacy instead of applying universal strategies, with competency scaffolding producing unequal returns among novices and autonomy features introduced progressively as proficiency develops.

Competency's indirect effect through perceived ease of use increased systematically from high-literacy users ($\beta = 0.161$) to low-literacy users ($\beta = 0.340$), whereas usefulness-mediated effects were smaller across groups. These findings challenge frameworks that prioritize utility evaluations as primary adoption drivers and demonstrate compensatory equifinality, whereby experts rely on autonomy-mediated ease pathways and novices depend on competency-mediated pathways, yet both arrive at comparable adoption intentions through qualitatively distinct psychological processes

These results theoretically challenge universalist assumptions in both TAM and Self-Determination Theory by showing that adoption pathways exhibit expertise-dependent configurations, necessitating literacy-conditional theoretical

specifications. The research extends cognitive load theory into technology acceptance by showing how limited working memory capacity among novices creates phenomenological collapses and constrains social engagement capacity. Methodologically, the study shows that multi-group analysis reveals heterogeneity masked by aggregate models, with effect size variations (7.5-fold for competency→ease) implying that pooled analyses in stratified populations may yield misleading conclusions.

6. Conclusion

This study shows that digital literacy stratification importantly determines how African university students adopt mobile gaming technologies, showing that technology acceptance pathways differ substantially across high, moderate, and low digital literacy groups. Through multi-group structural equation modeling with 310 Nigerian students, the research established that competency beliefs have disproportionately stronger influences on perceived usefulness and ease of use among low-literacy users when compared to their high-literacy counterparts, while autonomy needs show up as significant motivators only for digitally experienced users.

The findings challenge foundational assumptions within both the Technology Acceptance Model and Self-Determination Theory, as they have to do with the universal applicability of adoption processes, thereby necessitating literacy-conditional theoretical specifications that acknowledge expertise-dependent motivational hierarchies and perceptual evaluations. Despite strong behavioral intentions formed through positive technology perceptions in all literacy levels, actual usage remained universally suppressed by contextual barriers which include data costs, infrastructural limitations, and cultural constraints, which shows that individual-level psychological factors prove insufficient for driving adoption when systemic obstacles intervene. These results show the importance of adaptive technology designs that utilize competency scaffolding, autonomy features, and social integration to the digital proficiency levels of users, alongside policy interventions that address structural barriers to translate adoption intentions into sustained usage behaviors in African higher education settings.

7. Limitations

The sample comprised exclusively students from computer science and management information systems programs at a single Nigerian private university, which therefore limits generalizability to diverse academic disciplines, institutional types, and African nations with varying infrastructural and cultural settings. Moreover, cross-sectional design prevents causal conclusions about how digital literacy develops and how adoption processes change over time.

In addition, reliance on self-report measures may introduce method bias, particularly in classifying digital literacy and assessing actual usage, which may not accurately reflect objective behavior. Although contextual barriers were identified as suppressing the intention-behavior translation, specific constraints such as data costs, network quality, device capabilities, and cultural attitudes were not systematically measured or tested for differential effects in literacy

groups. As a result, it limits the understanding of which structural constraints most strongly impede adoption and whether barrier impacts vary by user expertise level.

Furthermore, the relatively small sample size of the Low Digital Literacy group (n=62) may have limited statistical power to detect smaller effect sizes in multi-group analyses, potentially increasing the risk of Type II errors and resulting in wider confidence intervals for path estimates within this subgroup. Also, the use of Awale, a traditional strategy board game with relatively simple mechanics, may not fully capture the complexities of modern mobile games that involve more sophisticated UI interactions and higher cognitive load. This simplicity may have influenced motivational dynamics, especially for digitally experienced users who might perceive the game as not having sufficient challenge or operational depth.

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