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Gadget Use and Students' Reading Interest in Biology Learning: A Correlational Study

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ABSTRACT

This study examined the relationship between gadget use and students' interest in reading biology materials at SMA Negeri 7 Palu. A quantitative correlational design was used to estimate the direction and strength of the relationship without manipulating the variables. The population comprised 344 tenth-grade students in 10 classes during the 2025/2026 academic year. Using the Slovin formula with a 5% margin of error, 185 students were selected through simple random sampling. Data were collected in February 2026 using two 15-item questionnaires scored on a five-point Likert scale. The instruments measured frequency and duration, learning activities, and purposes of gadget use, as well as reading enjoyment and motivation, reading habits, and time devoted to reading biology. Descriptive percentages and Pearson's product-moment correlation were analyzed using SPSS version 25. Learning activity type was the strongest gadget-use indicator (78%), and reading habits were the strongest reading-interest indicator (76%). Gadget use was positively and significantly related to reading interest ($r = .687$, 95% CI [.602, .756], $p < .001$), representing 47.2% shared variance. The findings indicate association rather than causation: students who used gadgets more purposefully for learning tended to report stronger interest in reading biology. Guided digital reading activities may therefore support biology learning and students' digital literacy.

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INTRODUCTION

Digital technology has reshaped twenty-first-century education by changing how students locate, evaluate, and use information. Smartphones and other personal gadgets enable rapid access to e-books, videos, scientific explanations, and interactive resources, thereby extending learning beyond printed textbooks and classroom time (Agni et al., 2024; Lestari, 2018; Pahriadi et al., 2025; Zainal et al., 2024). In biology education specifically, smartphones can provide access to videos, tutorial applications, self-assessment activities, and interactive three-dimensional representations that complement conventional instruction (Yadav & Chakraborty, 2023). In Indonesia, access to digital devices among school-age learners is increasingly common (Badan Pusat Statistik Indonesia, 2023). For science and biology education, this access is particularly relevant because digital resources can help students engage with biological information through multiple forms of representation.

Despite these potential benefits, access does not automatically produce academically productive use. Gadgets also provide entertainment, social media, and game content that can fragment attention and displace sustained reading when use is unguided (Huda, 2020; Prayogi et al., 2025). The educational value of a gadget therefore depends less on ownership alone than on the purpose, activity, and self-regulation associated with its use. This distinction is central to digital literacy: students need not only operational skills, but also the capacity to select credible sources and use digital media deliberately for learning.

Reading interest is an important affective foundation for learning biology. Biology texts contain specialized vocabulary, multilevel explanations, diagrams, and relationships among structures, functions, and processes; understanding these materials requires attention and repeated engagement. Students who are willing to read regularly have more opportunities to connect concepts, expand scientific vocabulary, and build the background knowledge needed for scientific literacy (Anjani et al., 2019; Etnanta & Irhandayaningsih, 2017). Conversely, weak reading habits can restrict students' engagement with explanatory texts even when information is readily available.

Preliminary observations at SMA Negeri 7 Palu indicated that nearly all tenth-grade students owned or could access gadgets, but their use was not consistently directed toward biology learning. Students used devices for communication and entertainment as well as for locating school materials. This pattern created a practical tension: the same device could widen access to biology readings or compete with the attention needed to read them. Examining the relationship at the school level was therefore necessary to determine whether more academically oriented gadget use corresponded with stronger reading interest.

Findings from previous studies have been inconsistent, Rauf et al. (2023), Suminar (2021), and Hayati et al. (2025) reported positive relationships or effects when gadgets were used to access learning resources, while Rosiyanti et al. (2018) similarly showed that digital devices can support learning when positioned as learning resources. However, other evidence suggests that digital reading does not automatically strengthen reading-related outcomes. Jensen et al. (2024) showed that reading medium can influence students' text processing and comprehension. More recently, Altamura et al. (2026) found no longitudinal causal paths between digital reading habits and reading comprehension for either leisure or academic purposes among 908 primary-school students; moreover, increased academic digital reading in Grade 5 predicted lower intrinsic reading motivation in Grade 6. These findings suggest that the relationship between digital-device use and reading outcomes is more complex than a simple exposure–benefit relationship and may depend on purpose, motivation, self-regulation, and the characteristics of the reading activity.

A further gap concerns context, outcome, and educational level. Previous research has examined general reading, digital reading habits, reading comprehension, reading motivation, and broad academic outcomes, often among elementary or junior-high-school students. Recent longitudinal evidence has also focused on digital reading habits and intrinsic reading motivation rather than subject-specific reading interest (Altamura et al., 2026). Evidence specifically connecting patterns of gadget use with interest in reading biology among Indonesian senior high school students therefore remains limited. The present study addresses this gap by focusing specifically on biology materials and distinguishing frequency and duration, learning activity type, and purpose of gadget use. This approach

allows gadget use to be interpreted as a multidimensional learning behavior rather than as undifferentiated screen exposure.

Accordingly, this study aimed to determine the direction and strength of the relationship between gadget use and students' interest in reading biology materials at SMA Negeri 7 Palu. The alternative hypothesis stated that gadget use would be positively and significantly associated with reading interest. The study contributes school-level evidence for designing guided digital reading activities, strengthening digital literacy, and directing students' everyday technology use toward meaningful engagement with biology.

METHOD

This study employed a quantitative correlational design (Sugiyono, 2023). The design was selected because both gadget use and reading interest were measured as they occurred naturally, without treatment or manipulation, and the objective was to estimate the direction and strength of their statistical association. The unit of analysis was the individual student, and the two questionnaire scores were treated as continuous composite variables.

The population comprised all 344 tenth-grade students distributed across 10 classes at SMA Negeri 7 Palu in the 2025/2026 academic year. A minimum sample of 185 students was calculated using the Slovin formula, $n = N/[1 + N(e^2)]$ (Arikunto, 2019; Sugiyono, 2024), where N is the population size and e is the tolerated sampling error. A 5% margin of error was applied. Simple random sampling was used to provide each member of the population with an equal opportunity for selection. The 185 students were selected using a lottery method.

Data were collected using two researcher-developed closed self-report questionnaires containing 30 statements: 15 items measured gadget use and 15 items measured interest in reading biology materials. The questionnaires were not adopted verbatim from a single existing scale. Rather, the indicators were derived from the operational definitions used in this study and informed by prior research on smartphone/gadget use and reading interest among secondary students (Etnanta & Irhandayaningsih, 2017; Suminar, 2021).

Two subject-matter experts in biology/science education reviewed the item pool for content relevance, construct alignment, wording clarity, and suitability for Grade 10 students; their recommendations were incorporated before pilot testing. Responses were scored on a five-point Likert scale from 1 (strongly disagree) to 5 (strongly agree).

The gadget-use scale covered frequency and duration; type of learning activity, including accessing biology e-books or articles and watching biology learning videos; and purpose of use, including supporting biology learning and independent study while regulating non-academic use. The reading-interest scale covered reading enjoyment and motivation, reading habits, and time devoted to reading; examples included seeking biology readings, taking notes, completing difficult texts, and allocating reading time outside lessons.

The study was conducted at SMA Negeri 7 Palu in February 2026. First, the constructs and indicators were operationalized, and the questionnaires were prepared and pilot-tested with students who had characteristics comparable to those of the research sample. Second, the population list was compiled, and 185 students were selected through simple random sampling using a lottery method. Third, the questionnaires were distributed directly at school with standardized instructions and checked for completeness. Fourth, responses were coded, tabulated, screened, and analyzed using SPSS version 25. Secondary data on enrollment, class distribution, and relevant biology-learning documents were obtained from school records. Data collection was conducted with school approval, and respondent confidentiality was protected.

Indicator scores were converted to percentages using the observed total score divided by the maximum possible score and multiplied by 100. The resulting values describe relative scale-score attainment and do not represent the percentage of students who performed a particular activity. Pearson's product-moment correlation was used to test the two-tailed hypothesis at $\alpha = .05$. The correlation coefficient was interpreted according to its direction and magnitude, a 95% confidence interval was calculated using Fisher's z transformation, and r^2 was used to express shared variance.

Statistical association was not interpreted as causation because the study employed a cross-sectional, non-experimental design.

The Kolmogorov–Smirnov test yielded a significance value of .200 for the unstandardized predicted values. However, this result alone does not establish the assumptions required for Pearson correlation. Therefore, the normality test result was treated as preliminary evidence rather than a complete assessment of bivariate normality. Additionally, Levene's test yielded a significance value of .321. However, homogeneity of group variances is not a core assumption of bivariate Pearson correlation.

RESULTS AND DISCUSSION

The results are presented in two stages. First, the indicator percentages describe how students reported using gadgets and engaging with biology reading. Second, the inferential analysis evaluates whether students with higher gadget-use scores also tended to report higher reading-interest scores. The normalized percentage scores for gadget-use and reading-interest indicators are presented in Table 1.

Table 1. Percentage of Gadget-Use and Reading-Interest Indicators

Variable	Indicator	Percentage (%)
Gadget use	Frequency and duration	65
Gadget use	Type of learning activity	78
Gadget use	Purpose of use	72
Reading interest	Reading enjoyment and motivation	70
Reading interest	Reading habits	76
Reading interest	Time spent reading	68

The descriptive results (see Table 1) show that learning activity type (78%), rather than frequency and duration (65%), was the most prominent gadget-use dimension. The purpose-of-use dimension reached 72%. This percentage is a normalized indicator score, not the proportion of students performing a specific activity. It represents the extent to which respondents reported using gadgets with an academic purpose for biology learning and independent study while limiting non-academic use. By contrast, accessing biology e-books or articles and watching biology learning videos were examples of the learning-activity-type indicator (78%). For reading interest, reading habits (76%) were more prominent than reading enjoyment and motivation (70%) and time spent reading (68%). This pattern suggests that students may have a recurring inclination to read without necessarily sustaining long reading periods. The comparison of gadget-use and reading-interest indicators is further illustrated in Figure 1.

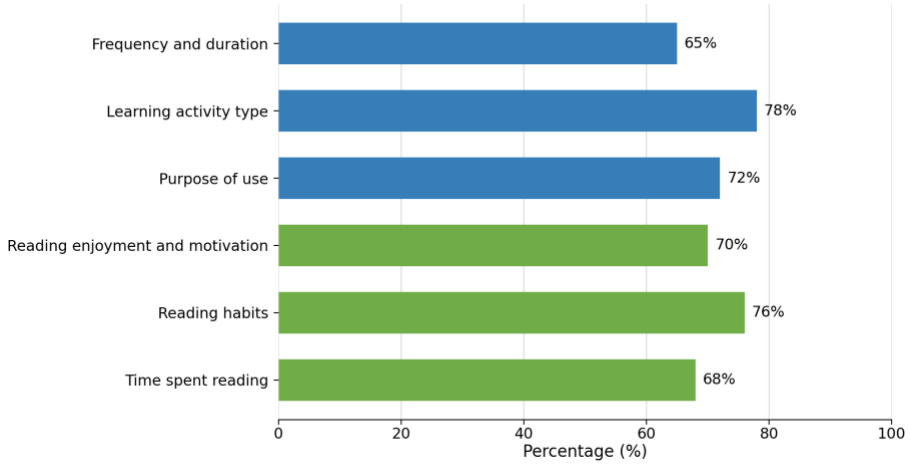


Fig.1. Comparison of gadget-use and reading-interest indicator percentages

Figure 1 reinforces the contrast within each construct. Learning activity type and reading habits form the strongest indicators, while frequency/duration and time spent reading are comparatively lower. The paired pattern supports an interpretation centered on the quality and regularity of learning behavior rather than on exposure time alone. The results of the preliminary statistical tests are summarized in Table 2.

Table 2. Summary of Reported Preliminary Tests

Test	Reported statistic	p	Interpretation
Kolmogorov-Smirnov	D = .060	.200	No statistically significant departure reported
Levene based on mean	F = 1.134	.321	Equal-variance result reported in the thesis

The Table 2 reported non-significant normality and homogeneity results before hypothesis testing. These values are summarized rather than reproduced as raw SPSS output. Their interpretation should remain cautious because the normality output refers to an unstandardized predicted value, and Levene's test is not required for a bivariate Pearson correlation.

The hypothesis test examined whether students' gadget-use scores covaried with their interest in reading biology. The compact results are shown in Table 3, raw SPSS output was omitted to improve readability and avoid duplicating software tables.

Table 3. Pearson Correlation Between Gadget Use and Reading Interest

Variables	N	r	p	r^2	95% CI for r
Gadget use–reading interest	185	.687	< .001	.472	[.602, .756]

Table 1 shows that gadget use was positively and significantly associated with students' interest in reading biology, r = .687, 95% CI [.602, .756], p < .001. The confidence interval remained entirely positive, supporting the positive direction of the association in this sample. Squaring the correlation coefficient yielded r^2 = .472, indicating approximately 47.2% shared variance between the two composite scores. This value represents statistical overlap rather than a causal contribution because the correlational design does not establish causality.

The positive association observed in this study is consistent with previous Indonesian studies reporting that academically oriented gadget use is associated with stronger reading interest (Hayati et al., 2025; Rauf et al., 2023; Suminar, 2021). However, the present findings should not be interpreted as evidence that greater digital exposure itself improves reading interest. The descriptive results support a more specific interpretation: learning activity type (78%) was more prominent than frequency and duration of gadget use (65%), while the purpose-of-use score (72%) indicated an academic orientation toward biology learning and independent study. Because these percentages are normalized indicator scores, they should not be interpreted as the proportion of students who performed a specific activity. In biology learning, the distinction between activity and exposure time is especially relevant because smartphones can provide access to videos, tutorial materials, self-assessment activities, and interactive biological representations (Yadav & Chakraborty, 2023).

The findings should also be considered alongside evidence showing that digital reading does not uniformly produce positive reading outcomes. Jensen et al. (2024) demonstrated that reading medium can influence students' comprehension and text-processing behavior. More importantly, Altamura et al. (2026), using longitudinal data from 908 students, found no causal paths from digital reading habits to reading comprehension and reported that increased academic digital reading in Grade 5 predicted lower intrinsic reading motivation in Grade 6. Although their participants, outcome measures, and design differed from those of the present study, these findings reinforce the need to distinguish purposeful academic gadget use from digital reading exposure alone. The positive correlation identified in the present study may therefore reflect differences in how students use gadgets for biology learning rather than a general benefit of increased screen use.

Recent evidence further indicates that affective engagement with digital reading depends on multiple motivational and environmental factors. Lin et al. (2026), analyzing digital reading enjoyment

among 10,979 children, identified intrinsic motivation, social motivation, mastery goals, self-efficacy, extrinsic motivation, and parental reading autonomy support as important positive contributors to model-based predictions of digital reading enjoyment. Thus, reading-related engagement in digital environments cannot be attributed to device use alone. In the present study, the observed association between gadget use and reading interest may similarly coexist with motivational, family, and learning-environment factors that were not measured.

Several limitations qualify the interpretation of the findings. The cross-sectional correlational design cannot establish temporal order or causality. Both variables were measured using self-report questionnaires and may therefore be affected by recall and social-desirability bias. The sample was drawn from one school, which limits the generalizability of the findings. Although simple random sampling using a lottery method was applied, the study remains restricted to the population of SMA Negeri 7 Palu. In addition, the reported Kolmogorov–Smirnov test does not fully establish bivariate normality, linearity, or the absence of influential outliers required for a complete assessment of the assumptions underlying Pearson correlation. These statistical limitations should therefore be considered when interpreting the reported association. Future studies should combine self-report data with usage logs, reading-performance measures, interviews, or classroom observations and employ mixed-method, longitudinal, or multi-school designs.

The relatively high overlap between the two scores also requires careful measurement-based interpretation. Some questionnaire statements may capture adjacent behaviors—for example, using a gadget to locate a biology text and choosing to read that text—so part of the association may reflect conceptual proximity between the instruments. Although the gadget-use scale showed acceptable internal consistency (Cronbach's $\alpha = .774$) and the reading-interest scale showed high internal consistency (Cronbach's $\alpha = .881$), further construct-validation evidence is required to establish whether the scales adequately distinguish gadget-use behavior from reading interest. Future studies could use confirmatory factor analysis or structural equation modeling with larger multi-school samples to examine discriminant validity and estimate direct and indirect relationships. Academic and recreational gadget use could also be examined as separate predictors.

CONCLUSION AND SUGGESTION

Students who used gadgets more purposefully for learning tended to report stronger interest in reading biology materials. The central finding is therefore not that greater screen exposure automatically improves reading interest, but that academically directed gadget use is positively associated with reading interest in this sample. This interpretation is consistent with the higher percentage observed for learning activity type (78%) than for frequency and duration of gadget use (65%). However, evidence from digital-reading research indicates that digital exposure does not uniformly improve reading motivation or comprehension. Thus, the findings support guided and purposeful digital learning rather than increased gadget use per se.

Biology teachers should guide students toward credible digital resources and structured reading activities while maintaining opportunities for sustained and in-depth reading. Schools should strengthen digital-literacy support and promote focused gadget use, while students should distinguish academic use from entertainment. Further research should examine additional predictors of reading interest, distinguish academic from recreational gadget use, and employ mixed-method, longitudinal, or multi-school designs.

AUTHOR CONTRIBUTIONS STATEMENT

Conceptualization, R.A.; methodology, B. and R.A.; investigation, E.T.; data collection, E.T.; data curation, E.T.; formal analysis, E.T.; supervision, B., R.A., A.R., and I.I.; instrument content validation, R.A. and S.Z.; writing—preparation of the original draft, E.T.; writing—review and editing, B., R.A., A.R., I.I., and S.Z. All authors reviewed and approved the final version of the manuscript.

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DECLARATION OF GENERATIVE AI SOURCES

The authors used ChatGPT, a generative artificial intelligence tool developed by OpenAI, during manuscript preparation to assist with English-language editing, grammar correction, and improvement of clarity and scientific writing style. The tool was not used to generate, modify, or fabricate research data, statistical results, or scientific findings. All AI-assisted text was reviewed and verified by the authors, who take full responsibility for the accuracy, integrity, and final content of the manuscript.

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