



Differences in High School Students' Numeracy Literacy Skills through Problem-Based Learning and Discovery Learning Models

Mawadah Nur Asri ^{1,*}, Siti Maysarah ^{1,b}

¹Pendidikan Matematika, Universitas Islam Negeri Sumatera Utara, Jl. Willam Iskandar Ps. V, Medan Indonesia

E-mail: ^amawaddah0305202095@uinsu.ac.id, ^bsitimaysarah@uinsu.ac.id

* Corresponding Author

ARTICLE INFO

Article history

Received: Nov 2024

Revised: Nov 2024

Accepted: Des 2024

Keywords

Problem Based Learning;

Discovery Learning;

Numeracy Literacy Skills

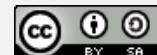
ABSTRACT

Numeracy literacy skills are essential for students to understand and express quantitative relationships in various real-world contexts. In Indonesia, the literacy level remains low, as indicated by the PISA scores. This study addresses the importance of effective learning models—Problem-Based Learning (PBL) and Discovery Learning (DL)—to improve numeracy literacy skills in mathematics, specifically on probability material. The study aims to determine differences in students' numeracy literacy skills when taught using the PBL and DL models. This research uses a quasi-experimental design with a post-test only control group. The study was conducted on 60 students in two experimental groups at SMAN 1 Sei Kepayang, North Sumatra, in the 2024/2025 academic year. Group 1 applied the PBL model, while Group 2 applied the DL model. Data were collected through post-tests consisting of essay questions. The findings reveal a significant difference in numeracy literacy skills between the two groups. The average post-test score of the PBL group was 79.13, compared to 63.33 in the DL group. Statistical tests confirmed the significance of this difference. The Problem-Based Learning model is more effective in improving students' numeracy literacy skills compared to the Discovery Learning model, particularly in enhancing problem-solving skills. These results emphasize the importance of selecting appropriate learning models to foster students' mathematical competencies.

Keterampilan literasi numerasi sangat penting bagi siswa untuk memahami dan mengungkapkan hubungan kuantitatif dalam berbagai konteks dunia nyata. Di Indonesia, tingkat literasi masih rendah, seperti yang ditunjukkan oleh skor PISA. Penelitian ini membahas pentingnya model pembelajaran yang efektif—Problem-Based Learning (PBL) dan Discovery Learning (DL)—untuk meningkatkan keterampilan literasi numerasi dalam matematika, khususnya pada materi probabilitas. Penelitian ini bertujuan untuk mengetahui perbedaan keterampilan literasi numerasi siswa ketika diajarkan menggunakan model PBL dan DL. Penelitian ini menggunakan desain quasi-eksperimental dengan post-test only control group. Penelitian ini dilakukan pada 60 siswa dalam dua kelompok eksperimen di SMAN 1 Sei Kepayang, Sumatera Utara, pada tahun ajaran 2024/2025. Kelompok 1 menerapkan model PBL, sedangkan Kelompok 2 menerapkan model DL. Data dikumpulkan melalui post-test yang terdiri dari pertanyaan esai. Temuan penelitian mengungkapkan perbedaan yang signifikan dalam keterampilan literasi numerasi antara kedua kelompok. Nilai rata-rata post-test kelompok PBL adalah 79,13, dibandingkan dengan 63,33 pada kelompok DL. Uji statistik

mengonfirmasi signifikansi perbedaan ini. Model Problem-Based Learning lebih efektif dalam meningkatkan keterampilan literasi numerasi siswa dibandingkan dengan model Discovery Learning, terutama dalam meningkatkan kemampuan pemecahan masalah siswa. Hasil ini menekankan pentingnya memilih model pembelajaran yang tepat untuk menumbuhkan kompetensi matematika siswa.

This is an open access article under the [CC-BY-SA](#) license.



How to Cite: Asri, M. N., Maysarah, S (2024). Differences in High School Students' Numeracy Literacy Skills through Problem Based Learning and Discovery Learning Models, *Jurnal Riset Pendidikan Matematika*, 11(2) 156-170. doi: <http://dx.doi.org/10.21831/jrpm.v11i2.79084>

INTRODUCTION

Education is a constructive human activity. This means that education plays an important role in determining the development and improvement of the quality of human resources (Siregar, 2023). In relation to education, mathematics plays an important role in human life. Mathematics is closely related to all human activities because the application of mathematics is inseparable from the context of daily life. As an activity, mathematics is not given to students in the form of a finished product, but rather as a form of activity in constructing mathematical concepts (Rahma & Refflina, 2023).

The connection between education and mathematics will be established through the presence of good mathematics learning objectives, which aim to enlighten the nation's life. As a developing country, Indonesia continues to strive to become a developed nation, including in education. Because the progress of a nation begins in the field of education (Lubis et al., 2023). Thus, the creation of the latest curriculum used as the standard of education in Indonesia, namely the Merdeka Curriculum.

The goal of mathematics education using the independent curriculum is to equip students with critical and creative thinking skills, problem-solving abilities, and the capacity to make logical and national decisions. In addition, it aims to develop numeracy skills necessary for everyday life and various other fields of study. Furthermore, it aims to foster a positive attitude towards mathematics as a tool for understanding concepts of the world around them through real and relevant experiences (Solehah & Setiawan, 2023). The goal of mathematics education goes beyond mere understanding of the subject matter by playing an important role in character development, enhancing rational, critical, and logical thinking, as well as stimulating creativity and strengthening students' skills. Despite its significant goals and substantial allocation in the curriculum, mathematics education continues to face challenges in various aspects (Lince & Ero, 2023).

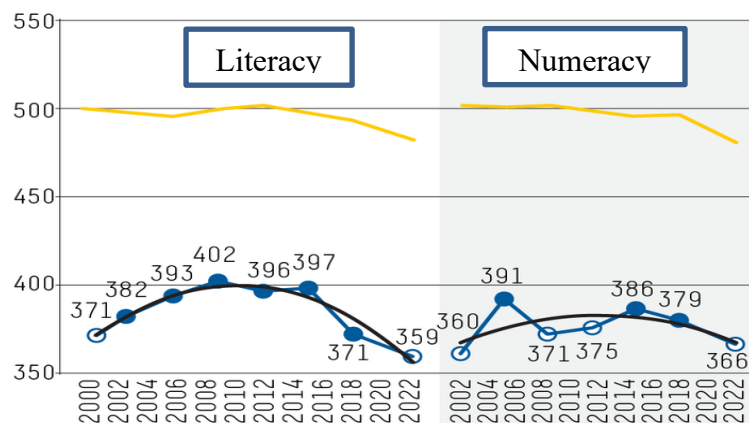
In relation to this, mathematics serves to enhance knowledge and the ability to read, write, calculate, analyze, and solve problems in the context of life. Therefore, a basic ability is required so that students can communicate mathematics with language and then translate it into mathematical models, mathematical sentences, diagrams, graphs, charts, and so on. That ability is called numeracy literacy (Lubis et al., 2023). Numeracy literacy skills, which include the ability to read, write, and calculate, are the capacity to think logically and methodically, reason based on previously learned concepts and information, and the skills to filter and process information (Jaelani & Ginanjar, 2021). This ability is useful for utilizing different

numbers and images to understand and communicate quantitative relationships. This is important for students because it requires thinking skills that involve language and mathematics in various situations, whether individual, social, or professional. This ability also involves other skills such as the ability to select and process information logically, systematically, and rationally, as well as using concepts and knowledge that have been learned, which are key for students to recognize and understand the world, and to provide an understanding of the importance of science in today's era (Dewayani et al., 2021). A small part of arithmetic skills is closely related to the use of rational judgment in daily life, but it is often overlooked. Therefore, it is not surprising that literacy and numeracy skills in Indonesia are still low.

For example, when faced with a situation where this year begins with the simultaneous implementation of the General Election (PEMILU), starting from the presidential election, legislative member elections, and regional head elections throughout Indonesia. To make related choices, it is necessary to select or qualify data from the prospective candidates. Then by observing how the developments and changes that have occurred. It is necessary to select data that can include numerical figures of the country's development and progress at present with the presence of such numeracy literacy skills. What if not? Then there will be ignorance and a lack of understanding of the relationship between all those numbers and our lives, even though it is related to the taxes we have been paying all this time. It is very unfortunate if the numeracy literacy level of the nation's generation is still low.

Indicators of numeracy literacy skills, namely: (a) the ability to solve practical problems in various situations using different numbers and basic mathematical symbols (problem-solving), (b) the ability to interpret information presented in various formats, such as graphs, tables, charts, etc. (interpreting information), and (c) the ability to use analytical findings to make predictions and draw conclusions known as numeracy literacy (drawing conclusions (Jaelani & Ginanjar, 2021). Next, when numeracy literacy skills are met according to the indicators, students can apply that understanding effectively, which will give this country great potential to have global strength capable of managing and overseeing natural resources and competing in human resource levels with other countries.

Based on these indicators, it can be concluded that literacy is the main indicator of a nation's progress. Interest in literacy among students can be obtained through efforts and support from the surrounding environment, so that students' interest in literacy does not disappear immediately when teachers continue to strive and introduce literacy habits to students (Hadimiati dkk., 2024). The ability of students' numeracy literacy refers to their ability to use mathematics in real-world contexts and to reason mathematically based on concepts and procedures. To measure students' numeracy literacy skills in Indonesia, one can look at the PISA scores (Maysarah, 2023). The level of students' numeracy literacy skills over time can be seen from *Program for International Student Assessment* (PISA) which shows that the literacy scores of Indonesian children have not experienced significant improvement. The literacy level of students in Indonesia is still far behind compared to countries that are included in *Organization for Economic Cooperation and Development* (OECD) (Kemendikbudristek, 2023c). OECD is a global organization that established PISA with assessment criteria from 38 countries around the world (Dewi & Nurjanah, 2022). That is explained in the following figure.



Source: OECD, PISA 2022 Database

Figure 1. Results of Indonesian Students' Numeracy Literacy Skills Test from OECD

In the 2022 PISA results, the average reading ability of Indonesian students reached 359 points, which is below the OECD average (Pusat Penilaian Pendidikan Balitbang Kemendikbud, 2019). This places Indonesia in a continuously declining rank, landing at the 70th position out of 80 countries with a numeracy score of 366 points (Dewayani et al., 2021). This shows that learning worldwide has declined due to the pandemic. Nevertheless, Indonesia managed to improve its position in PISA 2022 by 5 to 6 ranks compared to 2018, reaching the 68th rank. This reflects the resilience of Indonesia's education system in overcoming the impact of knowledge decline due to the pandemic. Indonesia's reading literacy position in PISA 2022 also improved by 5 positions compared to the previous year, bringing the total to 6 positions. Overall, the reading proficiency score in PISA 2022 showed a global decline of 18 points. Nevertheless, Indonesia's score drop of 12 points is still better than the global average. For mathematics skills, Indonesia's position in PISA 2022 improved by 5 positions from PISA 2018. The global average score for mathematical literacy decreased by 21 points, while Indonesia's score decreased by 13 points, which is also better than the global average. However, Indonesia's science literacy score showed a decline of 13 points in PISA 2022, or 12 points below the international average (Kemendikbudristek, 2023a).

In Indonesia, numeracy literacy has become a key component in the Minimum Competency Assessment (AKM) as a replacement for the National Examination (UN) from the National Assessment (AN). In 2022, it was found that half of the students from elementary to high school in Indonesia did not achieve the minimum literacy competency. In addition, the AN results also indicate a gap in the ability across various skills. Many schools, especially in 3T areas, show low levels of education and numeracy or are at level one. The low level of numeracy literacy according to the AKM assessment in the data from the education system evaluation report or the Indonesian education report shows that in 2022, the literacy level at the high school level was still classified as "moderate" with a decrease from 53.85% in 2021 to 49.26% in 2022, resulting in students having literacy competencies above the minimum; a decrease of 4.59. In 2022, the level of numeracy at the high school level was also classified as "moderate," with 35.16% in 2021 increasing to 41.14% in 2022, indicating that students had numeracy competencies above the minimum; an increase of 5.98 (Kemendikbudristek, 2023b). In the research conducted by Sima (2023), the results of the researcher's observation at SMAN 1 Sei Kepayang school indicate that the students' mathematics learning outcomes are still considered too low. This is because students do not enjoy math lessons and have difficulty understanding them, which affects their learning achievements, making them suboptimal. This situation clearly affects the way students think. So far, educators have only used conventional teaching methods, resulting in a less dynamic learning experience for

students and rarely requiring them to consider or explore problems or questions in depth. This causes many students to lose motivation or quickly feel despair in independent learning (Sima, 2023).

Based on the research, it can be seen that education in schools still does not align with the students' conditions because it is considered too monotonous during the learning process. Education in schools is also referred to as formal education. Formal education has significant value in intellectually enlightening individuals, which then shapes good character (Irsalulloh & Maunah, 2023). Thus, interaction from both parties regarding the teacher's teaching methods and the student's learning methods is necessary. Through active participation in every learning activity, students will be trained and developed in various competencies that support positive actions, which ultimately form the foundation for their lives. Therefore, an effective learning process is necessary. The implementation of the learning process will greatly determine the extent of success that must be achieved by a mathematics subject. mistakes occur among students in answering questions due to a lack of foundational knowledge (Amanda et al., 2024). Based on the research, it can also be seen that the urgency of this study lies in the importance of improving numeracy literacy skills that need to be enhanced for Indonesian students. By recognizing the importance of numeracy literacy skills, which is to strengthen education and numeracy in schools, energetic collaboration and coordinated efforts between various partners, both at the local and regional levels, are necessary (Wijaya et al., 2023). The initial step in building a literacy culture in schools involves the implementation of strategies in the academic, social-emotional, and physical domains. Thus, the school becomes the center of a collective effort to create students who are deeply rooted in the learning process.

To achieve this, it is important for educators to understand how students learn and master various models and approaches in teaching them. Because professional teachers are highly needed to achieve educational goals. Learning models reflect how students acquire knowledge, while learning approaches emphasize different teaching methods so that students do not feel bored and feel comfortable and enjoy the learning process. Thus, the selection of an appropriate learning model will have a significantly positive impact on students' learning progress. There are many learning models used by educators in the classroom. One of them is the problem-based learning (PBL) model and the discovery learning (DL) model. The use of PBL and DL is widely adopted by educators. This is because there is a compatibility in its application, especially in mathematics education (Bilolo et al., 2022). Every learning model guides us in designing learning to help students in such a way that learning objectives are achieved (Syafi'aturrosyidah et al., 2022). A good learning model must be in accordance with complete teaching materials. Teaching materials generally consist of knowledge, skills, and attitudes that students must learn in an effort to achieve the predetermined competency standards (T. J. Siregar & Richsan, 2023).

PBL is a development of the teaching model that utilizes problems as a convergence point to foster numeracy literacy, understanding of the material, and self-guidance. PBL is a learning model designed to develop skills in solving a learning problem, where students seek information related to the problem and can draw conclusions about the problem-solving from the information they obtain (Aulia et al., 2020). PBL encourages students to take an active role in solving everyday, unstructured, and complex problems. PBL encourages students to rediscover concepts, reflect, abstract, formalize, solve problems, communicate, and apply. This also focuses students' attention on the learning process. PBL has three objectives: to develop students' ability to systematically investigate a statement or problem, to foster independent learning, and to achieve mastery in problem-solving. Based on these three objectives, PBL will encourage students' numeracy literacy skills because problem-solving can help students improve their numeracy literacy abilities (Chrisdiyanto & Hamdi, 2023).

Additionally, the PBL strategy encourages engaging and student-centered learning by providing students with the opportunity to identify problems in their environment that can become the focus of instruction. Through discussions with their classmates, students are also encouraged to solve these problems. This helps them develop students' numeracy literacy skills from the creativity of students in problem-solving, which ultimately builds a positive attitude towards mathematics from the learning process taught by the teacher (Amara, 2021). The steps in the PBL model play an important role in guiding the learning process so that the learning has more systematic stages. The syntax or steps are as follows: (1) student orientation to the problem, (2) organizing students to learn, (3) guiding individual/group investigations, (4) developing and presenting work results, (5) analyzing and evaluating the problem-solving process (Ardianti et al., 2021).

PBL is increasingly being implemented in various educational institutions. Through this learning model, students will have a more relevant and meaningful learning experience. Here are some advantages of PBL that can enhance the quality of learning and improve students' numeracy literacy skills, namely: PBL can enhance communication between teachers and students, students will feel more active during the learning process due to group discussions, students will practice facing and overcoming difficulties, both inside and outside the classroom (everyday life), and students will be introduced to experimental techniques in learning (Siddiq et al., 2021).

Moreover, although PBL has many benefits in supporting more active and relevant learning, PBL also presents several challenges in its implementation, namely: many educators do not yet have the ability to assist students in problem-solving; students struggle to solve existing problems, but this is also appropriate to the students' thinking levels; and it takes a relatively long time compared to conventional learning (Siddiq et al., 2021).

Talking about discovery learning (DL), students learn through self-discovery in a learning model known as DL. Students are given the opportunity to discover on their own using a problem-solving approach. The DL learning model is often utilized by educators to help students improve their cognitive abilities and thinking processes, in addition to PBL. Student progress is facilitated according to each individual's learning pace by this model. Because it involves discussion and provides satisfaction when students succeed with their own discoveries, DL also has the potential to boost student motivation, allowing students to benefit from this learning model while also addressing doubts about certain facts (Kholili et al., 2021).

The DL model emphasizes the active involvement of students in discovering new concepts or knowledge through the process of exploration and investigation. Along with its effectiveness, this learning model requires learning steps to encourage students' curiosity and active involvement, making the learning process more meaningful and systematic. From that effectiveness, the DL model is considered effective in improving numeracy literacy skills in mathematics education (Agustin et al., 2023). The syntax or steps are as follows: (1) stimulation/provision of stimuli, (2) statement/identification of the problem, (3) data collection, (4) data processing, (5) verification, and (6) conclusion (Idrus, 2022).

The DL model helps students create a more independent learning atmosphere by centering the learning process around the students. Here are the advantages of the DL model that make it suitable for application in learning, among others: DL aims to help students build or develop their abilities and understanding of mental capabilities and learning independence, especially if they participate effectively in the directed disclosure of learning materials, allowing students to become more independent. Students' abilities can improve according to their own independence, and the DL model enables students to coordinate their own learning, making them feel more interested and motivated to learn, particularly in the process of concept discovery (Afandi et al., 2020).

Moreover, the DL model also faces challenges in its implementation, including: the DL model is not suitable for application in large classes with many students, readiness to learn from each student is required because not all students have the same curiosity about concept discovery, differences in concept discovery results can also easily distract students and lead to misconceptions, necessitating more individualized attention for each student (Afandi et al., 2020)

In the research conducted by Mahmudah (2020), it was shown that the learning model is capable of improving overall numeracy literacy skills, including in the large effect category. This indicates that the learning model has a very critical and highly important impact to be applied in mathematics education (Mahmudah, 2020). The PBL and DL learning models can be used to enhance mathematics learning by mastering problem-solving and discovering learning materials independently, which is believed to improve students' numeracy literacy skills. Mathematics teachers need support and encouragement to implement both learning models. Therefore, it is recommended that mathematics teachers use the discovery learning and problem-based learning models (Ferawati, 2020).

This research makes an important contribution to the field of education, particularly as this study focuses on the differences in high school students' numeracy literacy skills through the problem-based learning and discovery learning models, thus differing from previous research which focused on improving students' numeracy literacy skills through these two learning models. Compared to the learning models applied in schools, namely the conventional learning model which is considered monotonous. Furthermore, there have not been many studies identifying the unique characteristics in the application of problem-based learning and discovery learning models, and although various research has been conducted, there have not been many studies specifically comparing the effectiveness of these two learning models. Therefore, based on the urgency of the research and the gap analysis, it is deemed necessary to conduct an update of the research that includes the latest studies by implementing the independent curriculum in the learning process on probability material. Then, the sample taken used the total sampling technique by including the entire research object, so the research design used is a quasi-experimental design.

From the explanation, the researcher is interested in conducting a study using the problem-based learning and discovery learning models to observe the differences between the two models. From previous studies, it has been shown that numeracy literacy skills are still at a low level, so this research includes student interest in learning mathematics by applying both suitable learning models and incorporating them into the learning process. Thus, in addition to understanding the level of students' numeracy literacy skills, the researchers also found solutions to the problem of low numeracy literacy among students, which were then applied and incorporated into the learning process. It is hoped that with this research, students will improve in terms of problem-solving skills and numeracy literacy. Thus, this study addresses the importance of effective learning models—Problem-Based Learning (PBL) and Discovery Learning (DL)—to improve numeracy literacy skills in mathematics, specifically on probability material.

METHOD

This research was conducted in the odd semester of the 2024/2025 academic year in September 2024, located at Senior High School in Kepayang, Sumatera Utara. The population in this study is the 10th-grade MIA students of Senior High School in Kepayang, consisting of 2 (two) classes, namely class X MIA 1 with 30 students and class X MIA 2 with 30 students. The sampling technique used in this study is the total sampling technique. Total sampling is the entire research object that can be reached by the researcher or a small population object,

and the entire population serves as the research sample. Thus, in this study, the entire sample was used, which consisted of 60 students.

In this study, an experimental research type is used. Experimental research is conducted by performing experiments, so it can be seen that this research uses a quantitative research method. The research design that will be used is a quasi-experiment or a pseudo-experimental study. Quasi-experiment is a type of research conducted because the classes used have already been formed previously (Prawidya et al., 2023). This research design was conducted using a post-test only control design type. Post-test only control design uses experimental groups that are compared, but the samples are taken non-randomly or in their entirety (Rahmadina et al., 2023).

Data collection instruments are tools selected for use by researchers in their activities of collecting data so that their research becomes systematic (Thoibah et al., 2022). The data collection instrument in this study is a test of students' numeracy literacy skills on the topic of probability. In detail, the design and instruments in this study are as follows: two existing groups are given treatment and administered a post-test.

The research procedure is designed with a systematic research design to ensure that the data obtained is accurate and aligns with the research objectives. The initial stage of this research involves the researcher conducting a trial of the instrument with results from the validity and reliability tests. When the data obtained is valid and reliable, then the research can be conducted. Learning began with experimental group 1 receiving treatment using the problem-based learning model and experimental group 2 receiving the discovery learning model. The final stage, both groups were given a post-test consisting of 10 items as an essay test of numeracy literacy skills from this research. The essay test was administered by providing questions related to everyday life so that students could apply numerical concepts in real contexts. This was done to determine whether there is a significant difference between the two learning models, both problem-based learning and discovery learning, on students' numeracy literacy skills in probability material, as well as to understand students' interest in learning mathematics from both learning models. The research design can be briefly seen in the table below.

Table 1. Research Design

Group	Treatment	Result
X MIA 1 (Experiment 1)	Problem Based Learning Model (X ₁)	Post-Test (Q ₁)
X MIA 2 (Experiment 2)	Discovery Learning Model (X ₂)	Post-Test (Q ₂)

This research has independent and dependent variables. The independent variable is the variable that influences other variables, the independent variable is the cause of changes in other variables. The dependent variable is the variable that is influenced by the independent variable, the dependent variable is the result of the independent variable (Syafri, 2021). Therefore, this research uses the following variables.

Independent variables : Problem-based learning model (X₁) and discovery learning model (X₂).

Dependent variable : Students' numeracy literacy skills.

RESULT AND DISCUSSION

This research was conducted to determine whether there is a significant difference in the numeracy literacy skills of students taught using the problem-based learning model and the discovery learning model in order to improve students' numeracy literacy skills. Validity testing in research is very important to ensure that the instruments used truly measure the intended abilities, such as numeracy literacy skills. Validity allows researchers to ensure that

the measurement results are interpreted correctly and accurately (Colorado State University, 2024). Meanwhile, the reliability test is used to help ensure the consistency and accuracy of an instrument's measurement so that the research can be trusted and reused under similar conditions (Canatay et al., 2022).

For that reason, before referring to the research results, the researcher has conducted a trial of the research instrument in the form of a validity test using the Pearson product-moment formula and a reliability test using the Cronbach's alpha formula with the following results.

Table 2. Results of The Validity Test

	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10
Rcount	0,53	0,53	0,41	0,42	0,45	0,50	0,42	0,56	0,48	0,60
Rtable	0,25	0,25	0,25	0,25	0,25	0,25	0,25	0,25	0,25	0,25
Criteria	Valid	Valid	Valid	Valid	Valid	Valid	Valid	Valid	Valid	Valid

From the table, it can be seen that all the questions are valid with the stipulation. Thus, all questions have been proven to measure students' numeracy literacy skills. This proves that each question item is in accordance with the indicators of students' numeracy literacy skills.

Table 3. Reliability Test Results

	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10
Total variant						100,41				
Item variant	4,34	2,96	3,62	3,08	5,50	4,78	4,27	3,70	4,12	5,71
Cronbach's Alpha						0,64				
Criteria						Moderate				
Conclusion						Reliable				

From the table, it can be seen that with the reliability value criteria of "moderate," which has passed the range of 0.60-0.80. A reliability value of 0.64 was found and concluded as "reliable" with the reliability value criterion > 0.6 . Thus, all the questions can be used in the research and have been proven to measure students' numeracy literacy skills.

Next, treatment was conducted by applying the problem-based learning model and the discovery learning model. The problem-based learning model in the research was conducted with a focus on students, where real-world problems were given to be solved and served as a catalyst to spark students' interest in learning mathematics on the topic of probability. In the learning process, groups are formed so that students can discuss and solve the given problems.

The discovery learning model in the research is conducted with a focus on students, where students are given time to independently seek as much information as possible related to the topic of probability. With encouragement from the teacher also serving as a catalyst to spark students' interest in learning mathematics on the topic of probability. After the students are deemed to have sufficiently grasped the learning material concepts, the teacher begins discussing the material along with the understanding that the students have acquired. Previously, in the learning process, group work was also implemented so that students could discuss and discover the learning concept material. Then, based on the treatment results, a post-test was conducted, and the scores on each indicator of students' numeracy literacy skills were depicted in the achievement graph as follows.

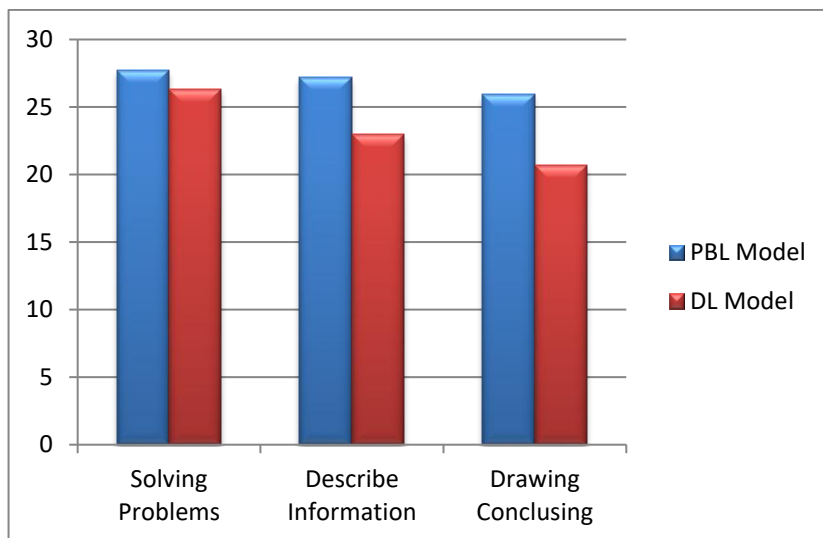


Figure 2. Results of Students' Numeracy Literacy Skills Test

Table 4. Student Grades

	Class X MIA 1	Class MIA 2
Mean	79,13	63,33
Percentage	79,13%	63,33%

From the students' scores that have been obtained, a prerequisite test is then conducted in the form of a normality test using the chi-squared formula and a homogeneity test using the F-test. In the normality test, if the data is normally distributed, then a homogeneity test can be conducted (Avram & Mărușteri, 2022). Next, if the homogeneity test results in homogeneous data, a T-test can be conducted (Orcan, 2020). Each of these tests yielded the following results.

Table 5. Results of the Normality Test for Class X MIA 1 Problem Based Learning Model

Mean	77,83
Standard Deviation	11,72
X^2_{count}	6,85
X^2_{table}	7,81
$X^2_{hitung} < X^2_{tabel}$ then H_0 accepted So that the data is normally distributed	

Table 6. Results of the Normality Test for Class X MIA 2 Model Discovery Learning

Mean	60,50
Standard Deviation	16,40
X^2_{count}	6,14
X^2_{table}	7,81
$X^2_{count} < X^2_{table}$ then H_0 accepted So that the data is normally distributed	

From the table, it can be seen that the data from both classes have a normal distribution with the criteria $X^2_{count} < X^2_{table}$ that in Class X MIA 1, which was given the problem-based learning model, has data $X^2_{count}(6,85) < X^2_{table}(7,81)$. Meanwhile, in class X MIA 2, which was given the discovery learning model, the data is $X^2_{count}(6,14) < X^2_{table}(7,81)$. This proves that the prerequisite test in the form of a parametric statistical test in this study is valid, so it can be continued with a homogeneity test. Then, a homogeneity test of the two classes was conducted using the F-test formula, and the following data was obtained.

Table 7. Results of the Variance Homogeneity Test

	Class Experiment 1	Class Experiment 2
Mean	79,13	63,33
Variance	155,29	298,23
Observations	30	30
Df	29	29
F	0,52	
P(F<=f) one-tail	0,04	
F Critical one-tail	0,54	

From the table, it can be seen that both classes have homogeneous results or meet the criteria $F_{count} < F_{table}$ with both classes having data $F_{count}(0,52) < F_{table}(0,54)$.

After all prerequisite tests are met, the next step is to conduct statistical calculations using the independent sample t-test as follows.

Table 8. Independent Sample t-test-Two-Sample Assuming Equal Vaiances

	Class Experiment 1	Class Experiment 2
Mean	79,13	63,33
Variance	155,29	298,23
Observations	30	30
Pooled Variance	226,76	
Hypothesized Mean Difference	0	
df	58	
t Stat	4,06	
P(T<=t) one-tail	7,35	
t Critical one-tail	1,67	
P(T<=t) two-tail	0,01	
t Critical two-tail	2,01	

From the table, it shows that there is a significant difference between the two learning models that have been applied in both classes, with class X MIA 1, which was given the problem-based learning model, having higher scores compared to class X MIA 2, which was given the discovery learning model. This is evident from the data $T_{count}(4,06) > T_{table}(2,01)$. Thus, the conclusion of the hypothesis from both classes can be determined, namely H_0 rejected and H_a accepted.

Based on the results of the hypothesis test using the T-test formula on both learning models, it was found that the numeracy literacy skills of students taught with the problem-based learning model in class X MIA 1 and the discovery learning model in class X MIA 2 showed a significant difference. The analysis of the results shows that students taught using the problem-based learning model have a higher improvement in numeracy literacy compared to students taught using the discovery learning model. This is also similar when viewed from the average results and the percentage of student scores. Class X MIA 1, which was taught using the problem-based learning model, had a numeracy literacy test score of 79.13 (79.13%), while Class X MIA 2, which was taught using the discovery learning model, had a score of 63.33 (63.33%).

The difference is due to the fact that the problem-based learning model is better than the discovery learning model in terms of improving students' problem-solving skills from the previously given trigger problems. This is in line with the research conducted by Gea (2024), which shows that with the problem-based learning model, students are more capable of answering tests well compared to the discovery learning model (Gea & Harefa, 2024). In the research conducted by Fitriyah (2022), it was revealed that a practical learning model to develop numeracy literacy skills is through the problem-based learning model, as it

significantly affects the improvement of students' mathematical reasoning abilities (Fitriyah et al., 2022). Thus, by using the problem-based learning model, it can enhance problem-solving skills, allowing students to successfully complete numeracy literacy skills tests on probability material.

Meanwhile, in the research conducted by Khairunnisa and Dadang (2022), it was stated that there is no effectiveness of the discovery learning model in improving students' numeracy literacy skills. This is because students are still not accustomed to using the discovery learning model in their learning activities. Without being given a triggering problem in the form of questions and solutions, students still do not fully understand the concept of probability material taught by the teacher (Khairunnisa & Dadang, 2022).

However, more than that, the discovery learning model is better than the problem-based learning model in terms of increasing student activity in the learning process, which is obtained from the students' independence in seeking understanding of the concept from the probability material. According to the research conducted by Asmal (2023), the discovery learning model is more effective in helping students develop thinking skills based on the information they obtain themselves (Asmal, 2023). Thus, by using the discovery learning model, the learning process becomes more active and students can answer the numeracy literacy skills test given by the researcher. However, the activity of the learning process must be encouraged by teacher instructions so that students can maximize their understanding of the concept of probability material.

Based on the overall test results, the classroom learning process is more effective when the problem-based learning model and the discovery learning model are applied, thereby contributing to the improvement of students' numeracy literacy skills. This is because students are more active and more understanding since both learning models focus on students in the learning process. Considering the problem-based learning model, which is taught with triggering problems, and the discovery learning model, which encourages students to seek understanding independently first, can create a more effective learning environment between students and teachers. Thus, it can be seen that the problem-based learning model and the discovery learning model can enhance students' numeracy literacy skills, and both learning models are considered good, suitable, and more effective to be applied in mathematics learning activities, especially in the topic of probability.

From this research, it can be seen that there are new insights regarding the effectiveness of the two learning models tested in improving students' numeracy literacy skills. Thus, teachers can consider integrating the problem-based learning model to enhance students' understanding of numeracy literacy concepts in a more in-depth and practical manner. The problem-based learning model requires students to think critically and work together in teams, which can also develop students' collaborative skills. Thus, teachers need to receive adequate training in the implementation of the problem-based learning model in order to manage the dynamics of problem-based learning more effectively. Moreover, the discovery learning model is also considered effective during the learning process, but there needs to be a habit between teachers and students in applying it. Thus, the findings of this research can be an important consideration in the development of curriculum and educational policies.

CONCLUSION

There is a difference in the numeracy literacy skills of students taught using the problem-based learning model and the discovery learning model at SMAN 1 Sei Kepayang in classes X MIA 1 and X MIA 2 on the topic of probability. From the test results obtained from the post-test scores, which indicate the students' numeracy literacy skills, it can be seen that using the problem-based learning model is better and more effective than the discovery learning model. From the results of the hypothesis test using the T-test formula, the statistical hypothesis results show a significant difference between the two learning models. The difference is seen from the data which shows that

$T_{count}(4,06) > T_{table}(2,01)$ which means H_0 is rejected and H_a is accepted. This indicates that there is a difference in the numeracy literacy skills of students taught using the problem-based learning model and the discovery learning model in the probability material at Senior High School in Keparang for the 2024-2025 academic year.

REFERENCE

- Afandi, M., Chamalah, E., & Wardanig, O. P. (2020). Model dan Metode Pembelajaran di Sekolah. In *Computer Physics Communications* (I, Vol. 180, Issue 4). UNISSULA PRESS. <https://doi.org/10.1016/j.cpc.2008.12.005>
- Agustin, A. A., Trisiagna, A., & Prihastari, E. B. (2023). Efektivitas Model Pembelajaran Discovery Learning terhadap Kemampuan Literasi Numerasi Materi Pecahan Siswa Kelas V SDN Jenggrik 03 Sragen Tahun Ajaran 2022 / 2023. *Jurnal Pendidikan Tembusai*, 7, 18495–18502.
- Amanda, A., Hasanah, R. U., & Nurmala, S. (2024). Systematic Literature Review : Kesulitan Belajar Mahasiswa Pendidikan Matematika. *Jurnal Ilmiah Matematika, Kebumihan Dan Angkasa*, 2(3). <https://doi.org/10.62383/bilangan.v2i3.54>
- Amara, I. (2021). Pengaruh Penggunaan Model Problem Based Learning. *Jurnal Pendidikan Karakter*, November, 106–110.
- Ardianti, R., Sujarwanto, E., & Surahman, E. (2021). Problem-based Learning : Apa dan Bagaimana. *DIFFRACTION: Journal for Physics Education and Applied Physics*, 3(1), 27–35. <http://jurnal.unsil.ac.id/index.php/Diffraction>
- Asmal, M. (2023). Perbandingan Model Pembelajaran Problem Based Learning dan Discovery Learning terhadap Hasil Belajar Siswa. *Journal on Education*, 05(02), 5413–5420. <http://jonedu.org/index.php/joe>
- Aulia, Nanda, & Andhany, E. (2020). Pengembangan Modul Berbasis Problem Based Learning untuk Meningkatkan Kemampuan Komunikasi Matematis Siswa di MAN 3 Langkat. *Jurnal Pendidikan Dan Matematika*, 09(2), 133–144. <https://doi.org/10.30821/axiom.v9i2.7822>
- Avram, C., & Mărușteri, M. (2022). Normality assessment , few paradigms and use cases. *Short Communication*, 30(3), 251–260. <https://doi.org/10.2478/rrlm-2022-0030>
- Bilolo, S., Rasul, A., & Sonda, R. (2022). Pengaruh Model Pembelajaran Problem Based Learning (PBL) Terhadap Hasil Belajar Matematika Pada Materi Himpunan di Kelas VII SMP Cordova Timika Papua. *Cerdas Jurnal Pendidikan*, 1(1).
- Canatay, A., Emegwa, T., Lybolt, L. M., & Loch, K. D. (2022). Reliability assessment in SEM models with composites and factors: A modern perspective. *Data Analysis Perspectives Journal*, 3(January), 1–6. <https://www.scriptwarp.com>
- Chrisdiyanto, E., & Hamdi, S. (2023). Efektivitas Problem Based Learning dan Problem Solving Terhadap Kemampuan Berpikir Kritis dan Kemandirian Belajar Matematika. *Jurnal Riset Pendidikan Matematika*, 10(2), 165–174. <https://doi.org/10.21831/jrpm.v10i2.65754>
- Colorado State University. (2024). *Understanding Reliability and Validity*. 1–19. <https://writing.colostate.edu/guides/guide.cfm?guideid=66>
- Dewayani, S., Retnaningdyah, P., Antoro, B., Susanto, D., Ikhwanudin, T., Fianto, F., Muldian, W., Syukur, Y., & Setiakarnawijaya, Y. (2021). *Panduan Penguatan Literasi dan Numerasi di Sekolah Dasar* (S. Handini (ed.); I). Direktorat Jenderal Pendidikan Anak Usia Dini, Pendidikan Dasar, dan Pendidikan Menengah Kementerian Pendidikan dan Kebudayaan Sekretariat: http://repositori.kemdikbud.go.id/22599/1/Panduan_Penguatan_Literasi_dan_Numerasi_di_Sekolah_bf1426239f.pdf
- Dewi, E. R., & Nurjanah, A. (2022). Problem-Based Learning and Case-Based Learning : Which is more effective for fostering mathematical connection? *Jurnal Riset Pendidikan Matematika*, 9(2), 124–136. <https://doi.org/10.21831/jrpm.v9i2.53276>
- Ferawati, & Suhendri, H. (2020). Efektivitas Model Discovery Learning dan Problem Based Learning terhadap Berpikir Kreatif dan Kemampuan Pemecahan Masalah Matematika. *JKPM (Jurnal Kajian Pendidikan Matematika)*, 6(1), 111. <https://doi.org/10.30998/jkpm.v6i1.8311>

- Fitriyah, I. M., Hidayanto, N., Setyo, P., & Apino, E. (2022). Meta analysis study : Effectiveness of Problem Based Learning on Indonesian Students ' Mathematical Reasoning Ability. *Jurnal Riset Pendidikan Matematika*, 9(1), 36–45. <https://doi.org/10.21831/jrpm.v9i1.46447>
- Gea, D. puspita sari, & Harefa, A. O. (2024). Perbedaan Problem Based Learning dengan Discovery Learning. *Jurnal Suluh Pendidikan*, 12(1).
- Hadimiati, A. S., Dewi, R., Nurmala, S., Salamah, S., & Ginting, B. (2024). Pengembangan Minat Baca Dan Literasi Anak-Anak Desa Bandar Magodang Melalui Kegiatan Pengabdian Masyarakat Mahasiswa UIN Sumatera Utara Developing Interest In Reading And Literacy For Children In Bandar Magodang Village Through Community Service Activitie. *ASPIRASI : Publikasi Hasil Pengabdian Dan Kegiatan Masyarakat*, 2(1), 181–187. <https://doi.org/10.61132/aspirasi.v2i1.288>
- Idrus, N. W. (2022). *Model Pembelajaran Discovery Learning Sekolah Menengah Pertama*.
- Irsalulloh, D. B., & Maunah, B. (2023). Peran Lembaga Pendidikan dalam Sistem Pendidikan Indonesia. *PENDIKDAS: Jurnal Pendidikan Sekolah Dasar*, 04(02), 17–26. <https://jurnal.habi.ac.id/index.php/Pendikdas>
- Jaelani, N., & Ginanjar. (2021). *Penguatan Literasi dan Numerasi Kemendikbud* (pp. 6–27). Direktorat Sekolah Menengah Atas. sma.kemdikbud.go.id
- Kemendikbudristek. (2023a). Laporan Pisa Kemendikbudristek. *Pemulihan Pembelajaran Indonesia*, 1–25. <https://balai bahasariau.kemdikbud.go.id/wp-content/uploads/2023/12/LAPORAN-PISA-KEMENDIKBUDRISTEK.pdf>
- Kemendikbudristek. (2023b). *Rapor Pendidikan Indonesia tahun 2023*.
- Kemendikbudristek. (2023c). Siaran Pers Kemendikbud. *Kemendikbudristek Luncurkan Merdeka Belajar Episode Ke-23: Buku Bacaan Bermutu Untuk Literasi Indonesia*. https://merdekabelajar.kemdikbud.go.id/upload/file/256_1677659407.pdf
- Khairunnisa, & Dadang, J. (2022). Meta-Analysis : The Effect of Discovery Learning Models on Students ' Mathematical Ability. *Jurnal Riset Pendidikan Matematika*, 9(2), 201–211. <https://doi.org/10.21831/jrpm.v9i2.49147>
- Kholili, A., Shoffa, S., & Soemantri, S. (2021). Pembelajaran Matematika Model Discovery Learning Terhadap Kemampuan Berpikir Kreatif Siswa : Kajian Meta Analisis. *Jurnal Pembelajaran Matematika Inovatif*, 4(6), 1441–1452. <https://doi.org/10.22460/jpmi.v4i6.1441-1452>
- Lince, R., & Ero, P. E. L. (2023). Evaluation and Effects of STEAM-PBL on Mathematics Interest and Numeracy Skills on Elementary School. *Jurnal Riset Pendidikan Matematika*, 10(2), 199–210. <https://doi.org/10.21831/jrpm.v10i2.67251>
- Lubis, M., Zein, H. U., & Lubis, M. S. (2023). Pengaruh Literasi Membaca dan Menulis terhadap Kemampuan Pemecahan Masalah Matematis Mahasiswa Pendidikan Matematika UINSU Medan di Era Society 5.0. *Jurnal Tarbiyah*, 30(1), 39–52. <https://doi.org/10.30829/tar.v30i1.2244>
- Mahmudah, U. (2020). Meta Analisis Pengaruh Model Discovery Learning dan Problem Based Learning. *Thinking Skills and Creativity Journal*, 3(2), 69–78.
- Maysarah, S., Saragih, S., & Napitupulu, E. (2023). Peningkatan Kemampuan Literasi Matematik dengan Menggunakan Model Project-Based Learning. *Jurnal Program Studi Pendidikan Matematika*, 12(1), 1536–1548. <https://doi.org/10.24127/ajpm.v12i1.6627>
- Orcan, F. (2020). Parametric or Non-parametric : Skewness to Test Normality for Mean Comparison. *International Journal of Assessment Tools in Education*, 7(2), 255–265. <https://doi.org/doi.org/10.21449/ijate.656077>
- Prawidya, A., Yahfizham, & Maysarah, S. (2023). Perbedaan Kemampuan Berpikir Kreatif dan Representasi Siswa dengan Strategi QOTD dan Quantum Learning. *Relevan: Jurnal Pendidikan Matematika*, 3(3), 304–308. <https://ejournal.yana.or.id/index.php/relevan>
- Pusat Penilaian Pendidikan Balitbang Kemendikbud. (2019). Pendidikan di Indonesia Belajar dari Hasil PISA 2018. *Pusat Penilaian Pendidikan Balitbang Kemendikbud*, 021, 1–206.
- Rahma, F. L., & Reflina. (2023). Analisis Kemampuan Literasi Numerasi dalam Menyelesaikan Soal Programme for International Student Assessment (PISA). *Jurnal Karya Pendidikan Matematika*,

- 10(1), 11–20. <http://jurnal.unimus.ac.id/index.php/JPMat/index>
- Rahmadina, S. W., Syahril, & Zulirfan. (2023). Penerapan Model Pembelajaran Conceptual Understanding Procedures alam Meningkatkan Pemahaman Konsep pada Topik Klasifikasi Materi dan Perubahannya Siswa Kelas VII SMPN 6 Siak Hulu. *Edusaintek: Jurnal Pendidikan, Sains, Dan Teknologi*, 10(1), 58–68. <https://doi.org/10.47668/edusaintek.v8i1.647>
- Siddiq, R., Najuah, & Lukitoyo, P. S. (2021). *Model-Model Pembelajaran Abad 21* (H. W. A. dan J. P. Manalu (ed.)). CV. AA. Rizky.
- Sima, M. (2023). *Skripsi: Perbandingan Hasil Belajar Siswa Menggunakan Model Connecting Organizing Reflection Extending (CORE) dan Reciprocal Teaching Kelas X SMA Negeri 1 Sei Kepayang T.P2022-2023*.
- Siregar, M. B., & Narpila, S. D. (2023). Influence of Problem- Based Learning Model on Students ' Critical Thinking Ability and Learning Motivation in Mathematics Learning. *Jurnal Matematika Dan Pendidikan Matematika*, 7, 263–274. <https://doi.org/10.25217/numerical.v7i2>
- Siregar, T. J., & Richsan, A. A. (2023). Pengembangan bahan ajar algoritma pemrograman pada program studi pendidikan matematika. *AXIOM: Jurnal Pendidikan Dan Matematika*, 12(1), 71–83. <https://doi.org/10.30821/axiom.v12i1.14739>
- Solehah, H., & Setiawan, D. (2023). Kurikulum Merdeka dan Penilaian Pembelajaran Matematika dalam Membangun Generasi Matematika yang Kompeten (Studi Literatur). *Jurnal Pendidikan Tambusai*, 7(3), 23929–23940.
- Syafi'aturrosyidah, M., Ningtyas, T. R. Z., & Zumaroh. (2022). Implementasi Model Pembelajaran CTL (Contextual Teaching and Learning) dalam Pembelajaran PKn Jenjang Pendidikan Dasar. *Jurnal Primary*, 3(2), 42–53.
- Thoibah, Rakhmawati, F., & Maysarah, S. (2022). Perbedaan Kemampuan Berpikir Kritis Matematis Siswa Diajar dengan Model PBL dan SSCS. *Relevan: Jurnal Pendidikan Matematika*, 2(2), 212–216. <https://yana.web.id/index.php/relevan>
- Wijaya, A., Fanggidae, J. J. R., & Setyaningrum, W. (2023). Kemampuan Numerasi dan Growth Mindset Siswa SMP dan Madrasah Tsanawiyah di Kabupaten Purworejo. *Jurnal Pendidikan Riset Matematika*, 10(2), 153–164. <https://doi.org/10.21831/jrpm.v10i2.66831>