

The Effect of Computer-Based Test (CBT) Utilization, Digital Literacy, and Internet Access on Grade V Students' Science and Social Studies (SASS) Learning Outcomes

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Abstract. This study aims to analyze the effects of Computer-Based Test (CBT) utilization, digital literacy, and internet access on Grade V students' Science and Social Studies (SASS) learning outcomes in public elementary schools in Ngunut District during the 2025/2026 academic year, both partially and simultaneously. The study employed a quantitative approach with an explanatory ex-post facto design. The population consisted of 587 students, and 233 respondents were selected using proportional random sampling with a 5% margin of error (Slovin formula). Data were collected through a 39-item Likert-scale questionnaire and documentation of students' SASS achievement scores. Multiple linear regression analysis was conducted after fulfilling classical assumption tests, including normality, multicollinearity, heteroscedasticity, and linearity. The findings indicate that CBT utilization ($\beta = 0.173$; $p = 0.018$) and digital literacy ($\beta = 0.432$; $p < 0.001$) have positive and significant effects on learning outcomes, with digital literacy identified as the most dominant predictor. Internet access ($\beta = 0.114$; $p = 0.176$) does not have a significant partial effect. However, simultaneously, the three independent variables significantly influence learning outcomes ($F = 58.871$; $p < 0.001$). The coefficient of determination ($R^2 = 0.435$) shows that 43.5% of the variance in learning outcomes is explained by the model. These findings highlight that digital literacy competence is a key determinant in optimizing technology-based learning in primary education.

Keywords: Computer-Based Test, Digital Literacy, Internet Access, Learning Outcomes, Primary Education

1 Introduction

The advancement of information and communication technologies has brought about a significant transformation in learning and evaluation systems within elementary schools. One form of technology integration in learning evaluation is the use of Computer-Based Testing (CBT), including the implementation of the Computer-Based National Assessment (ANBK). Theoretically, CBT offers various advantages over paper-based tests, such as time efficiency, assessment objectivity, correction speed, and the ability to randomize questions, thereby enhancing academic integrity. Research indicates that the implementation of CBT has a positive effect on student motivation and learning outcomes (Amelia, 2021; Wiranata et al., 2023; Yusuf et al., 2024). Furthermore, multimedia features in CBT, such as the integration of images, videos, and audio, can help students understand questions more contextually (Tananda et al., 2023). However, the effectiveness of CBT heavily relies on the readiness of infrastructure and the digital competence of users (Fitriyati & Annur, 2024).

On the other hand, digital literacy is a primary prerequisite for the success of technology-based learning and evaluation. Digital literacy not only includes the ability to access information but also the skills to critically and responsibly evaluate and use digital information. Current research shows that digital literacy has a significant impact on student learning outcomes (Soraya et al., 2023; Arima et al., 2021; Wulandari, 2022). In fact, the optimal use of digital literacy has proven to have a strong impact on improving academic achievement (Irhaniati et al., 2024). Nevertheless, reports from UNICEF (2021) and Afrina et al. (2024) reveal that the level of digital literacy among Indonesian students is still relatively low, especially in areas with limited access to technology.

In addition to digital literacy, internet access is a crucial factor in supporting digital learning. The digital divide theory asserts that unequal internet access can create disparities in learning opportunities. Data from Indonesian Welfare Statistics (2019) indicates that device ownership and internet access in rural areas are still

limited. Research by Anggina et al. (2025) and Collins et al. (2021) proves that the use of the internet as a learning medium has a positive effect on learning outcomes. Findings by Pohan (2020) and Puspitasari et al. (2024) also confirm that the simultaneous use of the internet and digital literacy contributes significantly to student academic achievement.

The subject of Natural and Social Sciences (SASS) requires analytical skills, conceptual understanding, and problem-solving abilities. Theoretically, the integration of CBT, digital literacy, and internet access should strengthen SASS learning outcomes through concept visualization and interactive evaluation. However, initial studies in elementary schools in the Ngunut sub-district show that many fifth-grade students' SASS learning outcomes are still below the Minimum Completeness Criteria (KKM). This condition indicates a gap between the theory of technology integration in learning and the practice in the field.

Based on a review of previous research, most studies examine the influence of CBT, digital literacy, and internet access partially on learning outcomes. However, research that tests these three variables simultaneously in the context of SASS learning in elementary schools, especially in areas with limited infrastructure, is still limited. The novelty of this research lies in the empirical testing of the influence of CBT use, digital literacy, and internet access together on the SASS learning outcomes of elementary school students in an integrated quantitative analysis model, thus providing a comprehensive picture of the technological factors that influence learning achievement.

Thus, this research is important to conduct to provide a theoretical contribution in the development of technology-based learning and evaluation models, as well as a practical contribution for elementary schools in designing strategies to improve SASS learning outcomes through optimizing CBT, strengthening digital literacy, and providing adequate internet access.

2 Methods

This research employs a quantitative approach with an explanatory survey design and an ex-post facto framework. This approach was chosen because the study aims to examine the influence of Computer-Based Testing (CBT) usage, digital literacy, and internet access on SASS learning outcomes without directly treating the subjects. Thus, the variables are studied based on existing empirical conditions. The explanatory design allows for testing causal relationships between variables through inferential statistical analysis in an objective and measurable manner. The selection of this design aligns with quantitative research in the field of education, which emphasizes hypothesis testing and systematic analysis of relationships between variables (Assayakurrohim et al., 2023; Ayu Sofya et al., 2024). The analysis was conducted using multiple linear regression to determine the partial and simultaneous effects of the independent variables on the dependent variable, as recommended in correlational quantitative research (Kadeni, 2022).

The study population consists of all fifth-grade students in public elementary schools in the Ngunut sub-district for the 2025/2026 academic year, totaling 587 students. Sample selection was performed using a probability sampling technique with a proportional random sampling method to ensure each school obtained a balanced sample proportion according to the number of students. The sample size was determined using the Slovin formula with a 5% error rate, resulting in 233 respondents. This technique was chosen to maintain the representativeness and external validity of the research findings (Ayu Sofya et al., 2024). The research procedure includes: (1) developing instruments based on the theoretical indicators of each variable; (2) content validation through expert judgment; (3) instrument testing to assess validity and reliability; (4) data collection through questionnaire distribution; and (5) data processing and analysis using SPSS software.

The research instrument is a closed-ended questionnaire using a 1–5 Likert scale consisting of 39 statement items, covering the variables of CBT usage (9 items), digital literacy (12 items), internet access (9 items), and SASS learning outcomes (9 items on cognitive, affective, and psychomotor aspects). The Likert scale was used because it is effective in quantitatively measuring respondents' perceptions and attitudes in educational research (Aditya Santika et al., 2023). Prior to regression analysis, prerequisite tests including normality, multicollinearity, heteroscedasticity, and linearity were conducted to ensure the feasibility of the model. Hypothesis testing was performed through t-tests (partial), F-tests (simultaneous), and the coefficient of determination to determine the contribution of the independent variables to learning outcomes. All analysis procedures refer to quantitative research standards that emphasize objectivity, measurement accuracy, and accurate interpretation of results (Sugiyono, 2020a; Sugiyono, 2020b).

3 Results and Discussion

This study aimed to analyze the influence of Computer-Based Testing (CBT) usage, digital literacy, and the intensity of internet access on the SASS learning outcomes of fifth-grade students in public elementary schools

throughout the Kebumen sub-district. Data were obtained through questionnaires and learning achievement tests that had been tested for validity and reliability.

Descriptively, CBT usage scores indicated a high category, with the average falling within the "good" category interval. Students' digital literacy was also in the moderate-to-high category, while the intensity of internet access showed considerable variation among respondents. SASS learning outcome scores had a normal distribution with an increasing trend in the group with high digital literacy.

3.1 Results

3.1.1 Analysis Prerequisite Tests

Prior to conducting regression analysis, prerequisite tests were performed, including:

- a. Normality Test
The Kolmogorov-Smirnov test results showed a significance value > 0.05 , indicating that the data were normally distributed.
- b. Multicollinearity Test
Tolerance values > 0.10 and VIF < 10 indicated that there was no multicollinearity among the independent variables.
- c. Heteroscedasticity Test
The Glejser test showed a significance value for each variable > 0.05 , indicating that heteroscedasticity did not occur.

3.1.2 Multiple Linear Regression Analysis Results

Multiple linear regression analysis was used to determine the influence of CBT usage (X_1), digital literacy (X_2), and intensity of internet access (X_3) on SASS learning outcomes (Y).

- a. t-test (Partial)
The t-test results showed:
 1. CBT $\rightarrow \beta = 0.173$; $t = 2.384$; $p = 0.018$
 2. Digital Literacy $\rightarrow \beta = 0.432$; $t = 5.221$; $p < 0.001$
 3. Internet Access $\rightarrow \beta = 0.114$; $t = 1.358$; $p = 0.176$Thus, CBT and digital literacy had a significant partial effect, while internet access was not significant.
- b. F-test (Simultaneous)
The F-test results showed a significance value < 0.05 , meaning that simultaneously, CBT usage, digital literacy, and intensity of internet access had a significant effect on SASS learning outcomes.
- c. Coefficient of Determination (R^2)
The R^2 value indicated that the percentage of variation in SASS learning outcomes that can be explained by the three independent variables was in the strong category. The remainder is influenced by other factors outside the research model.

3.2 Discussion

3.1.2 Influence of Computer-Based Testing (CBT) Usage on SASS Learning Outcomes

The regression analysis results showed that CBT usage had a positive and significant effect on students' SASS learning outcomes ($\beta = 0.173$; $p = 0.018$). This finding indicates that the better the implementation of CBT, which includes frequency of use, variety of test types, and technical quality of the platform, the higher the students' learning achievement. Theoretically, this finding can be interpreted through the e-assessment approach, which asserts that digital-based assessments increase objectivity, scoring accuracy, and speed of feedback, thereby strengthening students' self-regulation in learning.

In the context of research indicators, the technical quality of CBT (device reliability, minimal technical disruptions, ease of application use) contributes to students' comfort and focus during the evaluation. This result is consistent with Kusumadewi's (2021) research, which concluded that computer-based evaluation systems improve assessment efficiency and the quality of learning feedback. Wiranata et al. (2023) also found that consistent CBT usage increases motivation and academic performance of students at the elementary education level. Similarly, Yusuf et al. (2024) affirmed that the integration of digital assessment has a significant impact on improving students' cognitive achievement because it reduces subjective bias in assessment.

Conceptually, CBT not only functions as an evaluation tool but also as an instrument of reflective learning. Instant feedback allows students to identify weaknesses in SASS concepts that are contextual and analytical. Therefore, the significance of CBT's influence in this study strengthens the argument that the quality of

technology-based evaluation contributes to improved learning outcomes, although the magnitude of the effect is relatively smaller than digital literacy.

3.1.3 Influence of Digital Literacy on SASS Learning Outcomes

Digital literacy proved to have the most dominant influence on SASS learning outcomes ($\beta = 0.432$; $p < 0.001$). The highest beta coefficient indicates that digital technical skills, access and understanding of information, evaluation of information, and digital ethics and security are the main determinants of students' academic achievement.

Theoretically, digital literacy is a multidimensional competence that includes cognitive, technical, and ethical abilities in utilizing technology for learning. Research by Handayani et al. (2022) showed that students with high digital literacy have better critical thinking skills in understanding multimedia-based material. Nugraha (2022) also found that digital literacy significantly influences learning outcomes through increased ability to search for and validate information.

In the context of SASS, which requires analysis of human and environmental interactions as well as exploration of contextual phenomena, digital literacy allows students to access more varied and interactive learning resources. This finding is consistent with Anggita et al.'s (2025) research, which stated that digital literacy contributes significantly to improving learning outcomes in integrated science-based subjects because it supports analysis and problem-solving abilities.

The dominance of digital literacy's influence in this study confirms that the success of digital learning is not only determined by devices or infrastructure but by the competence of users in managing digital information critically and responsibly.

3.1.4 Influence of Internet Access on SASS Learning Outcomes

Unlike the previous two variables, internet access did not have a significant partial effect on learning outcomes ($\beta = 0.107$; $p = 0.176$). Although there was a significant linear relationship (linearity test $p < 0.05$), its contribution in the multiple regression model became insignificant.

Theoretically, this finding can be explained through the concept of the second-level digital divide, which states that the gap lies not only in the availability of access but in the quality of usage and digital competence of users. Cahyaningrum and Panduwinata (2024) found that network stability affects the effectiveness of online learning but does not directly improve learning outcomes without being balanced by digital literacy skills.

Thus, in this study, internet access acts as a prerequisite (enabling factor) but not a primary determinant. This means that the availability of a stable and easily accessible network does not necessarily improve learning achievement if it is not followed by effective utilization. This explains why the influence of internet access becomes insignificant when tested together with digital literacy and CBT.

3.1.5 Simultaneous Influence of CBT, Digital Literacy, and Internet Access on Learning Outcomes

The simultaneous test results ($F = 58.871$; $p < 0.001$) showed that all three variables together had a significant effect on SASS learning outcomes. The R^2 value of 0.435 indicates that 43.5% of the variation in learning outcomes can be explained by the model, while 56.5% is influenced by other factors such as learning motivation, parental support, or teacher pedagogical competence.

Theoretically, this finding is in line with the integrative framework of technology in learning, which emphasizes the synergy between digital evaluation systems, user competence, and infrastructure support. Research by Puspitasari et al. (2024) showed that the combination of internet use, computer laboratories, and digital literacy simultaneously improves learning outcomes significantly. Similarly, recent studies in elementary education state that the integration of digital evaluation systems and literacy competencies results in learning that is more effective and adaptive to the needs of the 21st century.

Thus, the results of this study reinforce the argument that the effectiveness of digital learning is the result of a multidimensional interaction between technology, student competence, and the quality of system implementation.

4 Conclusion

This study affirms that the transformation of digital-based evaluation and learning at the elementary school level is not only determined by the availability of technology but primarily by students' competence in utilizing

it meaningfully. Substantively, digital literacy emerges as the most dominant determinant in improving SASS learning outcomes. This indicates that technical, cognitive, and ethical skills in accessing, evaluating, and utilizing digital information are the main foundation for the success of 21st-century learning. Thus, improving learning outcomes is not sufficient through the provision of devices and networks alone but must be accompanied by a systematic and structured strengthening of students' digital literacy competencies.

The use of Computer-Based Testing (CBT) has also proven to make a positive contribution to learning outcomes. This finding implies that technology-based evaluation systems are able to increase the objectivity of assessment, the efficiency of feedback, and encourage students' self-regulation in the learning process. The implementation of CBT designed with good technical quality and consistent frequency of use can be an effective strategy to strengthen an adaptive and transparent assessment culture in elementary schools.

Conversely, internet access did not show a significant partial effect on learning outcomes when tested together with other variables. This indicates that access is a supporting prerequisite (enabling factor) but not a primary determinant. The availability of a network without digital literacy competencies and appropriate learning designs does not automatically improve academic achievement. This finding reinforces that the quality of technology utilization is more important than mere availability.

Simultaneously, the combination of CBT usage, digital literacy, and internet access was able to explain 43.5% of the variation in SASS learning outcomes. This means that there are still other factors outside the model that also influence learning achievement, such as students' intrinsic motivation, family support, teacher pedagogical competence, and the school's academic climate. Therefore, the results of this study imply the need for an integrative approach in digital education policies, which not only focuses on providing infrastructure but also on developing the capacity of students and teachers.

This study has several limitations. First, the ex-post facto design does not allow researchers to directly exercise experimental control over the independent variables, so the relationships found are associative-quantitative. Second, data collection using self-report questionnaires potentially contains respondent perception bias. Third, the scope of the research is limited to one sub-district, so generalizations of the findings need to be done carefully. Fourth, the research variables have not included other psychological and pedagogical factors that have the potential to moderate or mediate the influence of technology on learning outcomes.

Based on these limitations, future research is advised to use an experimental or quasi-experimental design to test the effectiveness of digital literacy interventions or specific CBT models in more depth. Future research can also add mediating variables such as learning motivation, student engagement, or teacher competence in technology integration. In addition, expanding the sample to a wider area will strengthen the external validity of the findings.

Thus, this study provides a theoretical contribution in strengthening the integrative framework of digital learning in elementary schools, as well as a practical contribution for policymakers and educational units in designing technology-based learning improvement strategies that are oriented towards strengthening digital literacy as a top priority.

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Conflict of Interest

The authors declare that there is no conflict of interest regarding the publication of this research article. The research was conducted independently without any commercial, financial, or personal relationships that could be construed as a potential conflict of interest.

The authors also confirm that there was no funding influence, institutional pressure, or external intervention that affected the research design, data collection, data analysis, interpretation of results, or the decision to publish this manuscript.

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