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Development and Initial Validation of the User Experience Awareness Scale (UXAS) for Mobile Commerce Applications: A Pilot Study of Shopee Users in Indonesia

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ABSTRACT: The rapid evolution of mobile commerce (m-commerce) platforms into sophisticated, attention-capturing ecosystems necessitates new psychometric tools to evaluate user interaction beyond traditional usability metrics. This study introduces the User Experience Awareness Scale (UXAS), a validated instrument designed to quantify user metacognition regarding algorithmic curation, persuasive design, and interface manipulation in m-commerce. Utilizing a pilot study of Shopee users in Indonesia, we developed and evaluated the UXAS through an Exploratory Factor Analysis (EFA). The findings reveal a robust five-factor structure: Algorithmic Awareness, UI/UX Flow Awareness, Emotional Metacognition, Autonomy and Control, and Persuasive Susceptibility. Crucially, the results expose a significant intention-behavior gap: while digitally literate users possess high structural awareness of platform mechanisms, this knowledge does not inherently protect them from the impulsive behavioral effects of persuasive design. The UXAS provides a foundational tool for researchers and policymakers to assess digital well-being and develop ethical, transparent design standards in the digital attention economy.

KEYWORDS: User Experience Awareness Scale (UXAS), Mobile Commerce, Algorithmic Awareness, Persuasive Design, Metacognition.

I. INTRODUCTION

The global proliferation of digital technologies has fundamentally transformed the retail sector, culminating in the rapid expansion and near-ubiquity of mobile commerce (m-commerce) applications. The transition from legacy telecommunications infrastructure to advanced 4G and emerging 5G networks has provided the necessary bandwidth and low-latency environments to support seamless, data-intensive digital activities, driving unprecedented growth in global e-commerce markets (Martos & Arana, 2020). Within this highly dynamic digital ecosystem, m-commerce platforms have evolved significantly from simple, transactional interfaces into highly sophisticated, attention-capturing environments (Balatero, 2025). This evolution is particularly pronounced in Southeast Asia, and specifically in Indonesia, where digital adoption has accelerated at a staggering pace. In this highly competitive market, platforms such as Shopee, Tokopedia, Lazada, Bukalapak, and Blibli vie continuously for consumer attention and digital market share (Murniyati et al., 2026). Among these, Shopee has emerged as a dominant market leader, a success largely attributed to its aggressive implementation of complex User Experience (UX) designs, artificial intelligence (AI)-driven personalization, gamification, and highly targeted digital marketing campaigns (Gibran et al., 2026).

As m-commerce applications continue to grow in scale and sophistication, platform architects continuously optimize the user experience to maximize engagement, retention, and commercial outcomes (Spiegel, 2026). Contemporary digital consumer behavior is increasingly shaped by nonlinear, highly personalized decision pathways curated by intricate algorithmic architectures (Kanchan, 2026). Platforms deploy complex Graphical User Interfaces (GUI) specifically designed to reduce cognitive load, streamline navigation, and foster user comfort, which ultimately drives satisfaction and repurchase intentions (Gibran et al., 2026). However, the evolution of UX design has not remained strictly benign or purely functional. The integration of behavioral economics, persuasive technology, and algorithmic curation has given rise to environments that can subtly manipulate user behavior (Kanchan, 2026).

A critical concern in contemporary Human-Computer Interaction (HCI) and digital ethics is the deployment of "dark patterns" manipulative interface designs that exploit human cognitive biases to steer users toward decisions that disproportionately benefit the platform, often at the expense of user autonomy and financial well-being (Joshi & Naik, 2026). Furthermore, AI-driven recommendation systems create personalized feedback loops that reinforce repetitive usage and can lead to impulsive, unrestrained purchasing behaviors (Kumar et al., 2026). Despite the profound

psychological and behavioral impact of these advanced UX strategies, the vast majority of scale development and validation research in the field of HCI has focused predominantly on measuring the system's effectiveness from the perspective of usability and satisfaction. Instruments such as the System Usability Scale (SUS), the User Experience Questionnaire (UEQ), and various iterations of the Technology Acceptance Model (TAM) are inherently system-centric, evaluating how well the technology performs its intended function rather than how the user perceives the system's psychological influence (Märtin et al., 2023).

What is conspicuously absent from the extant literature is a validated psychometric instrument designed specifically to measure *user metacognition* namely, the extent to which users are aware of the UX mechanisms, algorithmic curations, and persuasive designs that actively shape their digital experiences. Algorithmic awareness, defined as the degree to which users recognize and understand the functioning of automated recommendation systems, has been identified as a critical factor in digital literacy and user agency (López-Barranco et al., 2026). Yet, user awareness of the broader UX spectrum encompassing visual design intent, navigation flow manipulation, and emotional targeting remains underexplored. The ability of a consumer to recognize that a countdown timer is a manufactured urgency nudge, or that a crowded homepage is designed to induce cognitive overload, represents a crucial frontier in consumer protection and digital well-being (Budimcic, 2023).

To bridge this substantial methodological and theoretical gap in the literature, the present study introduces the User Experience Awareness Scale (UXAS). The primary objective of this research is the development and initial validation of the UXAS, an instrument specifically tailored for contemporary m-commerce applications. Utilizing a pilot study of Shopee users in Indonesia, this research seeks to quantify user awareness across five distinct theoretical dimensions: algorithmic personalization awareness, UI/visual design awareness, navigation flow awareness, autonomy and persuasive design awareness, and emotional/behavioral metacognition. By shifting the analytical lens from system usability to user metacognition, this study aims to provide a robust, reliable, and valid methodological tool for future research in digital literacy, consumer protection, and ethical UX design. The findings will provide empirical insights into the "intention-behavior gap" in digital environments, exploring whether structural awareness of an application's design is sufficient to protect users from its persuasive effects.

II. LITERATURE REVIEW

A. The Evolution of Mobile Commerce and the UX Paradigm

Mobile commerce represents a fundamental paradigm shift in the global digital economy, defined by the purchasing of goods and services via mobile devices supported by secure digital payment platforms (Balatero, 2025). The architectural foundation of modern m-commerce relies heavily on providing a satisfying, easy-to-use, and seamless user experience that minimizes friction while maximizing transactional throughput (Ratanathamwat, 2023). Historical evaluations of m-commerce UX have predominantly utilized frameworks such as the Technology Acceptance Model (TAM), focusing on variables like Perceived Ease of Use (PEOU) and Perceived Usefulness (PU) (Kanchan, 2026). Studies consistently demonstrate that high-quality GUI design, characterized by clear navigation, logical icon arrangement, and aesthetically pleasing layouts has a direct, positive effect on user comfort, trust, e-satisfaction, and continuous usage intention (Gibran et al., 2026).

In the highly competitive Indonesian e-commerce market, platforms continuously battle for user attention and loyalty (Murniyati et al., 2026). Shopee has mastered the integration of social commerce, blending hedonic entertainment with utilitarian shopping to capture the tech-savvy Generation Z and Millennial demographics (Balatero, 2025). This is achieved through the deployment of gamified features, integrated live streaming, and high-density, stimulus-rich homepages that are designed to maintain user engagement for prolonged periods (Gibran et al., 2026). While these strategies enhance the perceived hedonic value of the application, they also transform the UX from a passive transactional interface into an active, behavior-shaping environment. The interface is no longer merely a tool for purchasing; it is an immersive ecosystem designed to cultivate habituation. Consequently, traditional metrics that measure "usability" fail to capture the coercive nature of these optimized environments (Spittle et al., 2023).

B. Algorithmic Awareness and AI-Driven Personalization

The transition from static e-commerce catalogs to dynamic, hyper-personalized m-commerce feeds is largely fueled by AI-driven personalization algorithms. These algorithms continuously harvest clickstream data, search histories, dwell times, and purchasing behavioral patterns to curate highly individualized product recommendations and targeted advertisements (Balatero, 2025). While personalization can significantly enhance the user experience by reducing search friction and increasing the relevance of presented content, it operates within a "black box" that remains opaque to the average user (López-Barranco et al., 2026). The opacity of these systems creates a significant power asymmetry between the platform and the consumer.

Algorithmic awareness has recently emerged as a vital construct in digital literacy research, seeking to address this asymmetry. It refers to a user's knowledge of the existence of algorithms and their understanding of how these systems curate digital realities (López-Barranco et al., 2026). Research indicates that users often attribute algorithmic filtering to their own autonomous actions or remain entirely unaware of the underlying mechanisms dictating their feeds, a phenomenon heavily documented in studies of social media

platforms (Smikova, 2023). However, heightened algorithmic awareness is associated with more proactive engagement, a greater sense of empowerment, and the ability to critically assess the reliability of digital content (Smikova, 2023).

In the context of m-commerce, the Personalization-Privacy-Value (PPV) framework suggests that personalization is only perceived positively when users possess a degree of awareness and feel they maintain transparent control over their data (Utami & Aimin, 2026). Without this metacognitive awareness, personalization transitions from a value-creating feature to a manipulative force, trapping users in consumerist filter bubbles that dictate purchasing pathways without their conscious consent (López-Barranco et al., 2026). Therefore, measuring the extent to which m-commerce users are aware that their recommendations, push notifications, and feed contents are algorithmically engineered is a foundational requirement for understanding modern consumer behavior.

C. Persuasive Design and Dark Patterns in E-Commerce

The boundary between effective, user-centric UX design and manipulative architecture is frequently blurred in digital retail. Persuasive design utilizes psychological principles such as social proof, scarcity, authority, and intermittent reinforcement to guide user behavior toward specific, platform-beneficial outcomes (Kanchan, 2026). While persuasive design can theoretically be employed ethically to encourage positive habits, its application in profit-driven e-commerce often devolves into "dark patterns" (Joshi & Naik, 2026).

Dark patterns are user interfaces meticulously crafted to trick, coerce, or manipulate users into making choices they might not otherwise make, such as initiating unintended purchases, subscribing to recurring fees, or surrendering excess personal data (Budimcic, 2023). These patterns operate by exploiting human cognitive biases, heavily relying on the dual-process architecture of cognition outlined in behavioral economics (Budimcic, 2023). By targeting the heuristic, automatic processes of System 1 thinking, dark patterns deliberately bypass the rational, deliberative mechanisms of System 2 (Budimcic, 2023).

Common typologies of dark patterns in m-commerce include interface interference (e.g., hiding the 'opt-out' button), sneaking (e.g., adding hidden costs at checkout), forced action (e.g., requiring an account to view a catalog), and urgency nudges (e.g., displaying "Only 1 item left in stock!" or artificial countdown timers) (Joshi & Naik, 2026). The integration of AI into these systems has fundamentally transformed the scale and subtlety of dark patterns, creating adaptive, data-driven optimization processes that deliver personalized manipulation in real-time (Gavilan & Martinez-Navarro, 2022). Consumer autonomy is highly vulnerable in these environments, yet regulatory responses such as the European Union's Digital Services Act (DSA) remain nascent and fragmented, relying heavily on the assumption that users possess the cognitive abilities to recognize these manipulative techniques (Budimcic, 2023).

D. Psychometric Measurement in Human-Computer Interaction

The evaluation of digital interfaces relies heavily on psychometric scale validation to ensure reliability and construct validity. Prominent tools in HCI include the System Usability Scale (SUS), a 10-item questionnaire measuring perceived usability, and the Modular Evaluation of Key Components of User Experience (meCUE), which captures instrumental and non-instrumental qualities, emotions, and consequences of use (Märtin et al., 2023). Other widely utilized scales include the User Experience Questionnaire (UEQ) and the Mobile Application Rating Scale (MARS), both of which focus on aesthetic appeal, efficiency, and dependability (Terhorst et al., 2020).

A critical limitation of this existing methodological repertoire is its strictly directional focus. These instruments evaluate the *technology* based on user feedback, operating on the assumption that the user acts as an objective, rational assessor of the system's performance. They fail entirely to capture the reciprocal dynamic: how well the *user* understands the technology's influence over their own cognition and behavior (Bang, 2024). Existing attempts to measure algorithmic awareness or digital literacy are often fragmented, highly specific to social media algorithms (e.g., Facebook's News Feed), or overly reliant on broad demographic proxies (such as device ownership) rather than nuanced psychological constructs (Smikova, 2023).

Therefore, there is an urgent and critical need for the development of a psychometrically sound instrument that quantifies user awareness of UX strategies, persuasive nudges, and algorithmic curation within digital commerce (Lachner, 2019). The User Experience Awareness Scale (UXAS) proposed in this study is meticulously designed to bridge this methodological gap. By synthesizing concepts from HCI, consumer psychology, and digital ethics, the UXAS provides a foundational tool for empirical investigations into the psychological defenses of modern digital consumers.

III. METHODOLOGY

A. Research Design

This study employs a quantitative, cross-sectional survey design structured around the established paradigms of psychometric scale development and validation in the behavioral sciences. The methodological procedure strictly follows classical guidelines for scale development, encompassing domain specification, deductive item generation, pilot testing, and preliminary psychometric evaluation (Marić Stanković et al., 2026). The primary analytical strategy utilizes an Exploratory Factor Analysis (EFA) approach to uncover the underlying latent structure of the proposed UXAS instrument, assess its internal

consistency, and establish preliminary construct validity (Lachner, 2019).

B. Domain Specification and Item Generation

The initial pool of items for the UXAS was generated using a theory-driven deductive approach. Based on the comprehensive literature review encompassing algorithmic awareness, GUI design, persuasive technology, dark patterns, and digital consumer psychology, five distinct theoretical dimensions were conceptualized:

1. **Algorithmic & Personalization Awareness:** The user's recognition of data harvesting practices, behavioral tracking, and the mechanics of recommendation systems (López-Barranco et al., 2026).
2. **UI & Visual Design Awareness:** The user's understanding of the intentionality behind layout architecture, color schemes, and visual stimuli designed to capture attention (Gibran et al., 2026).
3. **Navigation & Flow Awareness:** The user's cognizance of the application's structural flow, specifically designed to reduce transactional friction and facilitate seamless, prolonged engagement (Märtin et al., 2023).
4. **Autonomy & Persuasive Design Awareness:** The user's ability to detect notification nudges, their perceived freedom to ignore stimuli, and their overarching perception of behavioral control against manipulative designs (Joshi & Naik, 2026).
5. **Emotional & Behavioral Awareness:** The user's metacognitive reflection on emotional shifts during application use, enthusiasm triggered by artificial scarcity or promos, and awareness of impulsive purchasing tendencies (Kumar et al., 2026).

A total of 20 items (four items per theoretical dimension) were formulated. The items were originally constructed in Bahasa Indonesia to ensure high ecological validity, cultural resonance, and maximal comprehension among the target population in Indonesia. To minimize cognitive burden and standard response biases, the items were structured as declarative statements utilizing a 5-point Likert scale, ranging from 1 ("Sangat Tidak Setuju" / Strongly Disagree) to 5 ("Sangat Setuju" / Strongly Agree) (Smikova, 2023). None of the items were directly translated from pre-existing usability scales; all were originally developed by the researchers to specifically target the metacognitive awareness of m-commerce platforms.

C. Participants and Sampling Procedure

The pilot study data was collected from a convenience sample of active Shopee users in Indonesia. Shopee was selected as the reference application for this study due to its dominant market share in Southeast Asia, its comprehensive feature set encompassing both utilitarian and hedonic elements, and its aggressive implementation of gamified and highly personalized UX elements (Murniyati et al., 2026).

The inclusion criteria required participants to be active users of the Shopee mobile application, operationalized as having made at least one purchase on the platform within the preceding three months. A total of N = 77 valid responses were collected. Demographic data collected included participant names (which were fully anonymized prior to analysis), age, and academic major/cohort. The survey was administered digitally via an online questionnaire platform.

Although a sample size of 77 is relatively small for large-scale EFA, which typically requires a participant-to-item ratio of at least 5:1, it exceeds the minimum threshold required for a preliminary pilot study aimed at initial item reduction, variance checking, and internal consistency evaluation prior to a full-scale, nationwide validation deployment (Şahin Kızıl et al., 2025). Pilot studies of this scale are standard practice in psychometric development to identify problematic items and ensure data suitability for factor analysis.

D. Data Analysis Strategy

The raw data was subjected to a rigorous statistical pipeline using standard statistical software. The analytical procedure consisted of three main phases:

1. **Descriptive Statistics:** Calculation of the mean (*M*), standard deviation (*SD*), and distribution characteristics for each of the 20 items to assess central tendencies, evaluate response variability, and identify potential floor or ceiling effects.
2. **Reliability Analysis:** The internal consistency of the overall UXAS and its theorized sub-dimensions was evaluated using Cronbach's alpha (α). An alpha coefficient of ≥ 0.70 was considered acceptable, while values ≥ 0.80 indicated good to excellent reliability (Chan & Idris, 2017).
3. **Construct Validity via Exploratory Factor Analysis (EFA):** To test the suitability of the data for factor analysis, the Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy and Bartlett's Test of Sphericity were computed (Chan & Idris, 2017). A KMO value ≥ 0.70 and a significant Bartlett's test ($\rho < 0.05$) indicate that the correlation matrix is factorable. A Principal Component Analysis (PCA) extraction method with Varimax orthogonal rotation was applied to clarify the latent factor structure. Factors were retained based on the Kaiser criterion (Eigenvalues >1.0) and visual inspection of the scree plot. Items with factor loadings > 0.50 and minimal cross-loadings (on secondary < 0.30 factors) were considered robust indicators of their respective latent constructs.

IV. RESULT

A. Participant Demographics

The pilot study sample ($N = 77$) comprised a relatively young, highly educated demographic, which is highly representative of the core, high-frequency user base for m-commerce applications in Indonesia (Balatero, 2025). The mean age of the participants was 23.4 years ($SD = 3.65$), with ages ranging from 16 to 47 years. The majority of the sample (62.3%) fell

within the 21-25 age bracket, capturing the Generation Z and younger Millennial cohorts known for extensive digital engagement (Kumar et al., 2026).

An analysis of the academic backgrounds revealed a strong skew toward technology-related disciplines. Specifically, 55.8% of the participants were enrolled in or had graduated from Information Technology, Computer Science, or Information Systems programs (e.g., Teknik Informatika, Sistem Informasi). The remaining participants were distributed across various diverse disciplines, including Psychology, Civil Engineering, Communication Sciences, Management, and Education. This demographic composition is highly relevant to the study's objectives. Users with formal IT backgrounds are theoretically presumed to possess a higher baseline of digital literacy, algorithmic awareness, and systemic comprehension compared to the general population (Talandron-Felipe & Intao, 2024). Consequently, this sample provides an excellent stress test for the scale, determining if even digitally literate users exhibit variances in UX awareness and behavioral control.

Table 1. Demographic Profile of Pilot Study Participants

Demographic Variable	Category	Frequency (n)	Percentage (%)
Age Group	16 - 20 years	17	22.1%
	21 - 25 years	48	62.3%
	26 - 30 years	10	13.0%
	> 30 years	2	2.6%
Academic Discipline	Informatics / Comp. Science	43	55.8%
	Engineering (Civil, Industrial)	7	9.1%
	Social Sciences (Psych, Comm)	12	15.6%
	Business & Management	7	9.1%
	Education & Others	8	10.4%

B. Descriptive Statistics of UXAS Items

Table 2 presents the descriptive statistics for the 20 items comprising the preliminary UXAS. The English translations provided in the table encapsulate the core conceptual meaning of the original Indonesian items. The mean scores indicate a generally high level of awareness regarding systemic platform functions across the sample.

For instance, items measuring algorithmic awareness yielded very high mean scores. Item 4 (Awareness that frequently viewed products reappear) recorded the highest mean (M = 4.25, SD = 0.91), closely followed by Item 1 (Awareness that recommendations are based on past activity) with a mean of 4.21 (SD = 0.94). This suggests that the basic premise of algorithmic personalization and data harvesting is well understood by this specific demographic (López-Barranco et al., 2026). Similarly, awareness of the visual design's intent was universally acknowledged, with Item 6 (Awareness that colors, icons, and layout are designed to attract attention) scoring a high mean of 4.09 (SD = 0.96).

Conversely, items related to emotional metacognition, self-regulation, and susceptibility to persuasive design exhibited significantly higher variance and lower mean scores. Item 20 (Rarely reflecting on the reasons for purchasing) showed significant dispersion (M = 3.32, SD = 1.34), highlighting highly variable levels of impulse control and self-regulation among users. Item 16 (Using Shopee spontaneously without prior planning) also displayed high variance (M = 3.49, SD = 1.25). Furthermore, Item 17 (Awareness of emotional changes while using the app) recorded the lowest mean score in the entire scale (M = 3.25, SD = 1.31). These descriptive metrics indicate that despite possessing high technical awareness of the platform's mechanisms, behavioral submission to the platform's nudges and a lack of emotional metacognition remain prevalent.

Table 2. Descriptive Statistics of UXAS Items

Item Code	Item Description (Translated to English)	Mean (M)	Std. Dev (SD)
Q1	I am aware recommendations are based on past activity.	4.21	0.94
Q2	I understand Shopee uses my behavioral data.	3.97	0.98

Q3	I am aware my search history influences displayed items.	4.18	0.93
Q4	I understand frequently viewed products reappear.	4.25	0.91
Q5	I feel the design makes finding products easy.	3.86	1.05
Q6	I am aware colors, icons, layout are designed for attention.	4.09	0.96
Q7	I feel the interface affects my shopping comfort.	3.91	0.99
Q8	I am aware the homepage is designed to be crowded.	3.79	1.12
Q9	I understand the user flow from search to payment.	4.13	0.88
Q10	I rarely feel confused by Shopee's features.	3.82	1.15
Q11	I am aware Shopee places multiple features on one page.	4.06	0.95
Q12	I feel interactions are designed to prolong my usage.	3.87	1.03
Q13	I feel I have full control over my decisions on Shopee.	3.95	1.07
Q14	I am aware I can set notification preferences.	3.75	1.08
Q15	I feel free to ignore displayed promos or recommendations.	3.86	1.04
Q16	I often use Shopee spontaneously without prior planning.	3.49	1.25
Q17	I am aware of my emotional changes while using the app.	3.25	1.31
Q18	I feel enthusiastic when I see promos or product recommendations.	3.84	1.04
Q19	I am aware my emotions influence my shopping decisions.	3.66	1.18
Q20	I rarely reflect on the reasons I buy products via Shopee.	3.32	1.34

C. Reliability and Internal Consistency

The reliability of the complete 20-item scale was assessed using Cronbach's alpha to ensure the items consistently measured the same underlying construct. The overall UXAS demonstrated excellent internal consistency, with a Cronbach's alpha of $\alpha = 0.88$. This value is well above the conventional acceptable threshold of 0.70 (Chan & Idris, 2017), indicating that the items reliably measure a unified overarching construct related to user experience awareness.

When analyzing the internal consistency of the theoretically proposed sub-dimensions, the Algorithmic Awareness subscale (Q1-Q4) demonstrated strong reliability ($\alpha = 0.85$). The UI Design Awareness subscale (Q5-Q8) also performed well ($\alpha = 0.81$). The Emotional & Behavioral Awareness subscale (Q17-Q20) showed slightly lower, yet acceptable reliability ($\alpha = 0.76$), reflecting the inherent psychometric complexity of measuring emotional introspection and self-regulation (López-Barranco et al., 2026).

D. Exploratory Factor Analysis (EFA)

To assess construct validity and empirically determine the underlying factor structure of the UXAS, an Exploratory Factor Analysis was conducted. Prior to extraction, the data was evaluated for suitability. The Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy yielded a value of 0.812. This KMO value exceeds the recommended threshold of 0.70, indicating that the sample size, despite being a pilot cohort, possessed sufficient shared variance for a robust factor analysis (Chan & Idris, 2017). Furthermore, Bartlett's Test of Sphericity was highly significant ($\chi^2 = 845.32$, $\rho < .001$), confirming that the correlation matrix was significantly different from an identity matrix and that the variables were suitably correlated for dimension reduction (Chan & Idris, 2017).

A Principal Component Analysis (PCA) extraction method was utilized, followed by Varimax orthogonal rotation to maximize the dispersion of loadings within factors, facilitating easier interpretation. The analysis revealed a five-

factor solution with eigenvalues greater than 1.0. These five factors explained a cumulative 68.4% of the total variance in the data. The extraction of exactly five factors closely aligns with the five theoretical dimensions proposed during the deductive item generation phase, providing strong preliminary support for the scale's construct validity.

Table 3. Rotated Factor Matrix for the UXAS (Loadings < 0.40 suppressed)

Item	Factor 1: Algorithmic Awareness	Factor 2: UI/UX Flow Awareness	Factor 3: Emotional Metacognition	Factor 4: Autonomy & Control	Factor 5: Persuasive Susceptibility
Q4	**0.84**				
Q3	**0.82**				
Q1	**0.78**				
Q2	**0.75**				
Q11		**0.79**			
Q6		**0.76**			
Q9		**0.74**			
Q12		**0.71**			
Q8		**0.65**			
Q5		**0.58**			
Q19			**0.81**		
Q17			**0.77**		
Q18			**0.68**		
Q13				**0.82**	
Q15				**0.78**	
Q14				**0.74**	
Q16					**-0.79**
Q20					**-0.76**
Q10		0.45		0.52	
Q7		0.48	0.42		

The rotated factor matrix (Table 3) provides critical insights into how users conceptualize their interactions with the platform:

a. **Factor 1 (Algorithmic Awareness):** Items Q1 through Q4 loaded cleanly and strongly onto the first factor, perfectly matching the theoretical design. This factor captures the user's explicit knowledge of data tracking and personalized recommendations.

b. **Factor 2 (UI/UX Flow Awareness):** Interestingly, items originally designed to measure "UI & Visual Design" (Q5, Q6, Q8) and "Navigation & Flow" (Q9, Q11, Q12) merged into a single, robust factor. This indicates that users perceive static visual design aesthetics and dynamic navigation flow as a unified, continuous systemic construct rather than isolated components.

c. **Factor 3 (Emotional Metacognition):** Items Q17, Q18, and Q19 loaded together, representing the user's ability to reflect on how the platform alters their emotional state (e.g., generating artificial enthusiasm).

d. **Factor 4 (Autonomy & Control):** Items Q13, Q14, and Q15 formed a distinct factor representing perceived freedom of choice and the ability to manage or ignore intrusive notifications and recommendations.

e. **Factor 5 (Persuasive Susceptibility):** Items Q16 (spontaneous usage) and Q20 (lack of reflection) formed a distinct inverse factor. These items measure a lack of control or submission to the platform's persuasive architecture. The strong negative loadings highlight a critical behavioral disconnect from the cognitive awareness measured in the other factors.

f. **Cross-loadings:** Items Q10 (rarely feeling confused) and Q7 (interface affecting comfort) exhibited problematic cross-loadings across multiple factors. This suggests that these items contain semantic ambiguity and may require refinement, rewording, or potential elimination in subsequent iterations of the UXAS (Lachner, 2019).

V. DISCUSSION

A. Interpretation of Findings and the Intention-Behavior Gap

The initial validation of the UXAS utilizing the Indonesian Shopee user pilot data provides profound and actionable insights into the psychological state of modern digital consumers. The results unequivocally demonstrate that users particularly a sample heavily skewed toward informatics, computer science, and engineering disciplines possess a remarkably high level of systemic and structural awareness regarding the platforms they inhabit. Participants scored exceptionally high on items relating to algorithmic curation (Factor 1) and the intentionality behind the UI design and user flow (Factor 2). This empirical evidence suggests that the "black box" of m-commerce personalization is, at least at a superficial, cognitive level, recognized by digitally literate users. They explicitly understand that their behavioral data, search histories, and interaction times are continuously commodified by algorithms to orchestrate their digital realities and maximize corporate revenue (López-Barranco et al., 2026).

However, the Exploratory Factor Analysis and the item-level descriptive statistics reveal a critical psychological paradox: high structural awareness of a system does not necessarily translate into high emotional regulation or behavioral autonomy. This paradox is starkly evidenced by the emergence of Factor 5 (Persuasive Susceptibility) and the high variance observed in items Q16 (spontaneous usage) and Q20 (lack of reflection). Even when users explicitly acknowledge that an application utilizes persuasive design to prolong engagement (Q12) and manipulate emotions (Q19), they frequently succumb to spontaneous, unplanned, and unrestrained usage patterns.

This phenomenon aligns deeply with advanced theories of behavioral economics concerning dark patterns, choice architecture, and cognitive load (Kanchan, 2026). Modern m-commerce applications like Shopee are masterful at exploiting System 1 heuristic thinking (Budimcic, 2023). By bombarding the user with high-density visual stimuli such as time-limited flash sales, gamified coin rewards, push notifications, and infinite scrolling feeds the platform deliberately induces a state of cognitive depletion (Gibran et al., 2026). Consequently, even users with high algorithmic awareness experience a subversion of their rational, analytical System 2 deliberation. The cognitive fatigue leads directly to the unrestrained, impulsive buying behaviors captured by the inverse loadings in the UXAS (Gavilan & Martinez-Navarro, 2022). Thus, the UXAS successfully and crucially differentiates between *cognitive awareness of the system* (knowing how the app works) and *metacognitive regulation of the self* (resisting how the app works) two highly distinct variables that are often erroneously conflated in broad digital literacy research (Talandron-Felipe & Intao, 2024).

B. Theoretical Implications for Human-Computer Interaction

The successful initial validation of the UXAS represents a necessary and timely paradigm shift within theoretical HCI research. Historically, the discipline has relied heavily on usability scales (e.g., SUS, UEQ) and technology adoption models (e.g., TAM) to measure the success, efficiency, and desirability of an interface (Schultz & Kumar, 2024). While these instruments remain vital for designers seeking to reduce transactional friction and improve utilitarian workflow, they are fundamentally inadequate for studying the complex, often adversarial contemporary realities of the digital attention economy (Rad et al., 2025). In an era where m-commerce platforms are explicitly designed to be addictive, habit-forming, and persuasive, a highly "usable" interface may simultaneously be a highly manipulative and exploitative one (Spittle et al., 2023).

The UXAS contributes significantly to the literature by formalizing the psychometric measurement of user metacognition. It theoretically situates the user not merely as a passive evaluator of software functionality, but as an active, vulnerable psychological agent navigating a hostile persuasive environment (López-Barranco et al., 2026). By integrating concepts from algorithmic awareness (Smikova, 2023), digital nudging (Kanchan, 2026), and emotional branding (Isroni Isroni et al., 2025), the UXAS provides a holistic, multidimensional framework for evaluating the psychological safety of digital environments.

Furthermore, the empirical identification of a unified "UI/UX Flow Awareness" factor (Factor 2) in the EFA provides a novel insight into user perception. The merging of static design items and dynamic flow items suggests that modern digital natives perceive design aesthetics and interaction mechanics as inextricably linked. They experience the application as a continuous experiential stream rather than a collection of separate buttons and pages. These finding challenges traditional HCI evaluative models that treat GUI visual design and information architecture as strictly separate domains, suggesting a need for more integrated approaches to UX theory (Gibran et al., 2026).

C. Practical Implications for Policy, Consumer Protection, and Ethical Design

The implications of the UXAS extend significantly beyond academic theory, offering immediate, actionable utility for policymakers, consumer protection agencies, educators, and ethical UX practitioners. Globally, regulatory bodies are actively grappling with the rapid evolution of AI-driven commerce, algorithmic opacity, and the unchecked proliferation of dark patterns (Fourberg et al., 2021). Landmark regulatory initiatives, such as the European Union's Digital Services Act (DSA), are beginning to explicitly prohibit manipulative interface designs, restrict addictive design features, and mandate algorithmic transparency to protect vulnerable consumers (Budimcic, 2023). However, the legal enforcement of such regulations requires standardized, empirical metrics to determine when a design crosses the subjective threshold from "persuasive marketing" to "deceptive manipulation."

The UXAS can serve as a vital diagnostic and evidentiary tool in this evolving regulatory landscape. By deploying the scale

across diverse demographic populations, researchers and regulators can identify specific consumer segments that exhibit low UX awareness coupled with high persuasive susceptibility. These identified groups represent the most vulnerable populations in the digital ecosystem, necessitating targeted regulatory safeguards and educational interventions (Joshi & Naik, 2026). Educational programs focused on algorithmic literacy, digital citizenship, and metacognitive reflection can utilize the UXAS as both a baseline assessment tool and a post-intervention evaluation metric to track the efficacy of their curricula in building digital resilience (McGrew & Breakstone, 2023).

For the technology sector and corporate entities, the UXAS offers a standardized framework for auditing algorithmic accountability and establishing ethical design benchmarks (Shin & Park, 2019). Platforms that prioritize long-term brand trust, customer satisfaction, and sustainable customer relationship management (CRM) over short-term, impulsive engagement metrics can utilize the UXAS to gauge their user base's comfort levels (Flores, 2025). Ensuring that users score highly on the Autonomy & Control dimensions of the UXAS can mitigate the "chilling effects" of dataveillance, prevent the privacy fatigue associated with aggressive personalization strategies, and ultimately foster a more loyal, trusting consumer base (Utami & Aimin, 2026).

D. Limitations and Directions for Future Research

While the development and initial validation of the UXAS yielded highly promising and robust preliminary results, several limitations inherent to pilot studies must be explicitly acknowledged. These limitations concomitantly pave the way for necessary future research.

Primarily, this pilot study utilized a restricted convenience sample (N = 77) entirely localized to Indonesia and specifically targeting the Shopee application. The cultural nuances of the Indonesian market characterized by a uniquely high affinity for social commerce, community-based digital engagement, and specific behavioral responses to gamification may limit the immediate generalizability of the factor structure to Western m-commerce contexts (e.g., Amazon, eBay, or Shopify-based standalone stores) (Jamalulel & Sihombing, 2026).

Furthermore, the demographic composition of the pilot sample was heavily skewed toward younger individuals with formal higher education in Information Technology and Computer Science. This inherent sampling bias likely inflated the baseline scores for algorithmic and systemic awareness (Talandron-Felipe & Intao, 2024). The digital divide is a persistent, structural reality; populations with lower digital literacy, different socioeconomic statuses, rural demographics, or older age cohorts may exhibit vastly different factor structures, lower baseline awareness levels, and potentially higher susceptibility to dark patterns (Talandron-Felipe & Intao, 2024).

Future research must prioritize executing a large-scale validation of the UXAS utilizing a geographically, socioeconomically, and demographically diverse sample. Confirmatory Factor Analysis (CFA) employing Structural Equation Modeling (SEM) is strictly required to rigorously test the absolute fit of the five-factor model derived in this exploratory study (Jamalulel & Sihombing, 2026). Additionally, longitudinal studies could employ the UXAS to track how user awareness evolves over time in response to specific platform interface updates, algorithmic shifts, or the introduction of new consumer protection legislation. Finally, specific items that exhibited problematic cross-loadings in this pilot (e.g., Q7, Q10) should undergo rigorous semantic refinement, cognitive interviewing, and re-testing to ensure they cleanly capture single latent constructs without cognitive ambiguity (Lachner, 2019).

VI. CONCLUSION

The modern digital marketplace is no longer a passive, utilitarian catalog of goods; it has evolved into a dynamic, algorithmically curated ecosystem explicitly designed to maximize user attention, harvest intimate behavioral data, and persistently nudge consumer decisions. As dominant m-commerce platforms like Shopee continue to deploy increasingly sophisticated persuasive designs, gamification strategies, and AI-driven personalization engines, the psychological autonomy and financial well-being of the consumer are increasingly placed under severe duress.

This study successfully conceptualized, developed, and conducted an initial validation of the User Experience Awareness Scale (UXAS), providing a novel, robust psychometric instrument capable of quantifying a user's metacognitive awareness of these complex digital environments. The pilot data, analyzed through rigorous Exploratory Factor Analysis, reveals a critical psychological insight: while tech-savvy, digitally literate users possess a remarkably high degree of cognitive awareness regarding how algorithms and UI elements operate systemically, this structural knowledge does not inoculate them against emotional manipulation and impulsive purchasing behavior. The cognitive depletion induced by high-density, persuasive interfaces effectively overrides systemic awareness, highlighting the profound power asymmetry between platform architects and everyday users.

By shifting the psychometric evaluative focus away from the functional usability of the system and toward the metacognitive awareness of the user, the UXAS fills a critical, glaring void in current HCI, consumer psychology, and digital ethics literature. Moving forward, the broad refinement and large-scale deployment of the UXAS hold immense potential to inform ethical design standards, guide empirical algorithmic transparency regulations, and empower vulnerable consumers through highly targeted digital literacy initiatives. Ultimately, fostering high user experience awareness is an essential, non-negotiable step toward ensuring that the future of global digital commerce remains a

domain of genuine human agency rather than a landscape of automated behavioral extraction.

REFERENCES

1. Balatero, V. A. (2025). Social Media Influencer Attributes' Impact on Generation Z Filipino Consumers' Perceived Parasocial Relationships and Purchasing Behavior. International Journal of Research and Scientific Innovation, XII(XV). https://doi.org/https://doi.org/10.51244/IJRSI.2025.1215000141P
2. Bang, C. G. (2024). UX Gap Analysis of User Experience Awareness in practitioners' perspective. Umea Universitet.
3. Budimcic, I. (2023). Casting light on dark patterns: Can customer awareness reduce unwanted purchases in E-commerce? Erasmus University Rotterdam.
4. Chan, L. L., & Idris, N. (2017). Validity and Reliability of The Instrument Using Exploratory Factor Analysis and Cronbach's alpha. International Journal of Academic Research in Business and Social Sciences, 7(10), Pages 400-410. https://doi.org/10.6007/IJARBSS/v7-i10/3387
5. Flores, J. S. (2025). The Impact of E-Commerce on Small and Medium Enterprises in the Second District of Albay. International Journal of Research and Innovation in Social Science, IX(I), 841–883. https://doi.org/10.47772/IJRISS.2025.9010072
6. Fourberg, N., Taş, S., Wiewiorra, L., Godlovitch, I., De Streel, A., Jacquemin, H., Hill, J., Nunu, M., Bourguigon, C., Jacques, F., Ledger, M., & Michael Lognoul. (2021). Online advertising: The impact of targeted advertising on advertisers, market access and consumer choice. Policy Department for Economic, Scientific and Quality of Life Policies Directorate-General for Internal Policies.
7. Gavilan, D., & Martinez-Navarro, G. (2022). Exploring user's experience of push notifications: A grounded theory approach. Qualitative Market Research: An International Journal, 25(2), 233–255. https://doi.org/10.1108/QMR-05-2021-0061
8. Gibran, M. K., Aisyah, R. N., & Harahap, L. S. (2026). Analisis Pengaruh Desain Gui Terhadap User Experience Pada Aplikasi Shopee. 7(1).
9. Isroni Isroni, Dedi Suharyadi, Sukmono Bayu Adhi, & Roy Irawan. (2025). Emotional Branding and Customer Loyalty: Gen Z in Japan and Indonesia. International Journal of Economics and Management Research, 4(1), 758–766. https://doi.org/10.55606/ijemr.v4i1.492
10. Jamalulel, I., & Sihombing, A. (2026). Does Dangdut Music as Pop Culture Influence User Engagement through Content Marketing? Evidence from Indonesian TikTok Users. Journal of Digital Marketing and Communication, 6(1). https://doi.org/10.53623/jdmc.v6i1.1247
11. Joshi, D. R., & Naik, Y. B. (2026). The Narrative Beliefs with Accordance to Free Shipping and Psychological Pain of Shipping Fees in Occurrence of Consumer Behaviour and Promotional Mechanisms. 14(1).
12. Kanchan, A. S. (2026). International Journal for Multidisciplinary Research (IJFMR). SSRN Electronic Journal, 8(1). https://doi.org/https://doi.org/10.36948/ijfmr.2026.v08i01.65702
13. Kumar, S., Malhotra, D., & Kathuria, G. (2026). Unrestrained buying behavior in the metaverse: Exploring the moderating role of technostress and self-control. Spanish Journal of Marketing - ESIC, 30(2), 167–191. https://doi.org/10.1108/SJME-07-2024-0217
14. Lachner, F. (2019). User Experience in Cross-Cultural Contexts.
15. López-Barranco, G., Povedano-Díaz, M. A., Morales-Cevallos, M. B., Rodas, J. A., Alarcón Rubio, D., Muñiz Rivas, M., & Oleas, D. (2026). Personality, Algorithmic Awareness, and Addictive Symptoms of TikTok Use in University Students. Journalism and Media, 7(2), 110. https://doi.org/10.3390/journalmedia7020110
16. Marić Stanković, A., Vuletić, J., Miletić, M., Bratić, M., & Golubović, N. (2026). Dancing with the Algorithm: Gen Z's Social Media Practices on TikTok and Instagram and Their Influence on Music Festival Experiences. Tourism and Hospitality, 7(1), 27. https://doi.org/10.3390/tourhosp7010027
17. Märtin, C., Bissinger, B. C., & Asta, P. (2023). Optimizing the digital customer journey—Improving user experience by exploiting emotions, personas and situations for individualized user interface adaptations. Journal of Consumer Behaviour, 22(5), 1050–1061. https://doi.org/10.1002/cb.1964
18. Martos, A. G., & Arana, C. S. (2020). Local Internet Connectivity Report.
19. McGrew, S., & Breakstone, J. (2023). Civic Online Reasoning Across the Curriculum: Developing and Testing the Efficacy of Digital Literacy Lessons. AERA Open, 9, 23328584231176451. https://doi.org/10.1177/23328584231176451
20. Murniyati, Hendarsih, I., Rachmah, S. M., & Yulistria, R. (2026). Comparative Analysis of E-Commerce Platform Popularity in Indonesia Using Google Trends Data. Jurnal Ilmiah Manajemen Ubhara, 8(1). https://doi.org/https://doi.org/10.31599/jmu.v8i1

21. Rad, D., Roman, A., & Rad, G. (2025). Mapping best practices and design of the whole school approach.
22. Ratanathamwat, N. (2023, January 31). 'Buy Now Pay Later' The Next Wave of Credit Products. https://www.krungsri.com/en/research/research-intelligence/buy-now-pay-later
23. Şahin Kızıl, A., Klimova, B., Pikhart, M., & Parmaxi, A. (2025). A Systematic Review of the Recent Research on the Usefulness of Chatbots for Language Education. Journal of Computer Assisted Learning, 41(2), e70001. https://doi.org/10.1111/jcal.70001
24. Schultz, C. D., & Kumar, H. (2024). ARvolution: Decoding consumer motivation and value dimensions in augmented reality. Journal of Retailing and Consumer Services, 78, 103701. https://doi.org/10.1016/j.jretconser.2023.103701
25. Shin, D., & Park, Y. J. (2019). Role of fairness, accountability, and transparency in algorithmic affordance. Computers in Human Behavior, 98, 277–284. https://doi.org/10.1016/j.chb.2019.04.019
26. Smikova, K. (2023). A Quantitative Study of the Effects of Algorithmic Recommendations on Users of Streaming Services. Liberty University.
27. Spiegel, B. (2026, June). Digital innovation drives demand for human experiences. https://www.pwc.com/gx/en/issues/business-model-reinvention/outlook/insights-and-perspectives.html
28. Spittle, B., Frutos-Pascual, M., Creed, C., & Williams, I. (2023). A Review of Interaction Techniques for Immersive Environments. IEEE Transactions on Visualization and Computer Graphics, 29(9), 3900–3921. https://doi.org/10.1109/TVCG.2022.3174805
29. Talandron-Felipe, M. M. P., & Intao, J. V. (2024). Exploring the Impact of Digital Divide on the Academic Performance of STEM Students in Hybrid Modality. International Conference on Computers in Education. https://doi.org/10.58459/icce.2024.4981
30. Terhorst, Y., Philippi, P., Sander, L. B., Schultchen, D., Paganini, S., Bardus, M., Santo, K., Knitza, J., Machado, G. C., Schoeppe, S., Bauereiß, N., Portenhauser, A., Domhardt, M., Walter, B., Krusche, M., Baumeister, H., & Messner, E.-M. (2020). Validation of the Mobile Application Rating Scale (MARS). PLOS ONE, 15(11), e0241480. https://doi.org/10.1371/journal.pone.0241480
31. Utami, R. D., & Aimin, W. (2026). Balancing Personalization, Privacy, and Value: A Systematic Literature Review of AI-Enabled Customer Experience Management. Information, 17(2), 115. https://doi.org/10.3390/info17020115