PILLAR OF PHYSICS EDUCATION
Vol. 19 (4), 2026, pp.333-345
ISSN (Print) : 2337-9618
ISSN (Online) : 2684-8880

# THE EFFECT OF USING GOOGLE CLASSROOM ON STUDENTS' DIGITAL LITERACY IN PHYSICS LEARNING AMONG GRADE XI STUDENTS AT SMAN 1 LUBUK SIKAPING

Ajeng Husnul Khotimah[1], Zulhendri Kamus[1*], Desnita[1], Leni Aziyus Fitri[1]

[1]*Department of Physics, Padang State University, Jl. Prof. Dr. Hamka Air Tawar Padang 25131, Indonesia*
*Corresponding author. Email: zulhendri@fmipa.unp.ac.id*

**ABSTRACT**

Digital literacy is one of the important abilities in physics learning because students are required to be able to access, evaluate, and utilize digital information effectively. The use of technology in learning needs to be directed to activities that can train these skills, not only as a means of delivering material and collecting assignments. This study aims to determine the improvement of students' digital literacy skills through the use of Google Classroom in physics learning in grade XI at SMAN 1 Lubuk Sikaping. The research uses a quantitative approach with the pre-experiment method and One Group Pretest-Posttest. The research sample consisted of 32 students in grade XI F3, with 31 pairs of pretest and posttest data analyzed. Treatment was provided through Problem Based Learning (PBL) learning using Google Classroom as a learning medium for straight motion kinematics materials. Digital literacy ability is measured based on three indicators, namely accessing information, evaluating information, and utilizing information. The results showed that the average digital literacy ability increased from 34.54% in the pretest to 87.36% in the posttest. The average N-Gain value of 0.80859 was in the high category. The results of the Paired Samples t-test showed a significant difference between digital literacy skills before and after learning ($p < 0.001$). Thus, PBL learning using Google Classroom showed an increase in students' digital literacy skills in physics learning.

**Keywords :** *Google Classroom, digital literacy, physics learning, Problem Based Learning, N-Gain .*

Pillar of Physics Education is licensed under a Creative Commons Attribution ShareAlike 4.0 International License.

## I. INTRODUCTION

The development of information and communication technology in the 21st century requires the world of education not only to focus on mastering conceptual knowledge, but also on strengthening 21st century skills, one of which is digital literacy. 21st century learning is defined as learning that integrates literacy skills, knowledge skills, skills and attitudes, as well as mastery of technology [1]. Digital literacy is an important thing that students must have in order to be able to access, evaluate, and utilize digital information critically, ethically, and responsibly in the learning process and daily life [2][3]. In the context of formal education, digital literacy plays an important role in supporting meaningful learning, especially in science subjects such as physics which require the ability to analyze, solve problems, and utilize digital learning resources.

The importance of strengthening literacy skills can be seen from the results of the Programme for International Student Assessment (PISA) study. Indonesia is ranked 71st out of 79 literacy participating countries with an average score of 371. The data is the result of measuring reading literacy and not measuring digital literacy directly. However, these achievements can be an illustration of the challenges of students' ability to understand and use information. Therefore, PISA data in this study is used as a supporting context regarding the importance of strengthening literacy skills, not as a direct indicator of students' digital literacy levels. In a learning environment that increasingly utilizes digital technology, the ability to access, evaluate, and utilize information is becoming increasingly important. [4]. The development of digital literacy in schools also faces various challenges, ranging

from limited infrastructure to lack of teacher competence in teaching digital skills. Many schools, especially those in rural or remote areas, still do not have adequate access to technological and internet devices [5].

The problem of digital literacy is not only related to students' ability to obtain information, but also the ability to determine relevant and trustworthy information and use it for learning purposes[6]. This condition shows that students are not fully able to utilize digital technology as an effective means of learning, but are still limited to entertainment or communication media. This challenge is relevant to physics learning, which has been dominated by conventional learning and oriented towards material delivery, so it does not provide space for students to develop digital literacy skills optimally[7]. Therefore, the use of digital technology in learning that provides opportunities for students to actively search, examine, evaluate, discuss, and utilize information.

Based on the results of initial research through interviews with physics teachers in grade XI at SMAN 1 Lubuk Sikaping, it was found that the use of digital learning media in the physics learning process was not optimal. Teachers said that students tend to use the internet to get answers quickly without verifying the truth and relevance of the information found. The physics learning process also still tends to be teacher-centered, with teachers explaining more material directly while students play more roles as recipients of information. In addition, Google Classroom has been used in learning, but its use is still limited to the delivery of material and assignment collection. The findings of the interview show that the problem lies not in the availability of digital technology, but in how the technology is integrated with learning activities that can encourage students to actively search, evaluate, discuss, and utilize information.

On the other hand, Google Classroom as one of the Learning Management Systems (LMS) has the potential to increase students' digital literacy. The selection of LMS-Google Classroom as a digital platform in the learning process, because the implementation of the Google Classroom learning system is easy for educators to implement and use by students [8]. Ease of use makes it one of the platforms that has the potential to support digital-based learning[9] [10].

Some of the features contained in Google Classroom that can be effectively maximized by teachers as an effort to improve students' digital literacy skills. One of the features that will often be used by teachers who use this facility is Create Assignment [11]. The use of Google Classroom learning media can have a good influence on physics learning because it simplifies the learning process in the classroom and outside the classroom. The learning process using Google Classroom media is one of the uses of technology by being given images or videos related to phenomena in daily life, especially those related to physics concepts that are packaged simply [12]. However, the use of Google Classroom as a digital platform does not automatically improve students' digital literacy. Its use needs to be integrated with learning activities that specifically provide opportunities for students to access, evaluate, and utilize information.

One of the learning models that can support these activities is Problem-Based Learning (PBL). PBL places students on a problem that encourages them to identify problems, find relevant information, analyze and evaluate information, discuss alternative solutions, and use information to obtain solutions[13]. The integration of PBL with Google Classroom allows these activities to be carried out in a more structured digital learning environment. Google Classroom can be used to provide learning resources, organize assignments, facilitate discussions, and collect student work, while the PBL stage provides an activity structure that encourages students to actively process information. Thus, the use of Google Classroom in this study is not only directed at the delivery of materials and assignment collection, but also supports the implementation of PBL to develop students' digital literacy.

So far, there have been several studies on the use of digital platforms for learning to improve digital literacy. The results of the study show that students still experience obstacles in using digital technology optimally in online learning. Although most students have used smartphones and the internet in the learning process, the ability to understand valid sources of information and technical skills in the use of digital media are still obstacles in completing learning tasks. This problem is increasingly seen when learning is carried out through Google Classroom on abstract materials, such as hydrocarbons, so students need good digital literacy skills to understand learning materials. Google Classroom is used as an ICT-based media that facilitates assignment assignments, assignment collection, discussions, and virtual delivery of learning materials. However, the study only measured students' skills in using Google Classroom as an ICT-based learning medium, such as the ability to access classes, collect assignments, and communicate through digital platforms. Meanwhile, this study focuses on how the use of Google Classroom can shape and improve students' digital literacy skills more broadly. The novelty of this research lies in the study of the influence of the use of Google Classroom on students' digital literacy in physics learning, not only the skills to use digital platforms [4].

The results of the research on the use of discovery learning strategies assisted by the Google Classroom application show that there is an influence on students' digital literacy skills. Google Classroom is used as an online

learning medium that supports the process of discussion, assignment collection, material delivery, and communication between teachers and students virtually. The study also explains that the use of Google Classroom can help students develop the ability to read, find information, discuss, and access digital learning resources [14]. However, in its implementation, several obstacles were still found, such as students' low understanding of the use of learning technology, limited internet networks, quotas, and low student activity in online learning. These problems show that student literacy is still a challenge in technology-based learning in schools. In contrast to previous research that combined Google Classroom-assisted discovery learning strategies in biology subjects, this study focuses more on the use of Google Classroom on students' digital literacy in physics learning [15].

Based on research, the Blended Learning model assisted by Google Classroom has an influence on students' critical thinking skills. Google Classroom is used as an online learning medium that allows students to access materials, learning videos, assignments, attendance, and interact with teachers and other students online. The research shows that the use of learning technology can help the learning process become more flexible and support digital-based learning activities. However, in its implementation, several obstacles are still found, such as less effective learning, limited face-to-face learning time, the use of online-based learning media by teachers, and the lack of learning resources provided to students[16]. This condition shows that the use of digital learning technology in schools still needs to be optimized to support students' abilities in technology-based learning. The difference between this research and the previous research lies in the focus of research that examines the influence of the use of Google Classroom on students' digital literacy in physics learning. In addition, this study presents a more specific discussion of the role of Google Classroom in helping students access, evaluate, and utilize digital information as part of the digital literacy abilities of high school students [17].

Based on the previous research, there is still a research gap regarding the application of Google Classroom which is not only used as an administrative medium, but is applied in learning that uses the Problem-Based Learning (PBL) model to encourage students' digital literacy activities. In addition, research that examines the use of Google Classroom in physics learning with the PBL model, especially in developing students' ability to access, evaluate, and utilize digital information at the high school level, is still limited. Thus, the existence of Google Classroom in schools is not a novelty of this research. The novelty of the research lies in the application of Google Classroom in learning that uses the PBL model, so that its use is not only limited to the delivery of materials and assignment collection, but is also used in problem-solving activities that require students to access, evaluate, and utilize digital information. This approach is expected to optimize the use of Google Classroom from a previously more administrative dominant use to a learning activity that encourages active student involvement and information processing in the problem-solving process.

Based on the problems and gaps in the research, this study aims to determine the effect of the use of Google Classroom on the digital literacy of grade XI students in physics learning at SMAN 1 Lubuk Sikaping. The research questions in this study are: Does the use of Google Classroom have a significant influence on the digital literacy of grade XI students in physics learning at SMAN 1 Lubuk Sikaping.

## II. METHOD

This study uses a quantitative approach with a pre-experimental design, namely One Group Pretest-Posttest Design. The research was conducted on a group of students who were given measurements before and after learning using Google Classroom. Learning was carried out on straight-motion kinematics material using the Problem Based Learning (PBL) model, while Google Classroom was used as a learning medium in the implementation of these activities. This design was used to identify changes in students' digital literacy skills before and after learning. Because it did not use a control group, the research design could not fully control other factors that could affect changes in outcomes, such as maturation, test effects, learning experiences, and the influence of learning models. Therefore, the results of the study were interpreted as changes observed after treatment in the studied group and had limitations in drawing causal conclusions. The research design can be seen in Table 1.

**Table 1**. Research Design

| Pretest | Treatment | Posttest |
|---|---|---|
| *O1* | X | *O2* |

Description:
XI = Treatment in the form of *Google Classroom-based learning*
*O1* = Pretest (initial test to determine students' digital literacy skills before learning using *Google Classroom*)
*O2* = posttest to find out students' digital literacy skills after learning using *Google Classroom*

The research was carried out at SMAN 1 Lubuk Sikaping in the odd semester of the 2026/2027 Academic Year. The research population was all grade XI students who participated in physics learning, consisting of class XI F1 as many as 34 students, XI F2 as many as 32 students, XI F3 as many as 32 students, XI F4 as many as 32 students, and XI F5 as many as 35 students. The sample was selected using purposive sampling techniques by considering the similarity of the teaching teacher and the characteristics of the initial class ability. Based on these considerations, class XI F3 with a total of 32 students was selected as a research sample. Of the 32 students, there were 31 pairs of pretest and posttest data that were complete and used in the analysis, because one student did not take part in one of the measurement stages. The questionnaire data was analyzed based on 32 complete responses. The treatment was carried out through learning the physics of straight motion kinematics materials with the Problem Based Learning (PBL) model and using Google Classroom as a learning medium. The learning stages include introductory activities, core activities, and closing activities.

In the preliminary activity, the teacher checks the students' readiness, provides learning perceptions and objectives, and directs students to access Google Classroom. In the core activity, students follow the PBL stages which include orientation to the problem, organizing students to learn, guiding investigations, developing and presenting results, and analyzing and evaluating the problem-solving process. Google Classroom activities are used to access materials, open PPTs and learning resources, participate in discussions, work on assignments, collect work results, and reflect. The thesis records the allocation of 15-minute preliminary activities and 105-minute core activities. The use of Google Classroom is directed to support three indicators of digital literacy, namely accessing information, evaluating information, and utilizing information. In the learning stage, students are directed to obtain relevant information, examine and compare the information obtained, then use the information to solve the problem of kinematics of straight motion.Thus, Google Classroom in this study is not only used to deliver materials and collect assignments, but is also used to support student activities during the PBL learning process. However, because PBL is implemented in conjunction with Google Classroom and is not experimentally controlled, the contribution of each component to digital literacy change cannot be completely separated. In this study, the variable measured was the student's digital literacy ability. The instrument used in this study was the digital literacy ability test. The test was presented in the form of a written test with the type of essay questions and questionnaires using Google Classroom and Digital Literacy.

**1. Digital Literacy Test Questions**

**Table 2.** Motion Kinematics Digital Literacy Test Instrument Grid

| Yes | Learning Objectives | Question Number |
|---|---|---|
| 1 | Students are able to access and obtain relevant information about the concepts of straight, distance, displacement, speed, speed, and acceleration through various digital learning resources available on Google Classroom. | 1,2,3 |
| 2 | Students are able to analyze, compare, and determine the accuracy and relevance of information obtained from digital sources to understand and solve the problem of straight motion kinematics. | 4,5,6 |
| 3 | Students are able to utilize and use the information that has been obtained and evaluated to solve the problem of straight motion kinematics, especially GLB and GLBB, as well as present and communicate the results of their solutions through Google Classroom. | 7,8,9 |

The research instrument is in the form of description questions that are prepared based on indicators of digital literacy ability. The instrument test includes validity, reliability, difficulty, and differentiation of the questions so that each question item is able to measure the indicators that have been determined appropriately and provide consistent results. Therefore, the instrument is declared feasible to use after meeting the four criteria. The analysis of the results of the test questions is carried out by:

a. Test the Validity of the Question

The validity value of the instrument's contents is calculated using the following formula:

$$r_{xy} = \frac{N\sum XY - (\sum X)(\sum Y}{\sqrt{(N\sum X^2 - (\sum X)^2\,(N\sum Y^2 - (\sum X)^2}}$$

Price interpretation Correlation Coefficient This is done by comparing the price with the following test criteria: If the question item is declared valid. However, if , the question item is declared invalid. Question items that fall into the valid category will be included in the research instrument, while invalid questions will not be used in the research instrument.$\boldsymbol{r_{xy}r_{tabel}r_{xy} \geq r_{tabel}r_{xy} < r_{tabel}}$

**Table 3**. Classification of Validity of Questions

| Categories Collider | Classification |
|---|---|
| *0,81 – 1,00* | Very valid |
| *0,61 - 0,80* | Valid |
| *0,41 - 0,60* | Quite valid |
| *0,21 – 0,40* | Invalid |
| *0,00 – 0,20* | Invalid |

The digital literacy test questions that have been prepared are first tested for validity to find out the accuracy of each question item in measuring digital literacy that should be measured. The validity test is carried out using the help of the SPSS application through correlation analysis between the score of the question item and the total score. The determination of the validity of the question refers to the validity criteria that have been set. The results of the validity test of the digital literacy test are presented in Table 4 below.

**Table 4.** Validity Results of Digital Literacy Questions

| Yes | Validity | Criteria |
|---|---|---|
| 1 | -1,00 | Invalid |
| 2 | 0,639 | Valid |
| 3 | 0,707 | Valid |
| 4 | 0,733 | Valid |
| 5 | 0,575 | Valid |
| 6 | 0,164 | Invalid |
| 7 | -0,022 | Invalid |
| 8 | 0,687 | Valid |
| 9 | 0,606 | Valid |

Based on the results of the calculation of correlation coefficients and validity criteria, from the 9 questions that were tested, 6 questions were obtained in the valid category and 3 questions in the invalid category. Questions that did not meet the validity criteria were declared invalid and not used. Furthermore, valid question items were used in testing the reliability of the instrument.

b. Reliability Test

Reliability testing means testing the extent to which the results of a measurement are reliable. The formula used to determine the reliability of an instrument is as follows:

$$\boldsymbol{r_{11} = \left(\frac{n}{n-1}\right)\left(1 - \frac{M(n-M)}{nS^2}\right)}$$

$$\boldsymbol{S^2 = \frac{N\sum f_i x_i^2 - (\sum f_i x_i)^2}{N-(N-1)}}$$

The value obtained is interpreted in determining the reliability of the instrument with the following criteria if the following classification of the reliability coefficient of the instrument as shown in Table 5 follows:$\boldsymbol{r_{11}r_{11} > r_{tabel}}$.

**Table 5.** Classification of Reliability Index Questions

| Reliability coefficient | Reliability criteria |
|---|---|
| 0.00 − 0.20 | Very low |
| 0.21 − 0.40 | Low |
| 0.41 − 0.60 | Medium |
| 0.61 − 0.80 | Height |
| 0.80 − 1.00 | Very high |

After the validity test is carried out, the next stage is the reliability test of the instrument with the help of the SPSS application. The results of the reliability test obtained are presented in Table 6 as follows:

**Table 6.** Reliability Results of Digital Literacy Questions

| Reliability Statistics | |
|---|---|
| Cronbach's Alpha | N of Items |
| 0,629 | 9 |

Based on the results of the reliability test, a reliability coefficient value of 0.629 was obtained, which is in the high category. These results show that the test instrument has a good level of consistency in measuring students' digital literacy. Thus, the test instrument used is suitable as a data collection tool in the research because it is able to provide relatively fixed and reliable measurement results.

c. Difficulty Level of Question

The formula used to calculate the difficulty level of the question according to (Arikunto, 2016) is:

$$\boldsymbol{P = \frac{B}{J_s}}$$

The difficulty level of the questions can be found by using classifications such as Table 7 below.

**Table 7.** Difficulty Index Classification

| Difficulty Index (P) | Categories |
|---|---|
| 0,00-0,30 | Difficult |
| 0,31-0,70 | Medium |
| 0,71-1,00 | Easy |

After the reliability test is carried out, the next stage is to conduct a difficulty index test of the questions. The difficulty index test aims to find out the difficulty level of each question item so that it can be known whether the questions are in the easy, medium, or difficult categories. The difficulty index test is carried out using the SPSS application, and the results of the difficulty index analysis of the questions are presented in Table 8 below.

**Table 8.** Results of the Digital Literacy Difficulty Index

| Yes | Difficulty Index | Categories |
|---|---|---|
| 1 | 0,54 | Medium |
| 2 | 0,47 | Medium |
| 3 | 0,50 | Medium |
| 4 | 0,48 | Medium |
| 5 | 0,31 | Medium |
| 6 | 0,29 | Difficult |
| 7 | 0,25 | Difficult |
| 8 | 0,58 | Medium |
| 9 | 0,61 | Medium |

A good test instrument contains questions with a proportional level of difficulty, with questions dominated by questions in the medium category. Questions that are too easy or too difficult are generally not able to distinguish students' abilities optimally. Therefore, in this study, question items that meet the quality criteria of the instrument were selected based on the results of the analysis of validity, reliability, differentiation, and difficulty index.

d. Power Difference Questions

To calculate the differentiating power, the formula proposed by (Arikunto, 2016) can be used, namely:

$$\boldsymbol{D = P_A - P_B = \frac{B_A}{J_A} - \frac{B_B}{J_B}}$$

The following is the classification of the difference in the power index of the questions shown in Table 9.

**Table 9.** Classification of Power Index Differentiation Questions

| Differentiation Index (D) | Classification |
|---|---|
| Negative Marked | Very Ugly |
| 0,00-0,20 | Ugly |
| 0,21-0,40 | Enough |
| 0,41-0,70 | Good |
| 0,71-1,00 | Very good |

After the difficulty index analysis is carried out, the next stage is to conduct a differentiating power test of the question items. The differentiating power test aims to determine the ability of each question item in distinguishing students who have high ability and students who have low ability. The differentiating power analysis is carried out with the help of the SPSS application. The results of the differentiating power analysis of the question items are presented in Table 10 below.

**Table 10.** Results of Differences in Digital Literacy

| Yes | Differentiation | Classification |
|---|---|---|
| 1 | 0,032 | Ugly |
| 2 | 0,530 | Good |
| 3 | 0,595 | Good |
| 4 | 0,717 | Very good |
| 5 | 0,417 | Good |
| 6 | 0,092 | Ugly |
| 7 | -0,062 | Very Ugly |
| 8 | 0,687 | Good |
| 9 | 0,532 | Good |

The difference in good questions on the ≥ index is 0.40. Therefore, questions that have a difference power below 0.40 are not used.

2. Digital Literacy and Google Classroom Use Questionnaire

In this study, the instrument used was in the form of a statement questionnaire with four Likert scales to measure students' digital literacy, namely Strongly Disagree (STS), Disagree (TS), and Strongly Agree (SS). The Likert scale in this study consists of positive statements that aim to obtain an objective picture of student responses. Details of scoring for statements are presented in Table 11 below.

**Table 11.** Likert Measurement Scale

| Yes | Answer Options | Score |
|---|---|---|
| 1 | STS | 1 |
| 2 | TS | 2 |
| 3 | S | 3 |
| 4 | SS | 4 |

The interpretation of the motivation level is carried out based on the mean score range presented in Table 12 below.

**Table 12.** Questionnaire Interpretation

| Average Score Range | Interpretation |
|---|---|
| 3.01 - 4.00 | Height |
| 2.01 - 3.00 | Medium |
| 1.00 - 2.00 | Low |

This study uses two types of questionnaires, namely the digital literacy questionnaire and the Google Classroom use questionnaire. The two questionnaires were used to obtain data related to students' responses and experiences with Google Classroom used in the learning process.

The research data was analyzed quantitatively to determine changes in students' digital literacy skills before and after learning using Google Classroom. Data analysis included descriptive analysis, N-Gain calculation, normality test, and hypothesis test.

The calculation of the average N-Gain score is carried out to see an improvement in student learning outcomes. The N-Gain score is used using the following formula:

$$\boldsymbol{N - Gain = \frac{Skor\ posttest - skor\ pretest}{skor\ maksimal - pretest}}$$

**Table 13.** N-Gain Criteria

| N-GAIN *Value* | Classification |
|---|---|
| *N-Gain ≥ 0.71* | Height |
| *0.31 ≤ N-Gain < 0.70* | Medium |
| *N-Gain ≤ 0.30* | Low |

The normality test was carried out using Shapiro-Wilk on the data on the difference in scores between the pretest and posttest. The normality test was carried out with a significance level of 0.05. The data was distributed normally if the significance value > 0.05. If the difference data is normally distributed, hypothesis testing is carried out using the Paired Sample Test. If the data is not normally distributed, the Wilcoxon Signed-Rank test is used.

## III. RESULTS AND DISCUSSION

### RESULTS

This research was conducted on one sample group by providing a pretest before learning and a posttest after learning using Google Classroom. Learning using Google Classroom includes attendance lists, materials, learning videos, discussion rooms, assignments, and reflections. Digital literacy ability is analyzed based on three indicators, namely accessing information, evaluating information, and utilizing information. To see changes in students' digital literacy skills before and after participating in learning using Google Classroom, a comparison of Pretest-Posttest results was first conducted. The results of the comparison are presented in Figure 1.

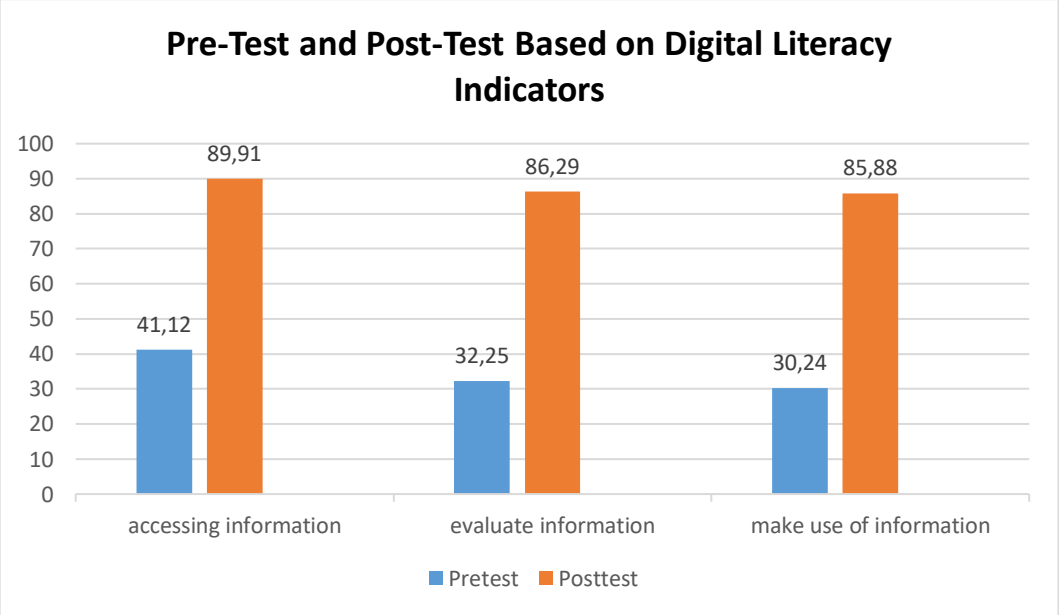



**Figure 1.** Pretest-Posttest Results of Students' Digital Literacy Ability

Based on Figure 1, it can be seen that the average score of students' digital literacy ability increased in all indicators after learning using Google Classroom. In the indicator of accessing information, the average score increased from 41.12% to 89.91%, with an increase of 48.79%. In the indicator evaluating information, the average score increased from 32.25% to 86.29%, with an increase of 50.04%. Meanwhile, the indicator of utilizing information increased from 30.24% to 85.88%, with an increase of 55.64%. To clarify the improvement of digital literacy skills in each indicator, the results of the comparison of pretest and posttest scores are presented in more detail in Table 14.

Based on the Table 14, the largest increase was in the indicator of utilizing information, which was 55.64%, then the indicator of evaluating information by 50.04%, and accessing information by 48.79%. These results show that after learning using Google Classroom, there was an increase in ability in all three digital literacy indicators. The improvement of digital literacy skills is supported by a questionnaire using Google Classroom and a digital literacy questionnaire is given after the entire learning series is completed. The questionnaire is used to obtain an

overview of students' experience in using Google Classroom and students' digital literacy conditions after participating in learning.

**Table 14.** Pretest-Posttest Scores of Students' Digital Literacy Ability

| Indicator | Pretest (%) | Post-test (%) | Increase (%) |
|---|---|---|---|
| Accessing Information | 41,12 | 89,91 | 48,79 |
| Evaluating information | 32,25 | 86,29 | 50,04 |
| Utilize | 30,24 | 85,88 | 55,64 |

The improvement of digital literacy skills is then supported by data on Google Classroom usage during the learning process. To find out how students use Google Classroom, measurements were carried out through a questionnaire that included convenience, benefits, access, interaction, engagement, and satisfaction. The results of the Google Classroom use questionnaire are presented in Table 15.

**Table 15.** Google Classroom Use Questionnaire Results

| Criteria | Material Indicators | | | | | |
|---|---|---|---|---|---|---|
| | GC Facilities | Benefits of GC | Accessing GC | GC Interactions | GC Engagement | GC Satisfaction |
| | Number of Students (%) | Number of Students (%) | Number of Students (%) | Number of Students (%) | Number of Students (%) | Number of Students (%) |
| Low | 0(0) | 0(0) | 0(0) | 0(0) | 0(0) | 0(0) |
| Medium | 2(6,3) | 0(0) | 1(3,1) | 0(0) | 2(6,3) | 3(9,4) |
| Height | 30(93,8) | 32(100) | 31(96,9) | 32(100) | 30(93,8) | 29(90,6) |

Based on Table 15, the results of the Google Classroom use questionnaire show that most students are in the high category. In the Google Classroom ease indicator, 30 students (93.8%) are in the high category and 2 students (6.3%) are in the medium category. In the Google Classroom benefit indicator, all students or 32 students (100%) are in the high category. The Google Classroom access indicator shows that 31 students (96.9%) are in the high category and 1 student (3.1%) is in the medium category. In the Google Classroom interaction indicator, all students (100%) are in the high category. Furthermore, in the Google Classroom engagement indicator, 30 students (93.8%) are in the high category and 2 students (6.3%) are in the medium category, while the Google Classroom satisfaction indicator shows that 29 students (90.6%) are in the high category and 3 students (9.4%) are in the medium category. There are no students who are in the low category in all indicators.

The high use of Google Classroom is further seen as related to students' digital literacy skills. Therefore, measurements are carried out through a digital literacy questionnaire based on three indicators, namely accessing information, evaluating information, and utilizing information. The results of these measurements are presented in Table 16.

**Table 16.** Digital Literacy Survey Results

| Criteria | Material Indicators | | |
|---|---|---|---|
| | Accessing Information | Evaluating Information | Utilizing Information |
| | Number of Students (%) | Number of Students (%) | Number of Students (%) |
| Low | 0(0) | 0(0) | 0(0) |
| Medium | 2(6,3) | 1(3,1) | 1(3,1) |
| Height | 30(93,8) | 31(96,9) | 31(96,9) |

Based on Table 16, the results of the digital literacy questionnaire also show a high category in all three indicators. In the information access indicator, as many as 30 students (93.8%) were in the high category and 2 students (6.3%) were in the medium category. In the information evaluation indicator, 31 students (96.9%) were in the high category and 1 student (3.1%) in the medium category. In the information utilization indicator, 31 students (96.9%) were in the high category and 1 student (3.1%) in the medium category.

The results of the questionnaire provide a descriptive overview of the conditions of using Google Classroom and students' digital literacy. Furthermore, to find out the magnitude of the increase in digital literacy skills based on the results of the pretest and posttest, an N-Gain analysis was carried out presented in Table 17.

**Table 17.** N-Gain Pretest-Posttest Test Results

| | N | Minimum | Maximum | Red | Std. Deviation |
|---|---|---|---|---|---|
| NGain Value | 31 | 0.588 | 1.000 | 0.80859 | 0.080497 |
| Valid N(listwise) | 31 | | | | |

Based on table 17, N-Gain scores were obtained from 31 students with a minimum score of 0.588, a maximum of 1,000, and an average score of 0.80859. Based on the N-Gain criteria, the average score is in the high category because it is greater than 0.70. This shows that overall there is an increase in students' high digital literacy skills after participating in learning using Google Classroom. After it is known that there is an increase in digital literacy skills based on N-Gain, the next stage is a prerequisite test to determine the statistical analysis used. The normality test is carried out using the Kolmogorov-Smirnov presented in Table 18.

**Table 18.** Pretest-Posttest Normality Test Results

| **Classes** | **N** | **α** | **KS-Count** | **KS Table** | **Sig.** | **Remarks** |
|---|---|---|---|---|---|---|
| Sample | 31 | 0,05 | 0,151 | 0,244 | 0,068 | Normal |

The results of the normality test showed a significance value of 0.068 > 0.05, so that the pretest and posttest data were declared to be distributed normally. Because the data is normally distributed and the study uses one group with pre- and post-treatment measurements, then a Paired Samples t-test is carried out to determine the difference in pretest and posttest results presented in table 19.

**Table 19.** Paired Sample Test Results

| | **Paired Samples Test** | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | t | Std. Error Mean | df | Sig. (2-tailed) | Red | Std. Deviaton | 95% Confidence Interval of the Difference | |
| | | | | | | | Lower | Upper |
| Pretest-Posttest Results | -28,59 | 0,443 | 30 | 0,000 | -12,677 | 2,468 | -13,583 | -11,772 |

Based on the results of the Paired Samples t-test, there was a significant difference between the pretest and posttest scores, with (t (30) = -28.59) and ($p < 0.001$). The average score difference of (-12.677) showed that the posttest score was higher than the pretest score. The effect size calculated using Cohen's was 5.14, which showed a very large effect. Thus, $H_0$ was rejected and $H_a$ was accepted, so there was a significant difference between students' digital literacy skills before and after learning using Google Classroom.$d_z$ A total of 32 students in grade XI F2 were selected through purposive sampling techniques based on the similarity of the teaching teacher and the characteristics of the initial ability of the class which were relatively similar. The pretest-posttest analysis was carried out on 31 data pairs because one student did not take one of the measurement stages, while the questionnaire data was analyzed based on 32 complete responses.

## DISCUSSION

The results showed an increase in students' digital literacy skills in all three indicators after learning using Google Classroom. The ability to access information increased from 41.12% in the pretest to 89.91% in the posttest, or an increase of 48.79 percentage points. The ability to evaluate information increased from 32.25% to 86.29%, while the ability to utilize information increased from 30.24% to 85.88%, with an increase of 54.04 and 55.64 percentage points, respectively. The increase in all indicators showed a change in digital literacy skills after students participated in learning, which was also supported by an average N-Gain value of 0.80859 in the high category.

The largest increase occurred in the indicator of information utilization, while the smallest increase was in the indicator of accessing information. This difference can be understood from the characteristics of the learning activities provided. In the early stages of learning, students use Google Classroom to obtain materials, videos, and information related to kinematic problems. These activities directly provide training in the ability to access information. However, the ability to access information is basically the initial stage in the digital literacy process

so that the room for improvement can be more limited than the skills developed through advanced activities. On the other hand, during learning, students not only obtain information, but are also directed to choose relevant information, discuss it, solve problems, and use the information in doing assignments. This series of activities provides more opportunities to practice the ability to use information, so this indicator shows the greatest improvement.

This pattern is also related to the application of Problem Based Learning (PBL) during learning. Google Classroom is used as a medium to provide materials, videos, discussion rooms, assignments, and reflections, while PBL provides an activity structure in the form of problem solving, investigation, discussion, and presentation of results. Thus, improving digital literacy skills does not only occur because students use digital platforms, but also because students get the opportunity to use digital information in solving learning problems. This is important because the ability to utilize information requires a more complex process than just finding or accessing information. [18]. [19][20].

These results are in line with previous research that shows that the use of Google Classroom can support digital learning activities, such as accessing materials, communicating, discussing, and collecting assignments. However, the previous research used in this article has a different focus. Research on the relationship between digital literacy and Google Classroom use skills, for example, emphasizes the ability of students to use Google Classroom as an ICT-based learning medium, while this study measures changes in digital literacy skills through three indicators, namely accessing, evaluating, and utilizing information. Thus, the results of this study provide an idea that the use of Google Classroom in physics learning can be used as a digital learning environment to train several digital literacy processes simultaneously [21].

The difference in improvement between components also needs to be understood by paying attention to the initial condition of the students. The pretest score is in the range of 30.24%–41.12%, while the posttest score is in the range of 85.88%–89.91%. The considerable increase shows that the initial ability of students in all three indicators is relatively low, while after learning the score is at a much higher level. This condition indicates a strong change, but the magnitude of the change cannot be fully attributed to Google Classroom because the study used a One Group Pretest-Posttest Design without a control group.

Several other factors have the potential to influence the increase. First, PBL used during treatment can contribute through investigation, discussion, and problem-solving activities. Second, the role of teachers in directing students during learning can affect the development of students' abilities. Third, there is a possibility of testing effects, namely students become more familiar with the form and demands of the questions after taking the pretest. Fourth, the novelty effect of using Google Classroom in a more structured way can increase student engagement during learning. In addition, the high posttest score can also be influenced by the suitability between the learning material and the test instrument, because the test used measures digital literacy in the context of the kinematic material that has been learned during the treatment. Therefore, the increase in score needs to be interpreted as a change observed after the treatment, not as evidence that Google Classroom is the only cause of the change [22] [23].

The results of the Google Classroom use questionnaire showed that most students responded in the high category to the aspects of convenience, benefits, access, interaction, engagement, and satisfaction. The data supports the idea that Google Classroom can be used well during the implementation of learning. However, because the questionnaire is given after learning and is descriptive, the results of the questionnaire are not used to prove an increase or statistical relationship with digital literacy skills. The change in digital literacy ability in this study was determined based on the comparison of pretest and posttest scores as well as the results of the N-Gain and Paired Samples t-test analysis. Thus, the interpretation of the questionnaire results is limited as an overview of students' experiences and responses while using Google Classroom.

Overall, the results showed an increase in digital literacy skills after learning using Google Classroom, with the largest increase in information utilization indicators. However, because the study did not use a control group, the influence of Google Classroom needs to be interpreted carefully. Further research may use experimental design with control groups or compare multiple learning conditions to separate the influence of Google Classroom from the influence of PBL, teachers, test effects, and other learning factors.

## IV. CONCLUSION

Based on the results of the study, learning using Google Classroom showed an increase in students' digital literacy skills in three indicators, namely accessing information, evaluating information, and utilizing information. The largest increase occurred in the indicator utilizing information by 55.64 percentage points, followed by evaluating information by 50.04 percentage points and accessing information by 48.79 percentage points. The

increase was strengthened by an average N-Gain value of 0.80859 which was in the high category, as well as the results of the Paired Samples t-test which showed a significant difference between digital literacy skills before and after learning ($p < 0.001$).

However, the results of this study need to be interpreted by considering the limitations of the One Group Pretest-Posttest design that does not use the control group. In addition, Google Classroom is implemented in conjunction with the Problem Based Learning (PBL) model so that the contribution of each component to improving digital literacy cannot be separated experimentally. Therefore, the improvements found show changes in digital literacy skills after learning, but cannot be used as evidence that Google Classroom is the only cause of these changes.

Further research is recommended to use a control group or a stronger experimental design, involving a larger sample and schools with different characteristics, as well as conducting follow-up measurements to determine the sustainability of digital literacy skills after treatment. Subsequent research can also compare learning conditions using Google Classroom with and without PBL so that the contribution of each component to the development of digital literacy can be studied more clearly.

## REFERENCES


[1] D. M. Anggraeni and F. B. Sole, "Moodle E-Learning, 21st Century Physics Learning Media," *J. Researcher. and Researcher. Educator Science. e-Science*, vol. 1, no. 2, p. 57, 2018, doi: 10.36312/e-saintika.v1i2.101.

[2] R. M. Rany, E. Lusiana, and F. Perdana, "The Role of Digital Literacy in Improving Critical Thinking Skills in the Era of Information Technology," vol. 3, no. 4, pp. 47–56, 2025.

[3] I. Afriana and F. Festiyed, "Development of Authentic Assessment Based on Digital Literacy Integrated LKPD to Assess 21st Century Skills," *J. Researcher. Fis.*, vol. 8, no. 1, p. 90, 2022, doi: 10.24036/jppf.v8i1.116565.

[4] N. Alfin, "THE RELATIONSHIP BETWEEN DIGITAL LITERACY AND THE SKILL OF USING GOOGLE CLASSROOM AS AN ICT-BASED LEARNING MEDIUM ON HYDROCARBON MATERIALS," 2021.

[5] Adien Inayah, Aflah Husnaini Matondang, Diana Pauziah Ritonga, Friska Widia, and Novita Sari Nasution, "Improving Students' Digital Literacy in Elementary Schools," *J. Educators. And Social Sciences.*, vol. 2, no. 3, pp. 247–258, 2024, doi: 10.54066/jupendis.v2i3.2039.

[6] I. P. Sari, "Improving Digital Literacy Skills in Pancasila Learning," vol. 4, no. 2, pp. 66–72, 2025.

[7] D. Bintarawati and Y. Citriadin, "IMPLEMENTATION OF VIRTUAL CLASSROOM WITH GOOGLE CLASSROOM TO IMPROVE LEARNING OUTCOMES," vol. 2, no. 2, pp. 177–190, doi: 10.20414/spin.v2i2.2573.

[8] R. Ramadhani, E. Astuti, and T. Setiawati, "THE IMPLEMENTATION OF LMS-GOOGLE CLASSROOM TO IMPROVING COMPETENCE SKILL OF SENIOR HIGH SCHOOL TEACH ERS' IN INDUSTRIAL REVOLUTION 4 . 0 One of the impacts of the development of the Industrial Revolution 4, 0 in the world of education is the integration of technology in p," vol. 3, no. 2, 2019.

[9] T. P. Socrates and F. Mufit, "Abstract Article Info: Edufics: Journal of Physics Education Volume 5 Number 1, June 2020," vol. 7, no. 2012, pp. 16–22, 2022.

[10] N. L. Handayani and D. Sulisworo, "USE OF GOOGLE CLASSROOM IN PRELIMINARY SCIENCE LEARNING During the pandemic such as learning and educational targets, following the learning process according to the targets to be achieved, now there is a need for distance learning innovation," vol. 9, no. 1, pp. 66–80, 2021.

[11] I. halimatul Mu'minah and A. A. Gaffar, "Optimizing the use of google classroom as an alternative to digitalization in distance learning (pjj)," vol. 5, pp. 23–36, 2020.

[12] S. A. Permatasari, "Physics learning with Google Classroom in problem-solving skills," pp. 62–71, 2020.

[13] D. Irawati, I. Janah, S. Karlina, naja seindah Hafidho, and Sulistiyono, "The Influence of PBL Learning Model on the Interest and Learning Outcomes of High School Students," vol. 2, no. September, pp. 113–23, 2020.

[14] R. Syah, D. Darmawan, A. Purnawan, and (2019), "Analysis of factors that affect digital literacy ability," vol. X, pp. 60–69.

[15] S. & widya S. Hariyati, "THE EFFECT OF DISCOVERY LEARNING STRATEGIES ASSISTED BY SMART CLASSROOM APPLICATIONS ON STUDENTS' DIGITAL LITERACY SKILLS ON HUMAN RESPIRATORY SYSTEM MATERIALS OF THE STATE ISLAMIC UNIVERSITY OF NORTH SUMATRA MEDAN Email : sri.hartati@uinsu.ac.id," *Scaffolding J. Educator. ...*, vol. 4, no. 1, pp. 435–447, 2022, [Online]. Available: https://ejournal.insuriponorogo.ac.id/index.php/scaffolding/article/view/1413%0Ahttps://ejournal.insurip

onorogo.ac.id/index.php/scaffolding/article/download/1413/758
[16] S. N. Haromain, "Analysis of the Level of Students' Digital Literacy Ability in the Use of Search Engine Applications in Biology Learning at SMAN 1 Tasikmalaya," vol. 1, pp. 1–7, 2024.
[17] Y. Huki, V. O. Bano, R. Rambu, and H. Enda, "The Effect of Google Classroom-Assisted Blended Learning on the Critical Thinking Ability of Class X Students of SMA Negeri 1 Pandawai," vol. 06, no. 1, pp. 160–171, 2024.
[18] H. Nofita, Y. W. Fitri, F. Zahara, and Desnita, "Meta-Analysis of the Influence of Problem-Based Learning Model on Mathematics Learning Outcomes," *Martyvel J. Educator. and Learning*, vol. 1, no. 2, pp. 62–69, 2024, doi: 10.33084/martyvel.v1i2.7517.
[19] J. Danurahman and D. Baehaqi, "A STUDY ON THE USEFULNESS OF GOOGLE CLASSROOM IN IMPROVING STUDENTS' CRITICAL THINKING SKILLS," pp. 254–263, 2021, doi: 10.17977/um039v6i12021p254.
[20] V. Indriyani, Jasmienti, M. . Taufiq, Nofrahadi, and H. . Manalu, "Jurnal Educative: Journal Of Educational Studies The Effectiveness Of The Mulgraning Model With Google," *J. Educ. J. Educ. Stud.*, vol. 10, no. 2, pp. 149–163, 2021.
[21] R. N. Antika and R. R. T. Marpaung, "Profile of Science Literacy and Digital Literacy of Students of the University of Muhammadiyah Palembang," vol. 12, no. 1, 2023.
[22] I. Radhiyah, "Empowering Students' Digital Literacy through Google Classroom: A Case Study of Library-Based Learning in Indonesian School," *Indonesian. J. Educ. Soc. Stud.*, vol. 4, no. 1, pp. 114–126, 2025, doi: 10.33650/iTess.v4i1.5011.
[23] C. A. Dewi, M. Muhali, Y. Kurniasih, D. Lukitasari, and A. Sakban, "The impact of Google Classroom to increase students' information literacy," *Int. J. Eval. Res. Educ.*, vol. 11, no. 2, pp. 1005–1014, 2022, doi: 10.11591/ijere.v11i2.22237.