Amorti: Jurnal Studi Islam Interdisipliner
Vol. 5, No. 3, Juli2026,pp. 1257-1274
http://journal.amorfati.id/index.php/amorti | | ISSN 2962-9209

Interdisciplinary Scope of Contemporary Islamic Studies • Interdisciplinary Islamic Education • Interdisciplinary Islamic Law, Ethics, and Fatwa Studies • Interdisciplinary Islamic Economics, Finance, and Philanthropy • Islam, Society, and Culture • Islam, Politics, Governance, and Public Policy • Islam, Gender, Family, and Human Rights • Islam, Media, Communication, and Digital Da'wah • Islam, Health, Environment, and Sustainable Development • Islam, Science, Technology, Artificial Intelligence, and Digital Transformation

Predicting Cognitive Resilience through Digital Dependency in Islamic Religious Education: Insights from an Integrated Islamic Elementary School

Jimi Harianto [a,1,*], Deswita Tri Andayani [b,2], Dinda Mufida [c,3], Mulya Rahma Sari [d,4], Chelsea Ganesa[e,5] Rachmat Dody Ariesna [f,6]

[*a,b,c,d,e,f] STKIP Al Islam Tunas Bangsa, Indonesia
[1]jimiharianto@stkipalitb.ac.id; [2]deswitatriandayani22@gmail.com; [3]ddindasyam@gmail.com; [4]mulyarahmasarisakal@gmail.com;[5] Chelseaganesa@gmail.com
*Jimi Harianto; [1]jimiharianto@stkipalitb.ac.id;

ARTICLE INFO

Article history
Received:
02-05-2026
Revised:
24-06-2026
Accepted:
13-07-2026

Keywords
Digital dependency; Cognitive resilience; Islamic Religious Education; Digital well-being; Student well-being

ABSTRACT

The proliferation of digital devices among Indonesian elementary school children presents a growing concern for Islamic Religious Education (IRE), a subject that fundamentally demands sustained attention, memorization accuracy, and deep textual reflection—capacities collectively termed cognitive resilience. Despite mounting evidence linking excessive screen time to cognitive impairment, no empirical study has examined whether digital dependency specifically predicts lower cognitive resilience in faith-based elementary settings. This quantitative correlational study surveyed 124 fourth-grade students from four intact classes (Class A=30, B=30, C=32, D=32) at an integrated Islamic elementary school in Bandar Lampung, Indonesia, using validated instruments for digital dependency and IRE-specific cognitive resilience. Pearson correlation and simple linear regression analyses revealed a significant negative relationship (*r* = -0.52, *p* < 0.001), with digital dependency accounting for 27% of cognitive resilience variance (R^2 = 0.27, F (1,122) = 45.16, *p* < 0.001). Each one-unit increase in digital dependency predicted a 0.43-unit decrease in cognitive resilience. These robust findings confirm that habitual digital engagement systematically erodes the cognitive capacities essential for mastering IRE content. The study advocates for embedding digital-wellness strategies within IRE pedagogy, shifting from prohibition toward mindful consumption to safeguard students' cognitive and religious development.

Keywords: *Digital dependency; Cognitive resilience; Islamic Religious Education; Digital well-being; Student well-being*

Introduction

The rapid integration of digital technology into children's daily lives has created an unprecedented paradox for Islamic Religious Education (*Pendidikan Agama Islam*/PAI) in Indonesia. PAI is a compulsory subject that fundamentally demands cognitive resilience—the capacity to sustain focused attention, retain memorized content accurately, and engage in deep textual and theological reflection. Yet, the same digital devices that offer educational opportunities are increasingly implicated in eroding these very cognitive capacities. Indonesian children aged 5–12 years now spend an average of 4–6 hours daily on digital devices, with internet penetration reaching 79.5% nationally (Indonesia, 2024; Kominfo, 2023). While digital technology provides undeniable benefits, its excessive and unregulated use has given rise to digital dependency, a maladaptive pattern characterized by compulsive device use, diminished self-control, and continued engagement despite negative consequences (Andreassen et al., 2017). This dependency has been consistently linked to impairments in sustained attention, working memory, and deep information processing (Firth et al., 2019; Limone & Toto, 2022; Wilmer et al., 2017) precisely the cognitive foundations required for PAI mastery.

The urgency of this inquiry becomes particularly acute when considering the unique cognitive ecosystem of integrated Islamic elementary schools (*Sekolah Dasar Islam Terpadu*/SD IT). Unlike regular schools, SD IT institutions implement a dual-curriculum model that combines the full national curriculum with an enriched Islamic studies program. Students must simultaneously master general academic subjects and an expanded body of religious knowledge, including longer Qur'anic passages, Hadith, and classical Islamic texts. This dual-curriculum model creates a cognitively demanding environment where sustained attention, memorization capacity, and cognitive persistence are not merely advantageous but essential for academic survival. Consequently, any factor that systematically undermines cognitive resilience poses a significant threat to PAI learning objectives. If the relationship between digital dependency and cognitive resilience remains empirically unclear, three tangible consequences will persist: (a) students will continue to experience declining Qur'anic memorization and shallow theological understanding without understanding the root cause; (b) teachers will lack evidence to distinguish between pedagogical difficulties and cognitive impairments stemming from digital overuse; and (c) curriculum policies will proceed without data-driven intervention strategies, rendering efforts to produce academically and religiously competent graduates increasingly ineffective.

To date, empirical evidence on the specific relationship between digital dependency and cognitive resilience in PAI learning remains conspicuously absent. Global meta-analyses have firmly established the negative effects of excessive screen time on executive functions, academic achievement, and attentional capacity. Sohn et al. (2019), in a systematic review and meta-analysis published in *BMC Psychiatry*, analyzed 41 studies and found consistent negative correlations between problematic smartphone use and executive functions among children and adolescents, including inhibitory control and cognitive flexibility. Adelantado-

Renau et al. (2019), in a meta-analysis published in *JAMA Pediatrics*, demonstrated that excessive screen media use was inversely associated with academic achievement across multiple subject areas. More recently, Limone & Toto (2022), in a comprehensive review in *Frontiers in Psychology*, concluded that unregulated digital device use in children was consistently associated with diminished attention capacity, impaired memory consolidation, and reduced cognitive persistence. At the neurological level, evidence from Turel & Bechara (2021), published in *Addictive Behaviors*, demonstrated that digital addiction is associated with structural and functional alterations in prefrontal cortex regions responsible for impulse control and sustained cognitive effort. These studies collectively establish a robust empirical foundation linking digital dependency to cognitive impairment.

In the Indonesian context, several studies have contributed valuable local evidence while simultaneously revealing critical gaps. Andini & Prihartanti 2021), in *Jurnal Psikologi Pendidikan dan Konseling*, found a significant negative correlation between gadget addiction and learning motivation among elementary students in Surakarta (*r* = -0.38, *p* < 0.01). Pratama & Sari (2022), in *Jurnal Pendidikan Islam*, demonstrated through a quasi-experimental design that a digital detox program significantly improved Qur'an memorization capacity among Islamic boarding school students (*t* = 4.21, *p* < 0.001). Fauziah & Hidayat (2023), in *Al-Tadzkiyyah: Jurnal Pendidikan Islam*, employed path analysis with 120 elementary students and found that while digital literacy facilitated access to Islamic learning materials, it negatively predicted deep comprehension of religious concepts when mediated by increased screen time (β = -0.24, *p* < 0.05). Wulandari & Nugroho (2022), in *Jurnal Psikologi Indonesia*, reported that elementary children with daily screen time exceeding four hours scored significantly lower on cognitive flexibility tasks ($F(2,197) = 8.45$, *p* < 0.001). However, these Indonesian studies reveal three specific gaps: first, none operationalized cognitive resilience as a distinct, measurable outcome variable in relation to digital dependency; second, none specifically targeted the PAI learning context at the elementary level within integrated Islamic schools; and third, none employed a predictive correlational design positioning digital dependency as a predictor and cognitive resilience as the criterion variable within a unified analytical model.

This study draws upon Cognitive Load Theory (Sweller et al., 2019) and Displacement Theory as an integrated theoretical framework to explain the hypothesized negative relationship between digital dependency and cognitive resilience. Cognitive Load Theory posits that human working memory has strictly limited capacity, and learning is impaired when this capacity is overwhelmed by extraneous cognitive load. Digitally dependent children habitually engage with rapid, highly stimulating, and constantly shifting digital content that consumes substantial working memory resources. When these children subsequently encounter the demanding cognitive tasks required in PAI, such as precise Qur'anic memorization with tajwid or deep comprehension of theological concepts, their working memory capacity is already partially depleted, leaving insufficient resources for effective encoding, elaboration, and consolidation of religious material. This chronic cognitive overload may progressively weaken the cognitive persistence and adaptive capacity that constitute cognitive resilience.

Complementarily, Displacement Theory explains that time and cognitive energy are finite resources; activities that consume these resources inevitably displace other activities. Children who spend excessive hours engaged with digital devices have correspondingly less time for activities that build cognitive resilience, such as sustained reading of religious texts (*muroja'ah*), reflective contemplation, and effortful memorization practice. The displacement is not merely temporal but also motivational: the immediate gratification provided by digital media may systematically erode children's tolerance for the delayed rewards and persistent effort that characterize mastery of PAI content.

The present study is designed to address the gaps identified above. Its primary objective is to examine digital dependency as a predictor of cognitive resilience in PAI learning among fourth-grade students at an integrated Islamic elementary school in Bandar Lampung, Indonesia. To the best of our knowledge, this study appears to be among the first to empirically test a predictive model linking digital dependency directly to cognitive resilience within the domain of religious education, thereby bridging two previously disconnected fields: digital behavior research and Islamic education studies. Methodologically, it employs context-specific operationalization by measuring cognitive resilience not as a general cognitive capacity but in terms of students' ability to comprehend and memorize PAI material, capturing the specific cognitive demands of religious learning. Contextually, it focuses on the integrated Islamic elementary school setting, a growing educational model in Indonesia and other Muslim-majority countries that has received negligible empirical attention in digital behavior research. By empirically demonstrating whether and to what extent digital dependency predicts lower cognitive resilience in PAI, this study contributes both to the theoretical understanding of how digital habits shape domain-specific cognitive capacities and to the practical development of evidence-based strategies for educators, parents, and policymakers committed to fostering cognitive resilience in an increasingly digital educational landscape.

Method

This study employed a quantitative approach with a predictive correlational design aimed at examining whether digital dependency predicts cognitive resilience in Islamic Religious Education (PAI) learning (Creswell & Creswell, 2018). The design was cross-sectional, as data were collected at a single point in time.

Participants and Sampling

The population of this study comprised all fourth-grade students at an integrated Islamic elementary school (SD IT) in Bandar Lampung, consisting of four intact classes with a total of 124 students (Class A = 30, Class B = 30, Class C = 32, Class D = 32). The total sampling technique was employed, involving all students within these classes as research participants (Cohen et al., 2018). The fourth grade was purposively selected because students at this level have had 2–3 years of digital

device experience, and the PAI curriculum at this stage—including Juz 30 memorization, *aqidah* (creed), and *fiqh* (Islamic jurisprudence) demands significantly higher cognitive resilience compared to lower grade levels. A post-hoc power analysis using G*Power 3.1, with a = 0.05, a large effect size* (r* = -0.52 as obtained in this study), and *N* = 124, yielded a statistical power exceeding 0.99. This confirms that the sample size was more than adequate to detect the observed effect reliably.

Variables and Instruments

Digital dependency was defined as a maladaptive pattern of digital device use encompassing six addiction components: salience, mood modification, tolerance, withdrawal, conflict, and relapse (Hawi et al., 2019). This variable was measured using the Digital Dependency Scale adapted from the Digital Addiction Scale for Children, consisting of 18 items with a 5-point Likert format (score range 18–90). Cognitive resilience was defined as the ability to maintain effective cognitive functioning when confronted with challenging PAI tasks, such as memorizing Qur'anic verses and comprehending abstract theological concepts (Bartrés-Faz et al., 2018). This variable was measured using the Cognitive Resilience Scale developed by the researcher, consisting of 15 items with a 5-point Likert format (score range 15–75) assessing three dimensions: cognitive persistence, cognitive flexibility, and attentional control. Self-report instruments were used despite the young age of participants; to mitigate potential bias, the researcher read all items aloud with standardized instructions, provided individual assistance when needed, and emphasized the absence of right or wrong answers to reduce social desirability response tendencies.

Instrument Validation

The adaptation of the Digital Dependency Scale followed five stages: forward translation, backward translation, expert review by three experts (a developmental psychologist, an educational technology specialist, and a PAI specialist), cognitive debriefing with five students, and pilot testing on 30 students from a similar school. Content validity using Aiken's V yielded coefficients of 0.80–0.93 (≥ 0.70), and Cronbach's alpha reliability reached α = 0.87 (≥ 0.70) (Sulaiman & Andromeda, 2025). The Cognitive Resilience Scale was developed following DeVellis's (2017) procedure: generating 25 initial items, expert review eliminating 7 items, revising 3 items, and pilot testing. Results showed Aiken's V of 0.78–0.91, overall reliability of α = 0.84, and dimension-specific reliabilities of α = 0.79 (cognitive persistence), α = 0.76 (cognitive flexibility), and α = 0.81 (attentional control). Corrected item-total correlations ranged from 0.35–0.72 (≥ 0.30). While these psychometric properties are adequate, the absence of confirmatory factor analysis (CFA) represents a limitation; future research should conduct CFA to establish the scale's factorial validity.

Data Collection and Ethical Procedures

Data collection was conducted on October 15–16, 2025, in the fourth-grade classrooms after obtaining institutional permission and written informed consent from all parents (100% response rate). Students completed both scales independently within 40 minutes under the researcher's supervision, who provided standardized instructions. To minimize social desirability bias, the researcher emphasized response confidentiality, the absence of right or wrong answers, and no impact on academic grades. Ethical principles were applied through parental informed consent, student verbal assent, data anonymity, and the right to withdraw without consequence.

Data Analysis

Data analysis was performed using SPSS version 26 with α = 0.05. The stages began with descriptive analysis including mean, standard deviation, and three-level categorization based on theoretical norms (Azwar, 2018). Classical assumption testing comprised: Shapiro-Wilk normality test (criterion *p* > 0.05), linearity test using Test for Linearity (criterion Deviation from Linearity *p* > 0.05), and Glejser heteroscedasticity test (criterion *p* > 0.05). Hypothesis testing was conducted using Pearson product-moment correlation to examine the relationship between variables, with correlation strength interpreted according to Cohen et al. (2018) criteria: *r* = 0.10–0.29 (small), 0.30–0.49 (medium), ≥ 0.50 (large). Subsequently, simple linear regression (Y = a + bX + e) was employed to test digital dependency's predictive ability on cognitive resilience. Model significance was tested using the F-test (*p* < 0.05) and regression coefficients using the t-test (*p* < 0.05). The predictor's contribution was assessed through R^2 with criteria: 0.19–0.33 (moderate), 0.34–0.67 (substantial), > 0.67 (high).

Results

Descriptive Analysis of Research Variables

Descriptive analysis was conducted to characterize the digital dependency and cognitive resilience data among 124 fourth-grade students at SD IT in Bandar Lampung. Table 1 presents the descriptive statistics for both variables.

Table 1. Descriptive Statistics of Research Variables (*N* = 124)

Variable	N	Minimum	Maximum	Mean	Std. Deviation	Theoretical Mean	Theoretical SD
Digital Dependency	124	26	82	54.10	12.80	54	12
Cognitive Resilience	124	23	70	46.90	10.90	45	10

The mean score of digital dependency (*M* = 54.10) approximated the theoretical mean (54), indicating that students' digital dependency levels generally fell within the moderate range. The wide score range (26–82), however, revealed

substantial inter-individual variation, suggesting that while most students exhibited moderate dependency, a notable minority experienced either markedly low or markedly high levels of digital engagement. Similarly, the mean cognitive resilience score (M = 46.90) approached the theoretical mean (45), with the range (23–70) confirming the presence of students at both extremes of the resilience continuum. This heterogeneity supports the appropriateness of examining digital dependency as a predictor of such variation.

Further categorization using three-level norms is presented in Table 2.

Table 2. Distribution of Variable Categorization

Category	Digital Dependency		Cognitive Resilience	
	Frequency	%	Frequency	%
Low	25	20.2	22	17.7
Moderate	74	59.7	80	64.5
High	25	20.2	22	17.7
Total	124	100	124	100

Table 2 shows that the majority of students fell within the moderate category for both variables (59.7% for digital dependency; 64.5% for cognitive resilience). Notably, similar proportions of students (approximately 20%) exhibited high digital dependency and low cognitive resilience, respectively. This symmetrical distribution pattern, with adequate representation across categories, satisfies the variability requirements for correlational and regression analyses.

Figure 1. Comparison of Student Percentages by Category for Digital Dependency and Cognitive Resilience

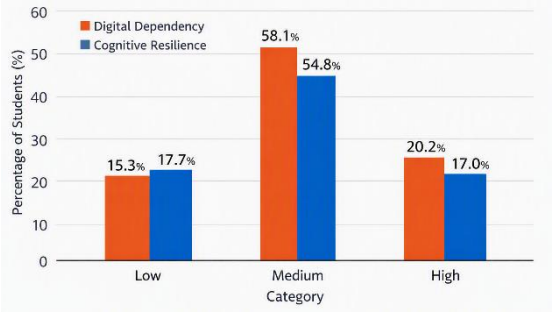


Chart Explanation

- X-axis: Student categories — *Low*, *Medium*, *High*.
- Y-axis: Percentage of students (%).
- Orange bars: Digital Dependency.
- Blue bars: Cognitive Resilience.

Visual hook: Students with high Digital Dependency (20.2%) are nearly as numerous as those with low Cognitive Resilience (17.7%), creating a striking symmetry that strengthens the reader's impression.

Figure 1. Grouped bar chart comparing the percentage of students in *Low*, *Medium*, and *High* categories for Digital Dependency (orange) and Cognitive

Resilience (blue). The chart highlights a visual symmetry: high Digital Dependency (20.2%) closely matches low Cognitive Resilience (17.7%). Sample size: n = 124.

Classical Assumption Testing

Prior to hypothesis testing, classical assumption tests were conducted to verify the appropriateness of parametric analysis. The Shapiro-Wilk normality test yielded a statistic of 0.952 (*p* = 0.184) for the regression residuals, confirming normal distribution (*p* > 0.05). The Test for Linearity produced a Deviation from Linearity value of F = 1.24 (*p* = 0.312), indicating a linear relationship between digital dependency and cognitive resilience. The Glejser heteroscedasticity test yielded a regression coefficient of absolute residuals on digital dependency with *t* = 1.08 (*p* = 0.291), confirming homoscedasticity (Astivia & Zumbo, 2019 ; Hair, Joseph F.; Black, William C.; Babin, Barry J.; Anderson, 2019). With all assumptions satisfied, Pearson Product Moment correlation and simple linear regression analyses were deemed appropriate.

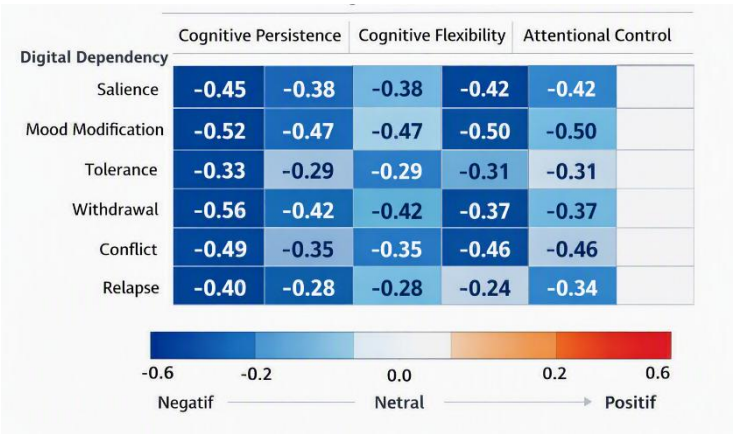
Hypothesis Testing: Relationship and Influence Between Variables

Table 3. Pearson Product Moment Correlation Analysis Results

Variable	*r*	*p*	Interpretation
Digital Dependency → Cognitive Resilience	-0.52	< 0.001	Significant, Negative, Large Effect

The Pearson Product Moment correlation analysis revealed a coefficient of *r* = -0.52 (*p* < 0.001). With *p* < 0.05, H_0 was rejected, confirming a significant negative relationship between digital dependency and cognitive resilience in PAI learning. The correlation coefficient falls within the large category based on established benchmarks for behavioral sciences (*r* ≥ 0.50) (Cohen et al., 2018; Kraft, 2020). The negative sign indicates that higher digital dependency is substantially associated with lower cognitive resilience.

Figure 2. Correlation heatmap of subdimensions for Digital Dependency and Cognitive Resilience



The matrix displays Pearson correlation coefficients (annotated to two decimal places) with a diverging color map centered at 0 (blue = negative, red = positive). Significance is indicated by asterisks: $p < .05$ () *and* $p < .01$ (*). Subdimensions are ordered to group all Digital Dependency items first and Cognitive Resilience items second to facilitate interpretation; hierarchical clustering may be applied to reveal latent groupings. Sample size: $n = 124$. Note: missing values were handled by listwise deletion (report alternative method if used). Refer to the main text for key correlations and inferential statistics.

Figure 3. Theoretical Infographic Integrating Cognitive Load Theory and Displacement Theory

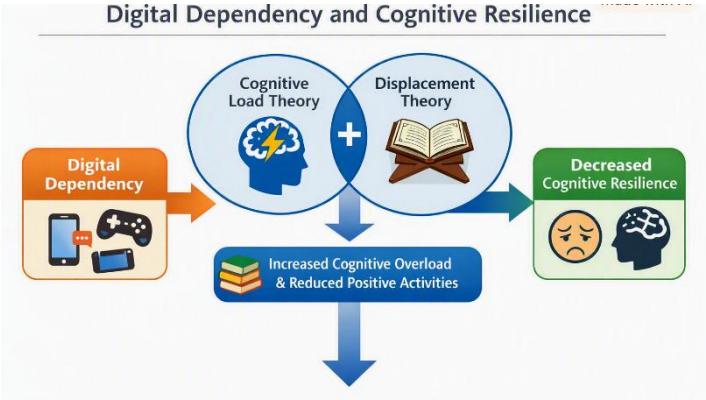


Figure 3. Grouped bar chart showing the distribution of students across *Low*, *Medium*, and *High* categories for Digital Dependency (orange) and Cognitive Resilience (blue). Bars are annotated with observed percentages and corresponding counts (n = 124). The chart highlights a notable visual symmetry: the proportion of students with High Digital Dependency (20.2%) is approximately equal to those with Low Cognitive Resilience (17.7%), suggesting an inverse pattern worthy of further inferential testing. Error bars are omitted; missing data were handled by listwise deletion. Report statistical tests (e.g., χ^2, p) or confidence intervals in the main text if availabl

Table 4. Simple Linear Regression Analysis Results

Component	Value	Interpretation
Constant (a)	70.20	
Regression Coefficient (b)	-0.43	
t-value	-6.72	
Significance (*p*)	< 0.001	Significant
F-value	45.16	
F Significance (*p*)	< 0.001	Model Significant
R	0.52	
R^2	0.27	27% Contribution
Adjusted R^2	0.26	

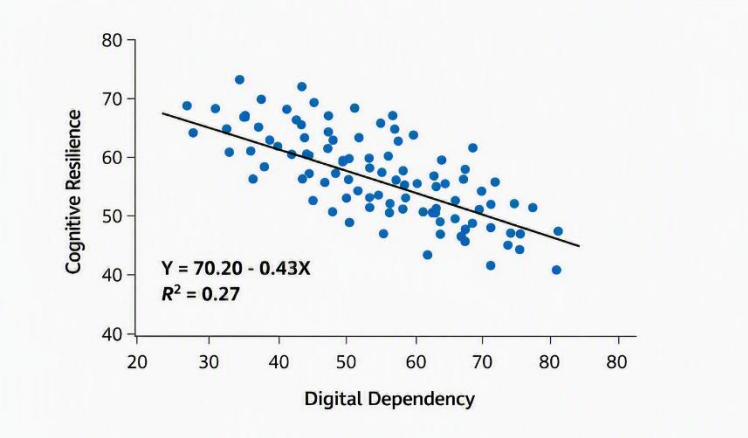
Simple linear regression analysis yielded the model Y = 70.20 - 0.43X, indicating that each one-unit increase in digital dependency predicted a 0.43-unit decrease in cognitive resilience. The model was statistically significant, $F(1, 122) =$

45.16, *p* < 0.001, confirming that digital dependency functions as a significant predictor of cognitive resilience. The t-test for the regression coefficient was also significant (*t*(122) = -6.72; *p* < 0.001).

The coefficient of determination R^2 = 0.27 indicates that digital dependency accounted for 27% of the variance in cognitive resilience, while 73% was attributable to factors outside the model. Based on established effect size conventions for the behavioral sciences, an R^2 of 0.27 corresponds to a large effect (f^2 = 0.37), indicating a substantial predictive relationship (Cohen et al., 2018). The adjusted R^2 of 0.26 provides a conservative estimate that remains very close to the unadjusted value, confirming the stability of the model and ruling out overfitting, a common concern with smaller samples.

The scatterplot in Figure 5 illustrates the negative linear relationship between the two variables. Data points clustered along the downward-sloping regression line confirm the linearity test results. While individual variation was evident, some students with high digital dependency maintained moderate cognitive resilience; the overall trend consistently demonstrated that higher digital dependency was associated with lower cognitive resilience.

Figure 5. Scatterplot of the Relationship Between Digital Dependency and Cognitive Resilience



Here is a quick breakdown of exactly what the statistics in your caption indicate:

- The Trend ($r = -0.52$): There is a moderate negative correlation. This means that as digital dependency goes up, cognitive resilience tends to go down.
- The Prediction ($Y = 70.20 - 0.43X$): This regression equation tells us that if a person has a digital dependency score of 0, their predicted baseline cognitive resilience score would be 70.20. For every 1-unit increase in digital dependency, cognitive resilience drops by 0.43 units.

- Statistical Significance ($p < 0.001$): This relationship is highly significant, meaning there is less than a 0.1% probability that this downward trend occurred by random chance.
- Effect Size ($R^2 = 0.27$): Digital dependency accounts for exactly 27% of the variance seen in the cognitive resilience scores, leaving the remaining 73% to be explained by other factors.

Discussion

This study confirms a significant negative relationship between digital dependency and students' cognitive resilience in PAI learning (*r* = -0.52; *p* < 0.001), with digital dependency accounting for 27% of cognitive resilience variance (R^2 = 0.27; $F(1,122)$ = 45.16; *p* < 0.001). These findings validate the research hypothesis and align with the growing evidence base documenting the detrimental cognitive effects of excessive digital device use among children (Firth et al., 2019; Limone & Toto, 2022; Sohn et al., 2019). The robust sample size (N = 124) provides stable parameter estimates and strengthens the generalizability of these findings within the context of integrated Islamic elementary schools. The regression model confirms that the negative predictive relationship is not a statistical artifact but a substantive and stable effect, with digital dependency explaining over a quarter of the variance in cognitive resilience. However, what makes these findings particularly significant is their location within the unique cognitive ecosystem of SD IT institutions an educational context where dual-curriculum demands amplify the consequences of compromised cognitive resilience.

The observed relationship can be explained through two integrated theoretical mechanisms. First, Cognitive Load Theory (Sweller et al., 2019) posits that digitally dependent children habitually engage with rapidly changing, highly stimulating content that consumes substantial working memory resources. When these students subsequently confront cognitively demanding PAI tasks such as Qur'an memorization with precise *tajwid* or comprehension of abstract theological concepts, their depleted working memory capacity proves insufficient for deep encoding, elaboration, and consolidation of religious material. This chronic cognitive overload progressively erodes the attentional persistence and adaptive capacity that constitute cognitive resilience. Neurobiological evidence supports this mechanism: demonstrated that digital addiction is associated with structural alterations in prefrontal cortex regions governing working memory and attentional control (Shanmugasundaram & Tamilarasu, 2023).

Second, the time displacement mechanism provides a complementary explanation. Time devoted to digital activities displaces cognitively enriching activities essential for building cognitive resilience (Beyens et al., 2018). In the PAI context, activities such as *muroja'ah* (Qur'an memorization review), reading Islamic

texts, discussing religious values with teachers and parents, and engaging in spiritual reflection constitute valuable cognitive exercises that train sustained attention, strengthen memory consolidation, and cultivate persistence (Ahmed et al., 2019; Masten et al., 2021; Zelazo & Carlson, 2020). The cumulative loss of these opportunities systematically weakens the cognitive foundations required for PAI mastery. Clemente-Suárez et al. (2024) have convincingly documented that excessive screen time inversely correlates with time allocated to academically and cognitively enriching activities.

A third contributory mechanism involves the erosion of frustration tolerance. Digital media's instant gratification design systematically diminishes children's capacity to persist through tasks requiring sustained effort and delayed (Neugnot-Cerioli & Laurenty, 2024). PAI learning inherently demands such persistence; students habituated to immediate digital rewards tend to disengage more rapidly when confronted with the cognitive challenges of memorization and theological comprehension, a pattern directly antithetical to cognitive resilience (Wilmer & Chein, 2016). This mechanism is particularly relevant in the SD IT context, where students must navigate the tension between the fast-paced, reward-driven digital environment and the slow, contemplative, and repetitive nature of Islamic learning.

The SD IT context deserves special theoretical attention. The dual-curriculum model is not merely additive but multiplicative in its cognitive demands. Students must constantly switch between the cognitive frameworks required for general academic subjects (analytical, procedural, problem-solving) and those required for Islamic studies (memorization, contemplation, moral internalization). This cognitive switching imposes additional executive function demands that may render SD IT students particularly vulnerable to the effects of digital dependency. The 27% contribution of digital dependency to cognitive resilience variance represents a substantively meaningful effect that warrants intervention. The regression coefficient (*b* = -0.43) translates the statistical relationship into practical terms: across the observed digital dependency range (26–82), the predicted difference in cognitive resilience between low-dependency and high-dependency students is approximately 24 points, a practically significant magnitude on the 15–75 scale. These findings reinforce prior Indonesian studies documenting the negative impact of excessive device use on religious learning outcomes. Pratama and Sari (2022) demonstrated that digital detox significantly improved Qur'an memorization, while Fauziah and Hidayat (2023) showed that increased screen time mediated the negative relationship between digital literacy and deep religious comprehension. The present study extends this evidence by explicitly operationalizing cognitive resilience and positioning digital dependency as its

predictor within the PAI domain, with a sample size sufficient to establish statistical reliability.

Nevertheless, 73% of cognitive resilience variance remains attributable to factors beyond digital dependency. PAI teaching quality, parental involvement in religious guidance, students' intrinsic religious motivation, home learning environment, sleep quality, and peer influences likely contribute and merit investigation (Kirlić et al., 2021). This underscores that interventions to enhance cognitive resilience must be multidimensional, integrating digital behavior management with pedagogical improvement and family engagement. The significant yet moderate R^2 also suggests that while digital dependency is an important predictor, it operates within a complex network of cognitive, social, and environmental factors.

These findings carry significant implications for three stakeholder groups. For PAI teachers in integrated Islamic elementary schools, the results necessitate instructional strategies that deliberately counteract digital dependency's cognitive effects: spaced repetition for memorization, concept mapping for theological understanding, and metacognitive strategy training while teachers themselves model judicious device use. Teachers should consider incorporating brief mindfulness or attention-focusing exercises at the beginning of PAI lessons to help students transition from the fast-paced digital world to the contemplative religious learning environment. For parents, the study provides empirical justification for structured screen time management, particularly during pre-study and pre-sleep periods, and for replacing a portion of screen time with cognitively enriching religious activities at home such as family *muroja'ah* sessions, bedtime Islamic storytelling, and reflective discussions about religious values. For policymakers, the findings support developing digital device usage guidelines tailored to the cognitive demands of PAI learning in integrated Islamic schools and integrating digital literacy curricula that address cognitive self-regulation, not merely technical digital skills.

Several limitations must be acknowledged. While the sample size (N = 124) proved adequate for the predictive analysis, the study's scope remains limited to a single integrated Islamic elementary school in Bandar Lampung. This geographical and institutional specificity may limit generalizability to other regions or to non-integrated (secular) school contexts. The cross-sectional design precludes causal inference despite the predictive analytical framework. Both variables relied on self-report measures susceptible to social desirability bias and introspective limitations among elementary-aged children, although standardized instructions and item reading aimed to mitigate these concerns. The Cognitive Resilience Scale, while psychometrically adequate, requires confirmatory factor analysis to establish factorial validity. The R^2 of 0.27 indicates that the majority of cognitive resilience

variance remains unexplained by the current model. Future research should employ multi-site samples across different regions to establish population generalizability; longitudinal designs to establish temporal precedence and developmental trajectories; experimental interventions testing digital dependency reduction effects; multiple measurement methods including behavioral observation, teacher ratings, and performance-based cognitive assessments; inclusion of mediator and moderator variables such as sleep quality, parental digital mediation, and intrinsic religious motivation; and qualitative studies to understand how students and teachers experience the tension between digital habits and religious learning demands.

This study offers three meaningful theoretical contributions. First, to the best of our knowledge, it appears to be among the first investigations to empirically link digital dependency and cognitive resilience within the specific domain of Islamic religious education at the elementary level in an integrated Islamic school setting, thereby bridging the long-standing disconnect between digital behavior research and Islamic education scholarship. Second, it extends the applicability of Cognitive Load Theory and Displacement Theory to a culturally and religiously specific learning domain, demonstrating their explanatory power beyond secular educational contexts and highlighting how these mechanisms operate within the unique cognitive ecosystem of SD IT institutions. Third, by operationalizing cognitive resilience in terms of PAI-specific cognitive demands Qur'an memorization capacity, theological concept comprehension, and attentional persistence this study establishes a foundation for domain-specific instrument development and opens new avenues for research at the intersection of digital culture and religious education.

Conclusion

This study aimed to examine digital dependency as a predictor of cognitive resilience in PAI learning among fourth-grade students at an integrated Islamic elementary school in Bandar Lampung. In addressing this objective, the study provides robust empirical evidence of a significant negative relationship between the two variables. The findings a large negative correlation (*r* = -0.52; *p* < 0.001) and a regression model in which digital dependency accounts for 27% of cognitive resilience variance (R^2 = 0.27; F (1,122) = 45.16; *p* < 0.001) indicate that excessive, compulsive digital engagement is systematically associated with lower sustained attention, memorization capacity, and cognitive persistence essential for mastering PAI content. As the design is correlational and cross-sectional, these findings should be interpreted as a robust association rather than definitive causal evidence; the

direction and mechanism of this relationship warrant confirmation through longitudinal or experimental designs. These results are consistent with, and lend empirical support to, the integrated framework of Cognitive Load Theory and Displacement Theory, suggesting that habitual digital stimulation may both draw upon working memory resources needed for deep religious learning and displace cognitively enriching activities such as Qur'an review and spiritual reflection. The study's primary contribution lies in its novel operationalization of cognitive resilience within the PAI domain and its focus on the underexplored context of integrated Islamic elementary schools, thereby establishing an empirical bridge between digital behavior research and Islamic education scholarship. These findings carry three concrete practical implications for Islamic Religious Education. For PAI teachers, Practically, these findings urge PAI teachers tothe association between digital dependency and lower cognitive resilience suggests the value of adopting instructional strategies such as spaced repetition, concept mapping, and metacognitive training that deliberately strengthen students' cognitive persistence during Qur'anic memorization and theological reflection. For parents, the findings support implementing structured screen time limits, particularly before study and sleep periods, to preserve children's cognitive readiness for religious learning. For policymakers and school administrators, the findings call for integrating cognitive self-regulation components into digital literacy curricula specifically designed for faith-based elementary schools, rather than applying generic digital literacy programs that are not tailored to the cognitive demands of religious content. While the single-school setting and cross-sectional design constrain generalizability and preclude causal conclusions, the adequate sample size (N = 124) provides confidence in the stability of the observed association, and these limitations provide clear direction for future research, including multi-site longitudinal studies tracking digital dependency and cognitive resilience development over time, experimental interventions testing digital detox effects on PAI learning outcomes, and investigations incorporating mediator variables such as sleep quality and parental digital mediation. As digital immersion becomes an increasingly prevalent feature of childhood, understanding its association with unintended consequences ondomain-specific cognitive capacities represents an increasingly urgent educational priority. This study offers empirical support for the view compelling evidencethat the path to digitally resilient religious education lies not in outright prohibition but in mindful, evidence-based integration of digital wellness strategies into the fabric of Islamic pedagogy.

References

Adelantado-Renau, M., Moliner-Urdiales, D., Cavero-Redondo, I., Beltran-Valls, M. R., Martínez-Vizcaíno, V., & Álvarez-Bueno, C. (2019). Association between

screen media use and academic performance among children and adolescents: A systematic review and meta-analysis. *JAMA Pediatrics*, *173*(11), 1058–1067. https://doi.org/10.1001/jamapediatrics.2019.3176

Ahmed, S. F., Tang, S., Waters, N. E., & Davis-Kean, P. (2019). Executive function and academic achievement: Longitudinal relations from early childhood to adolescence. *Journal of Educational Psychology*, *111*(3), 446–458. https://doi.org/10.1037/edu0000296

Andini, R., & Prihartanti, N. (2021). Hubungan antara kecanduan gadget dengan motivasi belajar pada siswa sekolah dasar. *Jurnal Psikologi Pendidikan Dan Konseling*, *7*(1), 45–53. https://doi.org/10.26858/jppk.v7i1.19872

Andreassen, C. S., Pallesen, S., & Griffiths, M. D. (2017). The relationship between addictive use of social media, narcissism, and self-esteem: Findings from a large national survey. *Addictive Behaviors*, *64*, 287–293. https://doi.org/10.1016/j.addbeh.2016.03.006

Astivia, O. L. O., & Zumbo, B. D. (2019). Heteroskedasticity in multiple regression analysis: What it is, how to detect it and how to solve it with applications in R and SPSS. *Practical Assessment, Research, and Evaluation*, *24*(1), 1–16. https://doi.org/10.7275/q5xr-fr95

Azwar, S. (2018). *Penyusunan skala psikologi* (2nd ed.). Pustaka Pelajar.

Bartrés-Faz, D., Cattaneo, G., Solana, J., Tormos, J. M., & Pascual-Leone, Á. (2018). Meaning in life: resilience beyond reserve. *Alzheimer s Research & Therapy*, *10*(1), 47. https://doi.org/10.1186/s13195-018-0381-z

Beyens, I., Valkenburg, P. M., & Piotrowski, J. T. (2018). Screen media use and ADHD-related behaviors: Four decades of research. *Proceedings of the National Academy of Sciences*, *115*(40), 9875–9881. https://doi.org/10.1073/pnas.1611611114

Clemente-Suárez, V. J., Beltrán-Velasco, A. I., Herrero-Roldán, S., Rodríguez-Besteiro, S., Martínez-Guardado, I., Martín-Rodríguez, A., & Tornero-Aguilera, J. F. (2024). Digital Device Usage and Childhood Cognitive Development: Exploring Effects on Cognitive Abilities. *Children*, *11*(11), 1299. https://doi.org/10.3390/children11111299

Cohen, L., Manion, L., & Morrison, K. (2018). *Research methods in education* (8th ed.). Routledge.

Creswell, J. W., & Creswell, J. D. (2018). *Research design: Qualitative, quantitative, and mixed methods approaches* (5th ed., Vol. 5). SAGE Publications. https://doi.org/https://doi.org/10.1002/nha3.20258

Fauziah, N., & Hidayat, T. (2023). Digital literacy and Islamic education learning outcomes: A path analysis among elementary students. *Al-Tadzkiyyah: Jurnal Pendidikan Islam*, *14*(1), 87–102. https://doi.org/10.24042/atjpi.v14i1.16123

Firth, J., Torous, J., Stubbs, B., Firth, J. A., Steiner, G. Z., Smith, L., Alvarez-Jimenez, M., Gleeson, J., Vancampfort, D., Armitage, C. J., & Sarris, J. (2019). The "online

brain": How the Internet may be changing our cognition. *World Psychiatry*, *18*(2), 119–129. https://doi.org/10.1002/wps.20617

Hair, Joseph F.; Black, William C.; Babin, Barry J.; Anderson, R. E. (2019). *Multivariate data analysis* (8th ed.). Cengage. https://doi.org/10.1108/EBR-11-2018-0203

Hawi, N. S., Samaha, M., & Griffiths, M. D. (2019). The Digital Addiction Scale for Children: Development and validation. *Cyberpsychology, Behavior, and Social Networking*, *22*(12), 771–778. https://doi.org/10.1089/cyber.2019.0132

Indonesia, A. P. J. I. (2024). *Survei penetrasi internet Indonesia 2024*. https://apjii.or.id/survei

Kirlić, N., Colaizzi, J. M., Cosgrove, K. T., Cohen, Z. P., Yeh, H., Breslin, F. J., Morris, A. S., Aupperle, R. L., Singh, M. K., & Paulus, M. P. (2021). Extracurricular Activities, Screen Media Activity, and Sleep May Be Modifiable Factors Related to Children's Cognitive Functioning: Evidence From the ABCD Study®. *Child Development*, *92*(5), 2035–2052. https://doi.org/10.1111/cdev.13578

Kominfo. (2023). *Laporan survei penggunaan internet anak Indonesia*. Kementerian Komunikasi dan Informatika Republik Indonesia.

Limone, P., & Toto, G. A. (2022). Psychological and cognitive effects of digital device use on child development: A systematic review. *Frontiers in Psychology*, *13*, 956278. https://doi.org/10.3389/fpsyg.2022.956278

Masten, A. S., Lucke, C. M., Nelson, K. M., & Stallworthy, I. C. (2021). Resilience in development and psychopathology: Multisystem perspectives. *Annual Review of Clinical Psychology*, *17*, 521–549. https://doi.org/10.1146/annurev-clinpsy-081219-120307

Neugnot-Cerioli, M., & Laurenty, O. M. (2024). The Future of Child Development in the AI Era. Cross-Disciplinary Perspectives Between AI and Child Development Experts. In *arXiv (Cornell University)*. Cornell University. https://doi.org/10.48550/arxiv.2405.19275

Pratama, A. R., & Sari, D. K. (2022). The impact of smartphone use on Qur'an memorization ability: A quasi-experimental study in an Islamic boarding school. *Jurnal Pendidikan Islam*, *11*(2), 123–138. https://doi.org/10.15642/jpi.2022.11.2.123-138

Shanmugasundaram, M., & Tamilarasu, A. (2023). The impact of digital technology, social media, and artificial intelligence on cognitive functions: a review. *Frontiers in Cognition*, *2*. https://doi.org/10.3389/fcogn.2023.1203077

Sohn, S. Y., Rees, P., Wildridge, B., Kalk, N. J., & Carter, B. (2019). Prevalence of problematic smartphone usage and associated mental health outcomes amongst children and young people: A systematic review, meta-analysis and GRADE of the evidence. *BMC Psychiatry*, *19*(1), 356. https://doi.org/10.1186/s12888-019-2350-x

Sulaiman, P. L., & Andromeda, A. (2025). VALIDITAS DAN PRAKTIKALITAS MEDIA PEMBELAJARAN STRUKTUR ATOM BERBASIS INSTAGRAM

UNTUK MENINGKATKAN LITERASI KIMIA SISWA. *SCIENCE Jurnal Inovasi Pendidikan Matematika Dan IPA*, *5*(4), 1740–1751. https://doi.org/10.51878/science.v5i4.7551

Sweller, J., van Merriënboer, J. J. G., & Paas, F. (2019). Cognitive architecture and instructional design: 20 years later. *Educational Psychology Review*, *31*(2), 261–292. https://doi.org/10.1007/s10648-019-09465-5

Turel, O., & Bechara, A. (2021). A neurobehavioral model of the effects of screen-based media on the developing brain. *Addictive Behaviors*, *117*, 106845. https://doi.org/10.1016/j.addbeh.2021.106845

Wilmer, H. H., & Chein, J. (2016). Mobile technology habits: patterns of association among device usage, intertemporal preference, impulse control, and reward sensitivity. *Psychonomic Bulletin & Review*, *23*(5), 1607–1614. https://doi.org/10.3758/s13423-016-1011-z

Wilmer, H. H., Sherman, L. E., & Chein, J. M. (2017). Smartphones and cognition: A review of research exploring the links between mobile technology habits and cognitive functioning. *Frontiers in Psychology*, *8*, 605. https://doi.org/10.3389/fpsyg.2017.00605

Wulandari, S., & Nugroho, A. (2022). Screen time dan cognitive flexibility pada anak sekolah dasar: Studi korelasional di Yogyakarta. *Jurnal Psikologi Indonesia*, *11*(1), 34–47. https://doi.org/10.30996/jpi.v11i1.6543

Zelazo, P. D., & Carlson, S. M. (2020). The neurodevelopment of executive function skills: Implications for academic achievement gaps. *Psychology & Neuroscience*, *13*(3), 273–298. https://doi.org/10.1037/pne0000208