

Integrating cultural dimensions into a cognitive affective model for LMS user satisfaction in Indonesia's higher education institution

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Article history:

Received: 7 May 2026

Revised: 25 July 2026

Accepted: 27 July 2026

Published: 30 July 2026

Keywords:

Cognitive-affective

Cultural dimensions

Indonesian higher education

Learning management system

PLS-SEM

ABSTRACT

This study investigates how cultural dimensions are integrated into a cognitive-affective model to explain user satisfaction with Learning Management System (LMS) interfaces in Indonesian higher education. Using PLS-SEM with data from 348 university students across Indonesia, the study examined the effects of cognitive factors, affective factors, and cultural dimensions on satisfaction. The results show that Classical Aesthetic significantly influences Efficiency ($\beta = 0.755$, $t = 29.767$, $p < 0.05$), Expressive Aesthetic ($\beta = 0.752$, $t = 32.485$, $p < 0.05$), and Satisfaction ($\beta = 0.185$, $t = 2.559$, $p = 0.011$). Efficiency positively affects Effectiveness ($\beta = 0.744$, $t = 25.889$, $p < 0.05$) and Satisfaction ($\beta = 0.298$, $t = 4.667$, $p < 0.05$), while Effectiveness also contributes to Satisfaction ($\beta = 0.273$, $t = 4.684$, $p < 0.05$). Expressive Aesthetic strongly predicts Playfulness ($\beta = 0.804$, $t = 37.624$, $p < 0.05$), but Playfulness does not meaningfully affect Satisfaction ($\beta = 0.066$, $t = 1.364$, $p = 0.172$). Power Distance has a significant positive effect on Satisfaction ($\beta = 0.183$, $t = 3.306$, $p = 0.001$), whereas Collectivism shows no substantial influence ($\beta = -0.068$, $t = 1.694$, $p = 0.09$). Overall, the findings suggest that LMS interfaces in Indonesia should prioritize efficient navigation, structured aesthetics, and clear hierarchical organization aligned with high power distance culture, providing practical insights for culturally responsive LMS design.

DOI:

<https://doi.org/10.31315/opsi.v19i1.16832>

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1. INTRODUCTION

Learning Management Systems (LMS) have become an essential component of higher education, especially after the COVID-19 pandemic accelerated the transition from traditional and blended learning

toward fully online course delivery [1], [2]. While LMS platforms are intended to support structured, accessible, and effective online learning, student satisfaction, motivation, and engagement remain persistent challenges, especially when users face technical barriers, unfamiliar learning environments, or limited readiness for e-learning [3], [4]. In Indonesia, these challenges may be further shaped by cultural characteristics such as collectivism and high-power distance, which influence how students interact with teachers, express disagreement, and participate in online learning environments [5]. Despite the widespread adoption of LMSs, many implementations still struggle to sustain meaningful engagement, suggesting a need for deeper understanding of the cognitive, affective, and cultural factors that influence user satisfaction in Indonesian higher-education LMS contexts.

Prior research highlights efficiency, effectiveness, and usability as primary drivers of user satisfaction in digital learning environments. Similar emphasis on usability and user experience has also appeared in broader Indonesian digital-system studies, where effectiveness, efficiency, learnability, ease of use, and satisfaction are treated as important dimensions in evaluating software interaction quality [6]. For example, Aldabbas et al. [7] and Al-Marroof et al. [8] confirmed that efficiency and effectiveness strongly predict satisfaction across LMS contexts. Aesthetic design has also been studied, with evidence suggesting that classical and expressive aesthetics influence cognitive fluency and user engagement [9]. Furthermore, prior studies indicate that playfulness can enhance satisfaction and engagement in blended or LMS-supported learning environments. Gao et al [10] found that perceived playfulness of blended learning platforms contributes to students' course satisfaction through emotional engagement, while Balkaya & Akkucuk [11] shows that playfulness plays an important role in teachers' intention to adopt and use LMSs. Nevertheless, these studies primarily examine playfulness in relation to engagement, satisfaction, or adoption rather than positioning it as an affective interface-design factor within formal higher-education LMS use. In addition, most studies have been conducted outside Southeast Asian higher-education LMS contexts [10], [11], leaving limited understanding of how cultural dimensions may shape LMS interface satisfaction. Therefore, further research is needed to clarify whether playfulness meaningfully contributes to user satisfaction in structured educational LMS environments, particularly within Southeast Asia.

Addressing this gap is essential because cultural values, particularly collectivism and power distance, play an important role in shaping user expectations in Indonesian education. Without integrating these cultural dimensions, LMS design risks misalignment with learner needs. By examining cognitive, affective, and cultural factors simultaneously, this study provides a holistic understanding of user satisfaction in LMS usage. Specifically, it aims to investigate how efficiency and effectiveness contribute to satisfaction, how aesthetics shape cognitive and affective pathways, and how cultural orientations indirectly influence satisfaction through efficiency. This direction is also supported by Salma & Widyanti [12], who reviewed the application of the prior model by Coursaris & Van Osch [13] in e-learning interface design and identified aesthetics, efficiency, effectiveness, and playfulness as key constructs for understanding perceived user satisfaction. However, their work remained literature-based, leaving room for empirical validation in formal LMS environments and culturally specific contexts such as Indonesian higher education.

This study contributes to the existing literature by extending the Cognitive-Affective Model of Perceived User Satisfaction (CAMPUS) by Coursaris & Van Osch [13] into the context of higher education LMS usage in Indonesia. While the original CAMPUS model explains user satisfaction through the complementary roles of usability and aesthetics, this study expands the model by incorporating cultural dimensions, namely power distance and collectivism. By doing so, this research provides a broader theoretical perspective on LMS satisfaction by showing that users' evaluations of digital learning platforms are not only shaped by cognitive and affective system perceptions, but also by cultural values that influence how students interact with institutional technology.

2. MATERIALS AND METHODS

This study employs a comprehensive quantitative approach, using Partial Least Squares Structural Equation Modelling (PLS-SEM) to explore the relationships between cognitive, affective, and cultural dimensions influencing user satisfaction in LMS. A structured questionnaire, developed from validated instruments by Coursaris & Van Osch [13], Nordin [14], and Minkov & Hofstede [15] was disseminated online to a diverse sample comprising 348 university students from various institutions across Indonesia.

According to the conceptual model in Figure 1, this study proposes ten hypotheses based on the relationships among usability, aesthetic perception, affective experience, cultural values, and user satisfaction in the use of LMS. Efficiency is hypothesized to have a positive effect on effectiveness and user satisfaction, indicating that users who can operate the system easily and complete tasks with minimal effort are more likely to perceive the system as effective and satisfying. Effectiveness is also expected to positively influence user satisfaction, as the ability of the system to support users in achieving their goals contributes to a better overall experience. Furthermore, classical aesthetics is hypothesized to positively affect expressive aesthetics, efficiency, and user satisfaction, suggesting that a clean, orderly, and visually structured interface may improve both functional performance and users' emotional evaluation of the system. Expressive aesthetics is expected to positively influence playfulness, while playfulness is hypothesized to positively affect user satisfaction by creating a more enjoyable interaction experience. In addition, the cultural dimensions of power distance and collectivism are hypothesized to have positive effects on user satisfaction, as users' cultural values may shape their expectations, perceptions, and evaluations of the LMS.

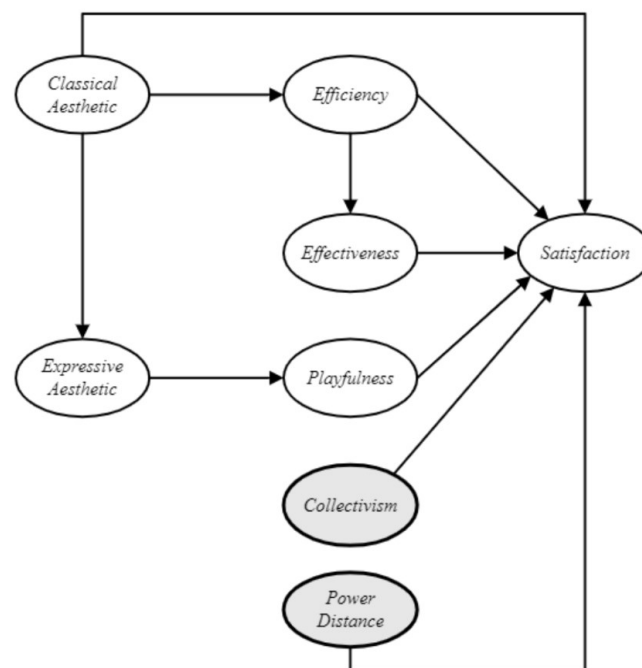


Figure 1. Conceptual model developed

The questionnaire integrated measures for classical aesthetic (orderliness, balance, visual clarity), expressive aesthetic (originality, emotional engagement, creative impact), cognitive factors (efficiency and effectiveness), affective factor (playfulness), and cultural dimensions (power distance and collectivism) as shown in the conceptual model in Figure 1. Participants rated their perceptions and satisfaction levels on a 5-point Likert scale, facilitating quantitative analysis.

This study employed a cross-sectional survey method, in which data were collected from respondents at a single point in time. The population of this study consisted of university students in Indonesia who had experience using a LMS. A pilot test with 20 respondents was conducted to ensure validity and reliability. Convergent validity was assessed using Pearson correlations, and reliability was evaluated using Cronbach's alpha, with values above 0.60 considered acceptable Hair et al. [16] Following the pilot validation, the questionnaire was distributed online via Google Forms through platforms such as WhatsApp, Instagram, and Twitter, as well as offline through direct student engagement. The data collection process was conducted from May 2023 to September 2023 with the sampling method of convenience sampling.

The minimum sample size was determined using an a priori power analysis following Cohen's statistical power framework and the PLS-SEM sample size recommendation by Hair et al. [16]. The analysis used a medium effect size, $f^2 = 0.15$, a significance level of $\alpha = 0.05$, statistical power of 0.95, and six predictors, based on the maximum number of arrows directed toward an endogenous construct. The result indicated a

minimum required sample size of approximately 146 respondents. Therefore, the target sample size was rounded up to 155 respondents, and the final sample of 348 respondents exceeded the minimum requirement.

Data were analyzed using PLS-SEM, employing SmartPLS 4.0. Data collected underwent rigorous preprocessing, including validity and reliability assessments employing Cronbach's alpha, composite reliability, and Average Variance Extracted (AVE). The discriminant validity was evaluated through the Heterotrait-Monotrait ratio (HTMT) [17]. Following validation, the structural model was assessed using SmartPLS 4.0, analyzing path coefficients, R-squared values, and Variance Inflation Factor (VIF) to determine model accuracy and multicollinearity. Additionally, one-way Analysis of Variance (ANOVA) tests were performed to identify significant differences in satisfaction across various demographic groups, thus providing nuanced insights into user satisfaction dynamics relative to cognitive, affective, and cultural dimensions within Indonesian higher education contexts.

3. RESULTS

3.1. Data Validity and Reliability

Before performing the PLS-SEM analysis, the measurement model was evaluated to confirm its validity and reliability. Cronbach's Alpha and Composite Reliability values (ρ_a and ρ_c) exceeded the recommended threshold of 0.70, indicating strong internal consistency among the indicators. The Composite Reliability values (ρ_c), which ranged from 0.836 to 0.931, further demonstrate the robustness of construct reliability. For convergent validity, all constructs achieved AVE values above the minimum threshold of 0.50, ranging from 0.562 to 0.818. These results indicate that each construct explains more than 50% of the variance in its indicators, confirming adequate convergent validity. Overall, as shown in Table 1 and Table 2, the measurement model meets the required criteria for reliability and validity.

Table 1. Variable validity evaluation

Variable	Average Variance Extracted (AVE)	Interpretation
Classical Aesthetic (CLA)	0.651	Valid
Expressive Aesthetic (EXA)	0.710	Valid
Effectiveness (EFF)	0.810	Valid
Efficiency (EFI)	0.652	Valid
Playfulness (PL)	0.781	Valid
Power Distance (PD)	0.658	Valid
Collectivism (COL)	0.562	Valid
Satisfaction (SAT)	0.818	Valid

Table 2. Variable reliability evaluation

Variable	Cronbach's Alpha	Composite Reliability (ρ_a)	Composite Reliability (ρ_c)	Interpretation
CLA	0.821	0.825	0.882	Reliable
COL	0.745	0.781	0.836	Reliable
EFF	0.766	0.769	0.895	Reliable
EFI	0.867	0.869	0.904	Reliable
EXA	0.897	0.904	0.924	Reliable
PD	0.742	0.766	0.852	Reliable
PL	0.859	0.860	0.914	Reliable
SAT	0.888	0.890	0.931	Reliable

Discriminant validity was further assessed using the HTMT as shown in Table 3. The HTMT values ranged from 0.477 to 0.916. Most construct pairs showed HTMT values below the recommended threshold of 0.90. However, three construct pairs showed values close to or slightly above 0.90, namely Classical Aesthetic

and Effectiveness 0.903, Effectiveness and Efficiency 0.904, and Expressive Aesthetic and Playfulness 0.916. These results indicate that the constructs were generally distinguishable, although several relationships should be interpreted with caution. The discriminant validity assessment was further supported by the AVE results, where all constructs had AVE values above 0.50, and by the reliability results, where Cronbach's alpha, ρ_a , and ρ_c values were above the recommended threshold.

Table 3. HTMT values

Construct	CLA	COL	EFF	EFI	EXA	PD	PL	SAT
CLA	-							
COL	0.576	-						
EFF	0.903	0.585	-					
EFI	0.894	0.575	0.904	-				
EXA	0.862	0.587	0.720	0.707	-			
PD	0.785	0.646	0.737	0.671	0.638	-		
PL	0.775	0.591	0.749	0.688	0.916	0.584	-	
SAT	0.853	0.477	0.895	0.845	0.694	0.747	0.667	-

3.2. Partial Least Square - SEM

The R^2 results shown in Table 4 that the proposed model has moderate to substantial explanatory power. The model explains 55.4% of the variance in effectiveness, 57.0% of the variance in efficiency, and 56.5% of the variance in expressive aesthetic, indicating that the predictor variables provide moderate explanatory power for these constructs. Furthermore, the model explains 64.6% of the variance in playfulness, suggesting a relatively strong explanatory capacity. The highest R^2 value is found in user satisfaction, with 68.1% of its variance explained by the model. This indicates that the combination of usability, aesthetic, affective, and cultural variables provide substantial explanatory power in predicting LMS user satisfaction.

Table 4. R-squared values and interpretation

Endogenous Variable	R^2	Adjusted R^2	Interpretation
Effectiveness	0.554	0.553	Moderate
Efficiency	0.570	0.569	Moderate
Expressive Aesthetic	0.565	0.564	Moderate
Playfulness	0.646	0.645	Moderate to substantial
Satisfaction	0.681	0.676	Substantial

The VIF results show that all indicator values range from 1.348 to 3.371. Since all VIF values are below the commonly accepted threshold of 5.00, the results indicate that there is no serious multicollinearity issue among the indicators. This means that the indicators do not excessively overlap with one another and are suitable for further analysis in the PLS-SEM model. Therefore, the structural model estimation is not biased by collinearity problems.

The structural model results shown in Figure 2 indicate that most of the hypothesized relationships are statistically significant and positive. Classical Aesthetic has a strong positive effect on Efficiency ($\beta = 0.755$, $p < 0.01$) and Expressive Aesthetic ($\beta = 0.752$, $p < 0.01$), and it also has a direct positive effect on Satisfaction ($\beta = 0.185$, $p < 0.05$). Efficiency significantly influences Effectiveness ($\beta = 0.744$, $p < 0.01$) and directly affects Satisfaction ($\beta = 0.298$, $p < 0.01$). Effectiveness also contributes positively to Satisfaction ($\beta = 0.273$, $p < 0.01$). Furthermore, Expressive Aesthetic has a strong positive effect on Playfulness ($\beta = 0.804$, $p < 0.01$).

For the cultural dimensions, Power Distance positively and significantly affects Satisfaction ($\beta = 0.183$, $p < 0.01$), while Collectivism shows no significant effect on Satisfaction ($\beta = -0.075$, $p > 0.05$). Likewise, Playfulness does not exert a significant direct influence on Satisfaction ($\beta = 0.068$, $p > 0.05$). For the measurement model, all indicator loadings exceed the recommended threshold of 0.70 and are statistically

significant ($p < 0.01$), confirming good indicator reliability. Overall, the findings suggest that aesthetic factors influence Satisfaction both directly and indirectly through Efficiency and Effectiveness, while cultural factors show mixed effects.

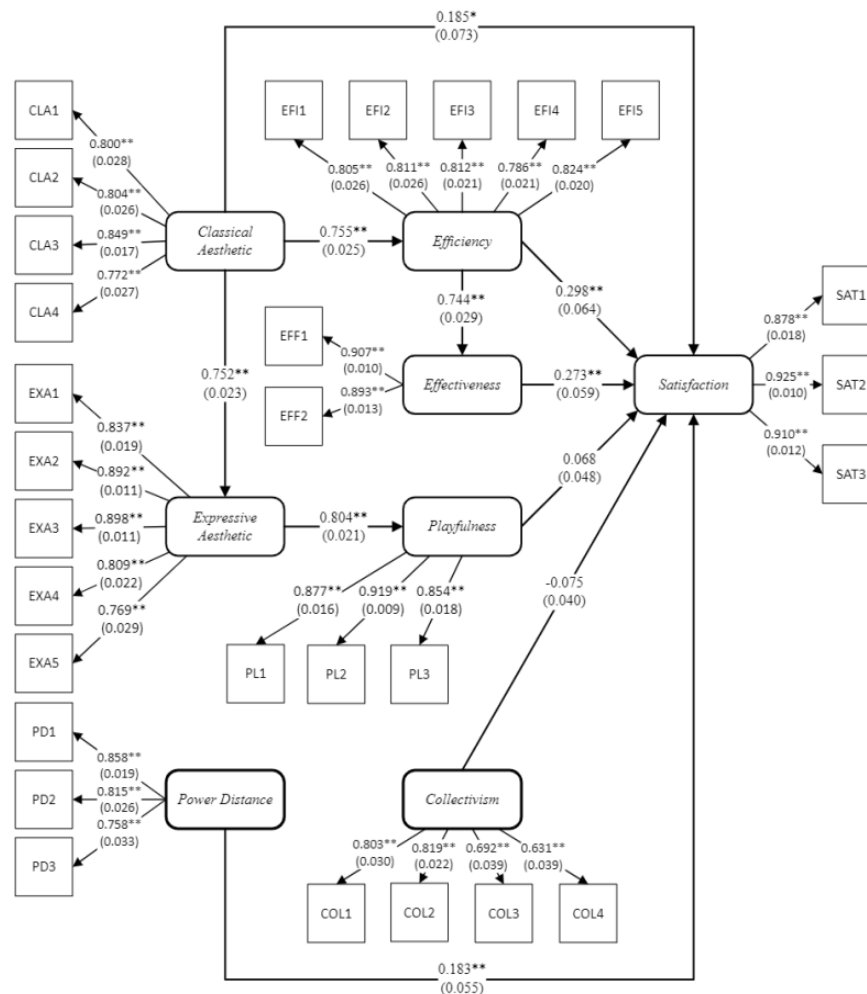


Figure 2. Integrated structural model of cultural dimension and cognitive-affective aspects

Taken together, the results emphasize that efficiency is the central mediator linking aesthetics and cultural orientations to satisfaction. Classical aesthetics contribute by enhancing efficiency, which subsequently improves effectiveness and satisfaction. In contrast, playfulness, though supported by expressive aesthetics, does not translate into higher satisfaction in formal LMS usage. For practitioners, this highlights the importance of prioritizing clarity, usability, and task performance over hedonic features when designing LMS interfaces for educational contexts, especially in collectivist cultures such as Indonesia.

The results of the structural model as displayed in Figure 2, show that most of the proposed relationships are statistically significant. Classical Aesthetic has a significant positive effect on Efficiency ($\beta = 0.755$, $t = 29.767$, $p < 0.05$) and Expressive Aesthetic ($\beta = 0.752$, $t = 32.485$, $p < 0.05$), as well as a smaller but significant direct effect on Satisfaction ($\beta = 0.185$, $t = 2.559$, $p = 0.011$). Efficiency significantly influences Effectiveness ($\beta = 0.744$, $t = 25.889$, $p < 0.05$) and Satisfaction ($\beta = 0.297$, $t = 4.667$, $p < 0.05$). Effectiveness also has a significant positive effect on Satisfaction ($\beta = 0.273$, $t = 4.684$, $p < 0.05$). Furthermore, Expressive Aesthetic significantly affects Playfulness ($\beta = 0.804$, $t = 37.624$, $p < 0.05$), and Power Distance shows a significant positive effect on Satisfaction ($\beta = 0.180$, $t = 3.306$, $p = 0.001$).

However, COL does not have a significant effect on Satisfaction (SAT) ($\beta = -0.068$, $t = 1.694$, $p = 0.090$), and PL does not significantly influence SAT ($\beta = 0.066$, $t = 1.364$, $p = 0.172$). Overall, the findings suggest that aesthetic and efficiency-related constructs play a substantial role in shaping satisfaction, while collectivism and playfulness do not directly contribute to satisfaction in this model as stated in Table 5.

Table 5. Significance of each model path

Model Path	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	T Statistics (O/STDEV)	P-value	Conclusion
CLA → EFI	0.755	0.756	0.025	29.767	< 0.05	Significant
CLA → EXA	0.752	0.753	0.023	32.485	< 0.05	Significant
CLA → SAT	0.185	0.185	0.072	2.559	0.011	Significant
COL → SAT	-0.068	-0.064	0.04	1.694	0.09	Not Significant
EFF → SAT	0.273	0.271	0.058	4.684	< 0.05	Significant
EFI → EFF	0.744	0.746	0.029	25.889	< 0.05	Significant
EFI → SAT	0.297	0.3	0.064	4.667	< 0.05	Significant
EXA → PL	0.804	0.804	0.021	37.624	< 0.05	Significant
PD → SAT	0.183	0.177	0.055	3.306	0.001	Significant
PL → SAT	0.066	0.067	0.048	1.364	0.172	Not Significant

The indirect effect analysis was conducted to examine the mediating relationships in the structural model. The results show that several indirect relationships were significant. Efficiency had a significant indirect effect on satisfaction through effectiveness ($\beta = 0.203$, $t = 4.766$, $p < 0.001$), indicating that an efficient LMS can improve user satisfaction by increasing users' perception of system effectiveness. Classical aesthetic also had a significant indirect effect on satisfaction through effectiveness ($\beta = 0.153$, $t = 4.777$, $p < 0.001$) and through efficiency ($\beta = 0.224$, $t = 4.499$, $p < 0.001$). These findings suggest that a clean, orderly, and visually structured LMS interface can improve functional user experience, which subsequently enhances satisfaction. In addition, classical aesthetic significantly influenced effectiveness through efficiency ($\beta = 0.562$, $t = 16.271$, $p < 0.001$) and influenced playfulness through expressive aesthetic ($\beta = 0.604$, $t = 21.603$, $p < 0.001$). However, the indirect effect of expressive aesthetic on satisfaction through playfulness was not significant ($\beta = 0.053$, $t = 1.352$, $p = 0.176$). Similarly, the indirect effect of classical aesthetic on satisfaction through expressive aesthetic and playfulness was not significant ($\beta = 0.040$, $t = 1.349$, $p = 0.178$). These results indicate that the functional pathway involving efficiency and effectiveness plays a stronger mediating role in explaining user satisfaction than the affective pathway involving expressive aesthetic and playfulness.

3.3. ANOVA

The ANOVA results, as it shown in Table 6, indicate that gender does not significantly influence satisfaction levels ($F = 0.617$, $p = 0.433$). Although male respondents ($M = 3.905$, $SD = 0.810$) reported slightly higher satisfaction than female respondents ($M = 3.825$, $SD = 0.916$), the observed difference does not reach statistical significance. This suggests that satisfaction with the LMS does not differ meaningfully between male and female users.

Table 6. ANOVA table of demographic data

Demographics	Category	Mean	Std. Deviation	F	Sig	Conclusion
Gender	Female	3.825	0.916	0.617	0.433	Not significant
	Male	3.905	0.81	0.617	0.433	Not significant
Age	<20	3.623	0.94	6.552	0.002	Significant
	20-23	3.914	0.859	6.552	0.002	Significant
	>23	4.078	0.766	6.552	0.002	Significant
LMS Usage	<10	3.803	0.883	1.76	0.174	Not significant
Frequency	10-20	3.815	0.882	1.76	0.174	Not significant
	>20	4.04	0.882	1.76	0.174	Not significant

In contrast, age shows a statistically significant effect on satisfaction ($F = 6.552$, $p = 0.002$). Respondents aged over 23 years reported the highest level of satisfaction ($M = 4.078$, $SD = 0.766$), followed by those aged 20–23 years ($M = 3.914$, $SD = 0.859$), while respondents under 20 years reported the lowest satisfaction ($M = 3.623$, $SD = 0.940$). These findings suggest that satisfaction with the LMS tends to increase with age. However, post hoc pairwise comparisons were not conducted for this analysis; based on the descriptive means, the significant overall difference is likely driven primarily by the gap between the youngest (<20) and oldest (>23) age groups, which represent the lowest and highest satisfaction scores, respectively. Future research incorporating post hoc testing is needed to confirm which specific age group comparisons account for this difference.

Regarding LMS usage frequency, no significant differences were found among the groups ($F = 1.760$, $p = 0.174$). Although respondents who used the LMS more than 20 times reported slightly higher satisfaction ($M = 4.040$, $SD = 0.882$) compared to those with lower usage frequencies, the differences are not statistically significant. Therefore, satisfaction levels appear to be relatively consistent regardless of LMS usage frequency.

4. DISCUSSION

Prior research highlights efficiency, effectiveness, and usability as central determinants of user satisfaction in digital learning environments. The prior cognitive–affective model by Coursaris & Van Osch [13] provides a useful foundation for this relationship by demonstrating that efficiency significantly predicts effectiveness and that both cognitive dimensions contribute to perceived user satisfaction. This logic is consistent with LMS-related studies showing that system quality, perceived usefulness, ease of use, and learning-system effectiveness are important predictors of satisfaction and continued use in online learning environments [7], [17], [18]. In the present study, the cognitive pathway was similarly confirmed, with efficiency significantly influencing effectiveness ($\beta = 0.744$, $p < 0.001$), while efficiency ($\beta = 0.297$, $p < 0.05$) and effectiveness ($\beta = 0.273$, $p < 0.05$) both positively influenced user satisfaction. These findings suggest that efficient LMS interfaces can improve students' perceptions of task completion and overall system satisfaction. Thus, the cognitive structure proposed by Coursaris & Van Osch [13] appears transferable to LMS interface design, while the present study extends its relevance to a formal higher-education setting within the Indonesian cultural context.

Aesthetic design has also been widely recognized as an important factor in shaping users' perceptions of interface quality and experience. Lavie & Tractinsky [9] distinguished between classical aesthetics, which refers to orderly, clear, and clean visual design, and expressive aesthetics, which reflects creativity, originality, and visual richness. Building on this distinction, the prior model by Coursaris & van Osch [13] shows that classical aesthetics significantly influenced expressive aesthetics ($\beta = 0.649$, $p < 0.001$), efficiency ($\beta = 0.617$, $p < 0.001$), and satisfaction ($\beta = 0.311$, $p < 0.001$). This supports the idea that visually organized and harmonious interfaces can reduce perceived effort and improve user satisfaction. The present study produced a similar but contextually nuanced pattern, in which classical aesthetics significantly influenced expressive aesthetics ($\beta = 0.752$, $p < 0.05$), efficiency ($\beta = 0.755$, $p < 0.05$), and user satisfaction ($\beta = 0.185$, $p < 0.05$). Compared with the prior model by Coursaris & van Osch [13], the stronger effect of classical aesthetics on efficiency in the Indonesian LMS context suggests that clean, structured, and cognitively fluent interface design may be especially important in formal learning environments.

In addition to usability and aesthetics, playfulness has been discussed as an affective factor that may enhance engagement and satisfaction in digital learning environments. Gao et al. [10] found that perceived playfulness in blended learning platforms contributes to students' course satisfaction through engagement, while Balkaya & Akkucuk [11] shows that playfulness significantly contributes to teachers' intention to adopt and use LMSs. Similarly, Coursaris & Van Osch [13] found that expressive aesthetics strongly predicted playfulness ($\beta = 0.747$, $p < 0.001$), and that playfulness significantly predicted satisfaction, although its effect was relatively small ($\beta = 0.136$, $p < 0.001$). In contrast, the present study found that expressive aesthetics strongly influenced playfulness ($\beta = 0.804$, $p < 0.05$), but playfulness did not affect user satisfaction significantly ($\beta = 0.066$, $p = 0.172$). This comparison suggests that while expressive and creative interface elements may successfully evoke playful perceptions, playfulness may not necessarily translate into satisfaction in formal LMS settings. Therefore, the present study refines the prior cognitive–affective model by showing that the pathway from expressive aesthetics to playfulness remains relevant, but the final link from playfulness to satisfaction may be context-dependent, particularly in structured higher-education LMS environments.

Although the prior model by Coursaris & Van Osch [13] offers a strong basis for explaining the complementary effects of usability and aesthetics, it does not explicitly account for cultural dimensions such as power distance and collectivism. This creates an opportunity to extend the model into Southeast Asian educational contexts, where cultural expectations may influence how students evaluate structure, hierarchy, collaboration, and interface clarity. This extension is particularly relevant because prior reviews of collaborative online learning in Southeast Asia emphasize that culture shapes how students interact in online learning environments, while Indonesian studies show that students' online learning experiences are influenced by cultural expectations, respect for teachers, and reluctance to express dissatisfaction openly [19], [20]. In the present study, power distance exhibited a positive and statistically significant impact on user satisfaction ($\beta = 0.180$, $t = 3.306$, $p = 0.001$), indicating that structured and formally organized interfaces may align well with cultural expectations in Indonesia. This finding is consistent with broader argument that cultural values can influence technology acceptance and evaluation in learning environments [22]. Conversely, collectivism did not significantly influence satisfaction ($\beta = -0.068$, $p = 0.09$), differing from prior e-learning acceptance research showing that individualism–collectivism can moderate the influence of social norms on students' intention to use e-learning systems [22], [23]. That suggest collectivist orientations may support collaborative or socially mediated online learning. This contrast highlights the complexity of cultural influences in educational technology and suggests that collectivism may operate differently depending on the institutional setting, interface design, and degree of peer interaction supported by the LMS.

Further demographic analysis using ANOVA revealed significant differences in satisfaction across age groups ($F(3, 344) = 4.56$, $p < 0.05$), with notably lower satisfaction among users under 20 years old. This finding suggests that younger users may have different expectations toward LMS interfaces, particularly regarding perceived usefulness, task–technology fit, ease of use, and responsiveness. Pal & Patra [25] similarly shows that students' evaluation of video-based learning during COVID-19 was shaped by TAM and TTF-related factors, including perceived usefulness, ease of use, and fit between technology and learning tasks. Taken together, the findings indicate that LMS satisfaction in Indonesia is shaped not only by cognitive usability and aesthetic quality, as suggested by Coursaris & Van Osch [13], but also by cultural and demographic factors.

These comparative insights confirm and contextualize the present study's findings, emphasizing LMS designs tailored to Indonesian contexts must prioritize cognitive efficiency, effectiveness, classical aesthetics, and structured designs reflective of high-power distance cultural norms. The nuanced understanding of playfulness and collectivism also provides valuable guidance for interface priorities in Indonesian higher education LMS designs.

Theoretically, this study extends the original CAMPUS model by contextualizing it within the higher education LMS environment and by integrating cultural dimensions into the cognitive-affective explanation of user satisfaction. The original CAMPUS model emphasizes the role of usability, aesthetics, and playfulness in shaping perceived user satisfaction. This study supports the relevance of these dimensions in LMS usage, but also demonstrates that cultural values can further explain user satisfaction in educational technology contexts. In particular, the significant effect of power distance indicates that students' satisfaction with LMS may be influenced by hierarchical academic culture and expectations toward institutionally provided learning systems. Meanwhile, the non-significant effect of collectivism suggests that collective cultural orientation may not directly determine LMS satisfaction, indicating that cultural dimensions may operate differently depending on the type of technology and usage context. Therefore, this study contributes to the CAMPUS literature by extending the model from a general IS design context to a culturally embedded LMS context in Indonesian higher education.

Despite these, this study has few limitations. First, because the study uses a cross-sectional design, it cannot determine causal relationships over time between variables; future longitudinal or experimental studies could provide stronger evidence of causality. Second, the use of self-reported survey data may lead to potential biases, including social desirability bias and acquiescence bias. Third, the sample was limited to Indonesian university students, which may constrain the generalizability of findings to other cultural or institutional contexts. Fourthly, the perceived academic workload resulting from the use of e-learning needs to be taken into account, as done by Widyanti et al. [26]. Fifth, although the ANOVA results indicated a significant effect of age on satisfaction, post hoc pairwise comparisons could not be conducted due to data availability constraints; consequently, the specific age groups driving this difference could not be statistically confirmed, and future studies should replicate this comparison with post hoc testing to clarify which group

differences are responsible for the observed effect. Finally, playfulness was measured within the constraints of formal LMS environments; future studies could expand this to hybrid or gamified learning platforms to better capture its potential role.

Beyond these limitations, several speculative insights emerge. The weak effect of collectivism may reflect the dominant role of institutional structures in Indonesian universities, where LMS platforms are often standardized and top-down, reducing the room for peer-driven collectivist behaviors to shape satisfaction. Similarly, the stronger influence of power distance may suggest that students prefer clear and structured LMS interfaces that mirror broader societal hierarchies, an effect that may not be as pronounced in low power distance cultures. Future comparative research across Southeast Asian countries could clarify whether these findings are unique to Indonesia or indicative of broader regional trends.

5. CONCLUSION

This study has developed and empirically validated an integrated cognitive-affective model of user satisfaction, explicitly considering Indonesian cultural dimensions within LMS interface design. The findings underscore that efficiency and effectiveness, critical cognitive factors, significantly enhance user satisfaction, reinforcing the imperative of creating intuitive, efficient, and functional LMS interfaces. The robust relationship observed between classical aesthetics and user satisfaction further highlights the importance of visual harmony, clarity, and structured aesthetics in facilitating positive user experiences.

Significantly, the incorporation of cultural dimensions has provided new insights. Power distance was found to positively influence user satisfaction, revealing the cultural preference among Indonesian users for structured, hierarchical, and formally organized interfaces. This aligns with cultural expectations for clearly defined authority and roles, suggesting the need for interface designs that reflect organizational and instructional hierarchies clearly.

Conversely, collectivism did not exhibit a significant effect on satisfaction, challenging assumptions commonly held regarding collectivist societies. This indicates that within formal educational contexts, Indonesian users may prioritize individual functionality and structured navigation over communal or collaborative elements typically associated with collectivist cultures.

Demographic analysis further emphasized generational considerations, revealing lower satisfaction among younger users. This demographic insight suggests evolving expectations towards more dynamic, interactive designs, yet balanced with clear structure and efficient navigation which highlight a crucial area for future research and development.

The originality of this research lies in the integration of Indonesian cultural dimensions into a comprehensive cognitive-affective model, extending current understanding and providing a culturally responsive approach to LMS design. Practically, this study offers actionable guidance for educational technology developers and institutions, emphasizing the critical elements of efficiency, effectiveness, and structured aesthetics aligned with high power distance cultural contexts. By doing so, it advances both theoretical frameworks and practical LMS development, fostering enhanced user satisfaction and improved educational outcomes in Indonesia and similar cultural contexts globally.

Future research is encouraged to explore additional cultural dimensions, longitudinal changes in user expectations, and cross-cultural comparisons to further enrich the understanding of LMS user satisfaction dynamics.

ACKNOWLEDGMENT

The authors would like to express their gratitude to the four universities that collaboratively supported this research, the Department of Industrial Engineering at Institut Teknologi Kalimantan, the Department of Industrial Engineering and Management at Institut Teknologi Bandung, and the Department of Industrial Engineering at UPN Veteran Yogyakarta, and the Department of Industrial Engineering at Universitas Jenderal Achard Yani for their invaluable contributions, including access to participants, facilities, and administrative support.

REFERENCES

- [1] M. A. Camilleri & A. C. Camilleri, "The Acceptance of Learning Management Systems and Video Conferencing Technologies: Lessons Learned from COVID-19," *Technol. Knowl. Learn.*, vol. 27, no. 4,

- pp. 1311–1333, 2022, doi: 10.1007/s10758-021-09561-y.
- [2] M. M. Navarro, Y. T. Prasetyo, M. N. Young, R. Nadlifatin, & A. A. Redi, “The Perceived Satisfaction in Utilizing Learning Management System among Engineering Students during the COVID-19 Pandemic: Integrating Task Technology Fit and Extended Technology Acceptance Model,” *Sustainability*, vol. 13, no. 19, p. 10669, 2021. doi: 10.3390/su131910669.
 - [3] N. Cavus, Y. B. Mohammed, & M. N. Yakubu, “Determinants of Learning Management Systems during COVID-19 Pandemic for Sustainable Education,” *Sustainability*, vol. 13, no. 9, p. 5189, 2021. doi: 10.3390/su13095189.
 - [4] W. Wagiran, S. Suharyana, M. Nurtanto, & F. Mutohhari, “Determining the e-learning readiness of higher education students: A study during the COVID-19 pandemic,” *Heliyon*, vol. 8, no. 10, Oct. 2022, doi: 10.1016/j.heliyon.2022.e11160.
 - [5] N. Hanoum & H. Silvana, “Instructional Needs Analysis and Cultural Values in Online Learning,” *Int. J. Educ.*, vol. 12, pp. 9–15, Aug. 2019, doi: 10.17509/ije.v12i1.17776.
 - [6] A. Wibowo *et al.*, “A comprehensive usability study of 3D printing slicer software: Integrating SUS, USE questionnaire, and key UX dimensions,” *OPSI*, vol. 18, pp. 321–336, Dec. 2025, doi: 10.31315/opsi.v18i2.15537.
 - [7] H. Aldabbas, A. M. Elamin, A. Z. E. Ahmed, & L. Gernal, “Assessing Learning Management System success in the UAE universities: how quality measures linked to students’ academic performance,” *Front. Educ.*, vol. Volume 10-2025, 2025, doi: 10.3389/educ.2025.1554641.
 - [8] R. Al-Maroofo *et al.*, “The Effectiveness of Online Platforms after the Pandemic: Will Face-to-Face Classes Affect Students’ Perception of Their Behavioural Intention (BIU) to Use Online Platforms?,” *Informatics*, vol. 8, p. 83, Nov. 2021, doi: 10.3390/informatics8040083.
 - [9] T. Lavie & N. Tractinsky, “Assessing dimensions of perceived visual aesthetics of web sites,” *Int. J. Hum. Comput. Stud.*, vol. 60, no. 3, pp. 269–298, 2004, doi: <https://doi.org/10.1016/j.ijhcs.2003.09.002>.
 - [10] W. Gao, J. Jiang, & Y. Tang, “The effect of blended learning platform and engagement on students’ satisfaction: the case from the tourism management teaching,” *J. Hosp. Leis. Sport Tour. Educ.*, vol. 27, p. 100272, Nov. 2020, doi: 10.1016/j.jhlste.2020.100272.
 - [11] S. Balkaya & U. Akkucuk, “Adoption and Use of Learning Management Systems in Education: The Role of Playfulness and Self-Management,” *Sustainability*, vol. 13, no. 3, p. 1127, 2021. doi: 10.3390/su13031127.
 - [12] M. Salma & A. Widyanti, “Cognitive-Affective Model of Perceived User Satisfaction (CAMPUS) on the Design of E-Learning Interface: A Literature Review,” in *Proceedings of the 6th Asia Pacific Conference on Manufacturing Systems and 4th International Manufacturing Engineering Conference*, Springer Nature Singapore, Sep. 2023, pp. 549–558. doi: 10.1007/978-981-99-1245-2_51.
 - [13] C. K. Coursaris & W. van Osch, “A Cognitive-Affective Model of Perceived User Satisfaction (CAMPUS): The complementary effects and interdependence of usability and aesthetics in IS design,” *Inf. Manag.*, vol. 53, no. 2, pp. 252–264, 2016, doi: <https://doi.org/10.1016/j.im.2015.10.003>.
 - [14] H. Nordin, D. Singh, Z. Mansor, & E. Yadegaridehkordi, “Impact of Power Distance Cultural Dimension in E-Learning Interface Design Among Malaysian Generation Z Students,” *IEEE Access*, vol. 10, p. 1, Jan. 2022, doi: 10.1109/ACCESS.2022.3183117.
 - [15] G. Hofstede & M. Minkov, “Value Survey Module,” *Tech. Rep.*, no. May, pp. 1–17, 2013.
 - [16] J. Hair, G. T. M. Hult, C. Ringle, M. Sarstedt, N. Danks, & S. Ray, *Partial Least Squares Structural Equation Modeling (PLS-SEM) Using R: A workbook*. Springer US, 2021.
 - [17] J. F. Hair, C. M. Ringle, & M. Sarstedt, *Review of Partial Least Squares Structural Equation Modeling (PLS-SEM) Using R: A Workbook*, vol. 30, no. 1. New York: Springer, 2021. doi: 10.1080/10705511.2022.2108813.
 - [18] B. Bervell & I. N. Umar, “Blended learning or face-to-face? Does Tutor anxiety prevent the adoption of Learning Management Systems for distance education in Ghana?,” *Open Learn. J. Open, Distance e-Learning*, vol. 35, no. 2, pp. 159–177, May 2020, doi: 10.1080/02680513.2018.1548964.
 - [19] A. Bossman & S. Agyei, “Technology and Instructor Dimensions, e-Learning Satisfaction, and Academic Performance of Distance Students in Ghana,” *Heliyon*, vol. 8, p. e09200, Apr. 2022, doi: 10.1016/j.heliyon.2022.e09200.

- [20] C. Grothaus & O. Zawacki-Richter, "Collaborative Online Learning in the Cultural Context of South East Asia: A Systematic Review," *Hacettepe Univ. J. Educ.*, pp. 1–20, Jul. 2020, doi: 10.16986/HUJE.2020062020.
- [21] J. Usman, Z. Zainuddin, T. Zulfikar, D. Lugendo, & Y. Yusuf, "When online learning and cultural values intersect: Indonesian EFL students' voices," *Issues Educ. Res.*, vol. 32, p. 2022, Oct. 2022.
- [22] P. Ifinedo, J. Pyke, & A. Anwar, "Business undergraduates' perceived use outcomes of Moodle in a blended learning environment: The roles of usability factors and external support," *Telemat. Informatics*, vol. 35, no. 1, pp. 93–102, 2018, doi: <https://doi.org/10.1016/j.tele.2017.10.001>.
- [23] A. Tarhini, K. Hone, X. Liu, & T. Tarhini, "Examining the moderating effect of individual-level cultural values on users' acceptance of E-learning in developing countries: a structural equation modeling of an extended technology acceptance model," *Interact. Learn. Environ.*, vol. 25, no. 3, pp. 306–328, Apr. 2017, doi: 10.1080/10494820.2015.1122635.
- [24] M. Aparicio, F. Bação, & T. Oliveira, "Cultural impacts on e-learning systems' success," *Internet High. Educ.*, vol. 31, pp. 58–70, Jun. 2016, doi: 10.1016/j.iheduc.2016.06.003.
- [25] D. Pal & S. Patra, "University Students' Perception of Video-Based Learning in Times of COVID-19: A TAM/TTF Perspective," *Int. J. Human-Computer Interact.*, vol. 37, no. 10, pp. 903–921, Jun. 2021, doi: 10.1080/10447318.2020.1848164.
- [26] A. Widyanti & J. Park, "e-Learning readiness and perceived learning workload among students in an Indonesian university Bandung Institute of Technology (ITB), Indonesia," *Knowl. Manag. E -Learning*, vol. 12, no. 1, pp. 18–29, 2020, [Online]. Available: <https://www.kmel-journal.org/ojs/index.php/online-publication/article/view/431>

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