Jurnal Review Pendidikan Dasar:
Jurnal Kajian Pendidikan dan Hasil Penelitian
Vol 11(3), Oktober 2025

e-ISSN: 2460-8475
http://journal.unesa.ac.id/index.php/PD
https://doi.org/10.26740/jrpd.v11n3.p389-403

Digital Device Use Intensity and Main Idea Comprehension among Fourth-Grade Elementary School Students

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Abstrac: Digital devices are widely used by elementary school students, and evidence on how intensive use relates to specific reading skills remains mixed. This study aims to examine whether and how digital device use intensity is associated with main idea comprehension among fourth-grade students. The study extends previous research by examining device use intensity through four indicators (frequency, duration, purpose of use, and digital activity) in relation to a specific comprehension skill within an Indonesian elementary school context. A cross-sectional correlational (*ex post facto*) design was applied with 27 fourth-grade students selected through purposive sampling, and a separate class of 25 students was used to pilot the instruments. Data were collected with a 25-item questionnaire and a 25-item multiple-choice main idea test, and were analyzed with Pearson correlation and simple linear regression. Gadget use intensity showed a negative and statistically significant association with main idea comprehension ($r = -.518$, 95% CI [−.75, −.17], $p = .006$) and accounted for 26.8% of the variance ($R^2 = .268$). These findings describe an association in a small, single-school sample and do not establish causation. They suggest that guidance on the duration and purpose of device use may be relevant to reading comprehension, together with classroom instruction and home reading practices.

Keywords: Gadget Use; Digital Device Use Intensity; Reading Comprehension; Main Idea.

How to Cite: Wahono, S.A., Istiq'faroh, N., & Shukurilloyeva, L. (2025). Digital Device Use Intensity and Main Idea Comprehension among Fourth-Grade Elementary School Students. *Jurnal Review Pendidikan Dasar: Jurnal Kajian Pendidikan dan Hasil Penelitian, 11*(3), 389-403. https://doi.org/10.26740/jrpd.v11n3.p389-403

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Article Info:
Received: 2 June 2025; Accepted: 14 September 2025; Published Online: 28 October 2025

Published by:
Pendidikan Dasar Universitas Negeri Surabaya

INTRODUCTION

Smartphones and tablets have become part of children's daily routines and serve communication, entertainment, information access, and learning purposes. Recent evidence indicates that associations between screen use and child outcomes are small to moderate and vary by outcome. An umbrella review of 102 meta-analyses involving 1,937,501 participants found that screen use was negatively associated with literacy ($r = -.14$), and that this association turned positive when parents watched together with their children ($r = .15$) (Sanders et al., 2024). The authors also reported high heterogeneity and a medium-to-high risk of bias in most of the included meta-analyses. These features make it important to examine specific outcomes in specific age groups before drawing conclusions about device use in general.

Reading comprehension involves both decoding and linguistic comprehension, as described in the *Simple View of Reading* (Gough & Tunmer, 1986). Hoover and Gough (1990) found that these components jointly characterized reading ability among bilingual children in Grades 1 to 4. Florit and Cain (2011) further reported that their relative contributions varied across alphabetic orthographies during early reading development. This framework provides a basis for examining specific comprehension skills, including main idea identification.

Main idea identification is an important reading comprehension skill in upper elementary Indonesian language instruction. It requires students to connect sentences and distinguish central ideas from supporting details. Stevens et al. (2020) examined a paraphrasing and text structure intervention targeting main idea generation among students in Grades 4 and 5 with reading disabilities. Wanzek et al. (2010) synthesized evidence from 24 studies of comprehension interventions for students in the same grades with reading difficulties. These studies support the relevance of explicit instruction when examining differences in main idea comprehension.

Research comparing print and digital reading has reported different outcomes across text types and reader groups. Delgado et al. (2018) found an advantage for paper over screens when readers comprehended expository texts, particularly under time constraints. Clinton (2019) also reported lower reading performance on screens, with the effect concentrated in expository texts, whereas Schwabe et al. (2022) found no significant medium effect for narrative comprehension. Among young children, Furenes

et al. (2021) found that digital books without story-related enhancements were associated with lower comprehension than print books, while enhanced digital books showed different results. Hare et al. (2024) similarly reported variation by outcome, with print more often favoring informational-text comprehension and digital formats sometimes supporting engagement and vocabulary.

Evidence on digital reading habits also varies by educational stage. Altamura et al. (2025) reported a small average association between leisure digital reading and comprehension (r = .055), with negative associations in primary and middle school and positive associations in high school and university. By comparison, Mol and Bus (2011) found moderate to strong correlations between print exposure and reading comprehension across 99 studies involving 7,669 participants. Delgado and Salmerón (2021) reported lower comprehension among undergraduate readers using screens under time pressure. These findings suggest that the association between reading medium and comprehension may depend on age, reading conditions, and the type of activity measured.

Studies of digital devices have also reported different associations depending on how the devices are used. Dorris et al. (2024) found a positive combined effect of mobile-device interventions on primary pupils' literacy and numeracy (d = 0.24), while Savva et al. (2022) reported a small positive effect of electronic storybooks on language and literacy (g = .25). Lei et al. (2021) found a positive association between ICT literacy and academic achievement. In contrast, Madigan et al. (2020) reported negative associations between the quantity of screen use and child language skills, alongside positive associations for educational programming and caregiver co-viewing. Chen et al. (2021) found that metacognitive strategy knowledge mediated the relationship between social media use and adolescents' digital reading literacy. Ostiz-Blanco et al. (2021) recommended larger samples and longer interventions in future studies of digital reading.

Existing studies have primarily examined comparisons between reading media, structured device-based interventions, or broad academic outcomes. Less attention has been directed toward the relationship between everyday device-use intensity, measured through frequency, duration, purpose, and digital activity, and a specific comprehension skill such as main idea identification among upper-primary students. Research remains limited regarding this relationship in Indonesian elementary school settings. Preliminary observations at the study school indicated that most fourth-grade students had daily access

to gadgets, while some experienced difficulty identifying main ideas despite relatively good oral reading skills.

This study aims to examine whether and how gadget use intensity is associated with main idea comprehension among fourth-grade elementary school students in Indonesia. It addresses three research questions: (1) What are the levels of gadget use intensity and main idea comprehension? (2) Is gadget use intensity significantly associated with main idea comprehension? and (3) To what extent does gadget use intensity account for variation in main idea comprehension? Based on previous findings, the study expected higher gadget use intensity to be associated with lower main idea comprehension.

METHOD

Research Design

This study employed a quantitative, cross-sectional correlational (*ex post facto*) design. Gadget use intensity was the independent variable (X), and main idea comprehension was the dependent variable (Y). Both variables were measured as they naturally occurred, without intervention. Because data were collected at one time point, the analysis examined association and prediction rather than causation. The study was conducted at a public elementary school in Surabaya, Indonesia, during the even semester of the 2025/2026 academic year.

Context and Participants

The population comprised fourth-grade students in two classes at the study school. Purposive sampling was used based on academic comparability and data-collection feasibility. Class IV B (n = 25) served as the instrument pilot group, while class IV C (n = 27) constituted the research sample. Preliminary teacher observations indicated daily gadget use among most students and difficulties in main idea identification among some students despite relatively good oral reading skills.

Table 1. Characteristics of the Research Sample

Group	Class	N	Role in the study
A	IV B	25	Instrument pilot
B	IV C	27	Research sample

Table 1 presents the allocation of the 52 students: 25 participated in instrument

piloting and 27 formed the research sample. The pilot group was excluded from the main analysis. The small research sample was considered when interpreting the findings and limitations.

Instruments

Two instruments were used: a gadget use intensity questionnaire and a main idea comprehension test. Table 2 summarizes the variables, indicators, and instruments.

Table 2. Research Variables and Instruments

Variable	Indicators	Instrument	Items
Gadget use intensity (X)	Frequency of use, duration of use, purpose of use, digital activity	Likert-scale questionnaire	25
Main idea comprehension (Y)	Determining main ideas, identifying supporting ideas, determining main sentences, summarizing reading content	Multiple-choice test	25

The questionnaire contained 25 items covering frequency, duration, purpose, and type of digital activity. The 25-item multiple-choice test assessed main idea identification, supporting ideas, main sentences, and reading-content summarization.

The gadget use intensity questionnaire used a four-point Likert scale without a neutral option, which was intended to reduce middle-response tendencies among elementary school students. Each item was scored from 1 to 4, so the total score ranged from 25 to 100, and higher scores indicated higher intensity of gadget use. The main idea comprehension test used multiple-choice items aligned with fourth-grade Indonesian language learning outcomes. Each correct answer received one point, and the total was converted to a 100-point scale (correct answers divided by 25 and multiplied by 100), so that scores ranged from 0 to 100 and higher scores indicated better main idea comprehension.

Instrument Piloting

Both instruments were piloted with the 25 students of class IV B before they were administered to the research sample. Item validity was examined with the Pearson product-moment correlation for the questionnaire and the point-biserial correlation for the test, and an item was considered valid when its calculated r exceeded the critical r of .396 (n = 25, 5% significance level). Reliability was estimated with Cronbach's alpha for the questionnaire and the Kuder-Richardson 20 (KR-20) formula for the test, with a minimum acceptable coefficient of 0.70. Because a high alpha value offers limited

evidence of reliability on its own (Taber, 2018), the coefficients were interpreted together with the item validity results. Items meeting the validity criterion were retained in the final instruments.

Data Collection Procedure

Data collection began with the pilot administration in class IV B, followed by the analysis of item validity and reliability. After the instruments met the criteria, they were administered to the 27 students of class IV C in the classroom. Each student completed the gadget use intensity questionnaire and the main idea comprehension test individually, and the completed sheets were scored according to the rules described above. The resulting scores were entered into a dataset that was used for all subsequent analyses.

Data Analysis

Descriptive statistics (minimum, maximum, mean, and standard deviation) were calculated to answer RQ 1. Mean scores were expressed as percentages of the maximum possible scores and classified using the criteria in Table 3. Normality was assessed using the Shapiro-Wilk test, and linearity was examined using the deviation-from-linearity test. Pearson correlation and a 95% confidence interval calculated through Fisher's z transformation were used to answer RQ 2. Simple linear regression, the coefficient of determination (R^2), the ANOVA F test, and the regression-coefficient t test were used to answer RQ 3. All tests used a 5% significance level. Correlation magnitudes were interpreted using the guidelines of Gignac and Szodorai (2016), in which .10, .20, and .30 represented relatively small, typical, and relatively large correlations, respectively.

Table 3. Classification Criteria (Percentage of Maximum Score)

Percentage of maximum score	Gadget use intensity	Main idea comprehension
81 to 100	Very high	Very good
61 to 80	High	Good
41 to 60	Moderate	Fair
21 to 40	Low	Poor
0 to 20	Very low	Very poor

RESULTS

Preliminary Analysis: Instrument Quality

The instrument quality results are presented first because the conclusions of the study depend on the soundness of the measurements. Table 4 is included to show that the questionnaire and the test met the validity and reliability criteria in the pilot group of 25

students. Without this evidence, the correlation and regression results in the later sections could not be interpreted with confidence.

Table 4. Validity and Reliability of the Instruments (Pilot Group, n = 25)

Instrument	Items	Calculated r	Critical r	Reliability	Decision
Gadget use intensity questionnaire	25	.410 to .781	.396	α = .842	Valid and reliable
Main idea comprehension test	25	.428 to .762	.396	KR-20 = .785	Valid and reliable

All 25 questionnaire items and all 25 test items exceeded the critical validity value of .396. Reliability coefficients were .842 for the questionnaire and .785 for the test, both exceeding the .70 criterion. These results supported the use of both instruments in the research sample.

Preliminary Analysis: Assumption Tests

Assumption tests were conducted because Pearson correlation and simple linear regression rely on approximately normal distributions and a linear relationship. Table 5 is presented to document that these conditions were checked and to allow readers to judge whether the parametric analyses were appropriate for the data.

Table 5. Assumption Test Results

Test	Statistic	p	Decision
Shapiro-Wilk, gadget use intensity	.961	.391	Normal
Shapiro-Wilk, main idea comprehension	.954	.264	Normal
Shapiro-Wilk, regression residuals	.970	.598	Normal
Deviation from linearity	F = 0.923	.562	Linear

The Shapiro-Wilk tests were nonsignificant for gadget use intensity (p = .391), main idea comprehension (p = .264), and regression residuals (p = .598). The deviation-from-linearity test was also nonsignificant (F = 0.923, p = .562). These results supported the use of Pearson correlation and simple linear regression.

RQ 1: Levels of Gadget Use Intensity and Main Idea Comprehension

Table 6. Descriptive Statistics of the Research Variables (N = 27)

Variable	Minimum	Maximum	M	SD	M as % of maximum	Category
Gadget use intensity (X)	45	88	68.44	10.35	68.44	High
Main idea comprehension (Y)	52	92	73.19	9.89	73.19	Good

Gadget use intensity scores ranged from 45 to 88 (M = 68.44, SD = 10.35), corresponding to a high category. Main idea comprehension scores ranged from 52 to 92 (M = 73.19, SD = 9.89), corresponding to a good category. These descriptive results answer RQ 1 and indicate variation in both variables within the sample.

RQ 2: Association between Gadget Use Intensity and Main Idea Comprehension

The correlation analysis is presented to answer RQ 2 directly, since it expresses the direction and strength of the relationship between the two variables. Table 7 is included to report the correlation coefficient together with its 95% confidence interval, because the interval shows how precisely the association was estimated in a small sample. The coefficient of determination is added to link the correlation to the regression results reported in the next section.

Table 7. Pearson Correlation between Gadget Use Intensity and Main Idea Comprehension

Variable pair	N	r	95% CI	p	r^2
Gadget use intensity and main idea comprehension	27	−.518	[−.75, −.17]	.006	.268

Gadget use intensity was negatively associated with main idea comprehension (r = −.518, p = .006). Based on the guidelines of Gignac and Szodorai (2016), the magnitude was relatively large. The 95% confidence interval [−.75, −.17] indicates uncertainty around the estimated association. Thus, RQ 2 was answered by a statistically significant negative correlation in this sample.

RQ 3: Variance in Main Idea Comprehension Accounted for by Gadget Use Intensity

Simple linear regression is presented to answer RQ 3 and to quantify how much of the variation in main idea comprehension is associated with gadget use intensity. Table 8 is included to report the model summary and the regression equation, since these values show the size of the shared variance and the slope of the relationship. The standard error of the estimate is added to indicate the typical distance between observed and predicted scores.

Table 8. Simple Linear Regression Model Summary

Statistic	Value
R	.518
R^2	.268
Adjusted R^2	.239
Constant (a)	101.284
Regression coefficient (b)	−0.410
Standard error of the estimate	8.214

The coefficient of determination was .268 (adjusted R^2 = .239), which means that gadget use intensity accounted for 26.8% of the variance in main idea comprehension and that 73.2% was associated with other factors. The regression equation was Y = 101.284 − 0.410X, so each one-point increase in gadget use intensity was associated with a predicted decrease of 0.410 points in main idea comprehension. The standard error of the estimate (8.214) shows that individual scores deviated from the predicted values by roughly eight points on average. These values answer RQ 3 by showing a substantial share of explained variance together with a large share that remains unexplained.

Significance tests are presented next to show that the model and the coefficient differ from zero beyond chance variation. Table 9 is included because the F test evaluates the model as a whole and the t test evaluates the slope, and together they form the basis for the decision on the null hypothesis.

Table 9. ANOVA and t Test Results

Test	Value	df	p	Decision
F test (ANOVA)	9.150	1, 25	.006	Significant model
t test of regression coefficient	−3.025	25	.006	Coefficient differs from zero

The F test was significant, F(1, 25) = 9.150, p = .006, which indicates that the regression model predicts main idea comprehension better than the mean alone. The t test of the regression coefficient was also significant, t(25) = −3.025, p = .006, which confirms that the negative slope differs from zero. Both p values fall below the .05 level, and the identical values are expected because only one predictor was entered in the model. The null hypothesis of no association was therefore rejected for this sample.

To make the practical size of the slope easier to interpret, predicted scores were calculated from the regression equation. Table 10 is presented because a coefficient of −0.410 is difficult to judge without concrete examples, and the table translates it into

expected comprehension scores at several levels of gadget use intensity within the observed range.

Table 10. Predicted Main Idea Comprehension Scores at Selected Levels of Gadget Use Intensity

Gadget use intensity score (X)	Predicted main idea comprehension (Y)
45	82.83
55	78.73
65	74.63
75	70.53
85	66.43

The predicted comprehension score declined from 82.83 at an intensity score of 45 to 66.43 at an intensity score of 85, a difference of about 16 points across 40 points of intensity. Each 10-point step in intensity corresponded to a predicted decrease of 4.10 points in comprehension. These values lie within the observed range of intensity scores (45 to 88), so they do not extrapolate beyond the data. The table shows that the association is visible in the expected scores, although it describes an average pattern and does not predict the score of any individual student.

DISCUSSION

Association between gadget use intensity and main idea comprehension

The main finding is a negative and significant association between gadget use intensity and main idea comprehension ($r = -.518$, $p = .006$), with gadget use intensity accounting for 26.8% of the variance. One possible explanation is that students with high device use intensity spend less time on sustained reading of connected text, and main idea identification depends on relating sentences within a paragraph. A second possible explanation is that frequent engagement with brief and visual content shapes reading habits and attention. The questionnaire captured purpose and type of digital activity only as part of a composite intensity score, so these explanations remain interpretations that the present data cannot test directly. Their value lies in generating hypotheses for studies that record how children actually spend their time on devices.

This direction is consistent with earlier syntheses. Previous studies have reported that screen use was negatively associated with literacy ($r = -.14$) in an umbrella review (Sanders et al., 2024), and that leisure digital reading showed negative associations with

comprehension in primary and middle school (Altamura et al., 2025). The association observed here is larger than those pooled estimates. This variation may be associated with differences in measurement, since the present study used a composite of frequency, duration, purpose, and activity with an outcome limited to one comprehension skill. The small sample of 27 students also yields wide uncertainty, as the confidence interval from −.75 to −.17 shows, so the true association may be closer to the pooled estimates. The coefficient should therefore be treated as a preliminary estimate to be checked in larger samples.

Theoretical interpretation

The Simple View of Reading frames comprehension as the product of decoding and linguistic comprehension (Gough & Tunmer, 1986). Teachers at the study school reported that many students read aloud relatively fluently and still needed guidance to identify main ideas. If this report reflects the wider group, the association observed here may be located in the comprehension component and in the attentional processing that comprehension requires. Decoding was not measured in this study, so the framework guides interpretation without being tested by the data. A study that measures decoding, linguistic comprehension, and device use together would allow this interpretation to be examined directly.

Experimental work offers a related mechanism. Research by Delgado and Salmerón (2021) with undergraduate readers found that on-screen readers comprehended less under time pressure, which the authors interpreted as evidence of shallow information processing. Research by Clinton (2019) found that readers judged their own performance more accurately after reading from paper than from screens. These studies concern reading media and adult readers, and the present study measured everyday device use among children, so the findings should be interpreted in relation to these differences in population and construct. A reasonable inference is that attention during reading is a candidate mediator of the association, and future studies could measure attention directly to test this possibility.

Variation across previous evidence and the role of quality of use

Different patterns have been reported when devices are used for structured learning. A systematic review by Dorris et al. (2024) found a positive combined effect of mobile device interventions on primary pupils' literacy and numeracy (d = 0.24), and Savva et

al. (2022) reported a small positive effect of electronic storybooks on language and literacy (g = .25). Those studies examined designed learning activities, and the present questionnaire described habitual use in daily life, including entertainment. This difference in what was measured offers a plausible reason why the direction of the association differs from the intervention results. The finding should be interpreted in relation to this difference and cannot be taken as evidence about educational use of devices.

Evidence on quality of use is informative as well. Madigan et al. (2020) found that greater screen quantity was negatively associated with child language, and that educational content and co-viewing were positively associated. Research by Furenes et al. (2021) found that adult mediation during print book reading was more effective than enhancements in digital books read independently. A systematic review by Hare et al. (2024) reported that print was more often found better for comprehension of informational text, and that digital was more often found better for engagement and vocabulary. Taken together, these studies indicate that the relationship between devices and reading depends on content, purpose, and adult guidance. In the present study the purpose indicator was combined with the other indicators, so its separate contribution is unknown, and a practical implication is that schools and families can distinguish educational from entertainment use and add adult mediation.

Other factors associated with main idea comprehension

Gadget use intensity left 73.2% of the variance unexplained, which indicates that other factors contribute to main idea comprehension. Mol and Bus (2011) found moderate to strong correlations between leisure print exposure and reading comprehension, which suggests that time spent in print reading at home is a relevant factor. Main idea skills can be taught explicitly, as shown by the paraphrasing and text structure intervention of Stevens et al. (2020) and the synthesis of Wanzek et al. (2010), which indicates that the quality of classroom instruction deserves attention. Analysis of PISA 2018 data by Chen et al. (2021) pointed to metacognitive strategy knowledge as a mediator in the relationship between social media use and digital reading literacy among adolescents. The implication is that efforts to improve comprehension are likely to work best as a combination of guided device use, home reading routines, explicit instruction in main idea strategies, and self-regulation support.

Implications

For teachers, the findings support the use of explicit main idea instruction and of digital materials that require sustained reading and comprehension tasks. For parents, they support attention to the duration and purpose of device use and the maintenance of shared reading routines at home. For schools, literacy programs could include guidance on purposeful device use and could invite parents into reading activities. These implications are realistic for an elementary school setting because they build on existing classroom and family routines. They remain tentative because the study is cross-sectional and correlational, and the evidence does not justify strict prohibitions on device use.

Limitations and directions for future research

Several limitations should be considered. The sample consisted of 27 students from one class in one school, selected through purposive sampling, so the results cannot be generalized to other populations. With 27 participants, a two-tailed test at the 5% level and 80% power can reliably detect correlations of about .52 or larger, and the observed coefficient lies close to this threshold, which suggests that the estimate may be imprecise. The cross-sectional design cannot establish the direction of the relationship, and students with lower comprehension could also use devices more intensively. Longitudinal designs have been used to examine directionality in early childhood screen use (Madigan et al., 2019), and such designs would be valuable for this age group. Device use was also self-reported by children, and no covariates such as prior reading ability, motivation, family support, or socioeconomic background were included.

Future research could address these limitations in several ways. Larger multi-school samples would improve precision and allow multilevel analysis. Including covariates and objective usage data, such as device logs, would reduce measurement error and confounding. Analyzing purpose and type of activity separately would clarify which kinds of use are associated with comprehension. Following the recommendation of Ostiz-Blanco et al. (2021) for larger samples in digital reading research, studies that combine quantitative and qualitative methods could also explain why students with different usage patterns show different comprehension outcomes.

CONCLUSION

Gadget use intensity showed a negative and significant association with main idea comprehension among the fourth-grade students studied ($r = -.518$, $p = .006$; $R^2 = .268$). Students in the class reported high average gadget use and showed good average comprehension, and the association indicates that students with more intensive use tended to score lower. The findings are preliminary because they come from one small sample and a cross-sectional design, and they describe an association without establishing a cause. They suggest that guidance on the duration and purpose of device use is worth considering together with explicit instruction in main idea strategies and home reading practices. Future studies with larger, multi-school, and longitudinal designs are needed to examine the robustness and direction of this association.

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