THE EFFECT OF PROBLEM-BASED LEARNING AND DEEP LEARNING MODELS ON LEARNING OUTCOMES OF ISLAMIC SENIOR HIGH SCHOOL

Sutrisno
Universitas Islam Negeri Maulana Malik Ibrahim, Malang, Indonesia
Email: drsutrisno65@uin-malang.ac.id

Luchyto Chandra Permadi
Universitas Islam Raden Rahmat, Malang, Indonesia
Email: luchy.chandra@gmail.com

Angga Teguh Prastyo
Universitas Islam Negeri Maulana Malik Ibrahim, Malang, Indonesia
Email: anggateguh@pai.uin-malang.ac.id

Prayudi Lestantyo
Universitas Islam Negeri Maulana Malik Ibrahim, Malang, Indonesia
Email: prayudilestantyo@uin-malang.ac.id

ABSTRACT
The study aims to analyze the influence of problem based learning and deep learning models on the learning outcomes of Islamic Senior High School students on the need to improve critical thinking skills, problem solving, and conceptual understanding of students in the learning process. The research method uses a quasi-experimental using a Non-equivalent Control Group design with a 2 x 3 factorial version. The population of this study was Islamic Senior High School students. The research instruments included cognitive learning outcome tests and questionnaires to measure the level of depth of student learning. The data obtained were analyzed using two-way ANOVA statistical techniques to determine the effect of each variable and their interactions. The results of the study show 1) problem based learning and deep learning have a positive impact, but the deep learning learning model has a significant influence on improving the learning outcomes of Madrasah Aliyah students, 2) increasing student learning outcomes at high, medium, and low prior knowladge between the problem based learning student group and the student group who participated in learning using deep learning, 3) The interaction between the problem based learning model and deep learning has a positive influence on improving conceptual understanding and critical thinking skills of students. Thus, the application of the problem-based learning model supported by deep learning strategies can be an effective alternative in improving the quality of learning at the Islamic Senior High School education level.

Keywords, *Problem Based Learning, Deep Learning, Prior Knowladge, Learning Outcomes*

INTRODUCTION

Educational transformation in the digital era demands a learning approach that emphasizes not only cognitive aspects but also the development of critical thinking competencies, problem-solving, and meaningful learning.

Amid these demands, the Problem-Based Learning and Deep Learning models have become two approaches that are increasingly relevant for implementation, particularly in the context of Islamic-based secondary education such as Islamic Senior High School. Deep Learning in a pedagogical context is not simply artificial intelligence technology, but rather a learning approach that emphasizes in-depth conceptual understanding, meaningful reflection, and the transfer of knowledge into real-life contexts. Students are guided to construct meaning through reflective and integrative thinking processes. This model has been empirically proven to enhance meaningful learning and shape the character of active and independent learners (Aliyah et al., 2025). In the development of learning, Deep Learning has many advantages, but also several disadvantages have been found.

The advantages of deep learning include enabling students to build a deeper understanding of learning materials through reflective thinking processes, rather than simply memorizing. This aligns with Islamic educational values that emphasize understanding meaning, rather than merely mastering texts (Andayanie et al., 2025), directing students to actively explore material, construct their own meaning, and reflect on their learning outcomes, Deep Learning creates a more personalized learning environment and fosters intrinsic motivation (Mahulae & Tumanggor, 2025; Zain & Akbar, 2025), opening up spaces for reflective and contextual discussions that are highly suitable for Islamic Religious Education learning, as it allows students to connect Islamic values with the realities of life (Aliyah et al., 2025; Rochyati, 2025), and enabling teachers to conduct real-time evaluations through analysis of the achievement of learning objectives, so that learning can be tailored to students' needs directly (Kishore et al., 2022; Wang et al., 2024). The disadvantages of deep learning include the need for digital tools and stable internet access. Many Islamic Senior High School, especially in rural areas, do not yet have this infrastructure (Estrada-molina et al., 2024), Teachers need to have a deep understanding of reflection-based learning design and skills in using technology, even though not all teachers in madrasahs are trained in this (Zain & Akbar, 2025), are not transparent in the decision-making process, making it difficult for teachers to understand how and why a learning conclusion is drawn from the model. This can trigger distrust of the results (Marcus, 2018), Conventional evaluations are unable to capture deep learning outcomes (Andayanie et al., 2025), are vulnerable to algorithmic bias and data ethics issues (Wiese et al., 2025).

On the other hand, Problem-Based Learning encourages students to learn through solving real-life, contextual problems. This model is designed to develop critical thinking, communication, and collaboration skills. Several studies have demonstrated its effectiveness in improving student learning outcomes and reasoning skills, particularly in analysis-based subjects such as Fiqih (Islamic jurisprudence) and Aqidah (Akhlak) (Ni'mah et al., 2025). Problem-Based Learning has advantages and disadvantages in the learning process, both for educators and students. The advantage is

that it can encourage students to actively solve contextual problems related to their lives, including in Islamic studies (Cahaya & Ansori, 2025). This process helps students develop critical, analytical, and reflective thinking skills, which are crucial for a deeper understanding of religious values. It has been proven to increase student engagement because they feel challenged and responsible in the process of finding solutions (Anggun et al., 2025; Karim, 2023), creating a more active and collaborative learning environment. Placing students as active subjects responsible for their own learning process (Nadia Saputri & Putri Anggalia, 2025; Panggabean, 2025), this helps them develop independent learning skills and prepare themselves to face real-life challenges. In group work, students learn to communicate effectively, negotiate, and cooperate, all of which are part of Islamic character values (Mahliatussikah & Malang, 2023). However, Problem-based learning also has disadvantages, such as requiring a longer time in the learning process (Primadoniati, 2020), requiring high teacher competence as a facilitator (Prayetno et al., 2025), not all students are ready for independent and open learning (Sukriyatun et al., 2023), Evaluation of learning outcomes is difficult to do with conventional test methods (Fauziah & Nur, 2024; Ilmi et al., 2025).

The main challenge faced by most Islamic Senior High Schools (Malang) is the continued dominance of conventional, lecture and memorization based learning models. This approach is no longer sufficient to meet the demands of 21st-century competencies. Furthermore, the weak integration of innovative learning models, lack of teacher training, and low student motivation are contributing factors to low student learning outcomes in several Islamic Senior High Schools (MA). In this context, the integrated implementation of Problem-Based Learning and Deep Learning models is believed to complement each other. Deep Learning provides the foundation for reflective and meaningful thinking, while Problem-Based Learning strengthens application and problem-solving skills. The combination of the two has the potential to produce a holistic learning approach that supports optimal learning outcomes, across cognitive, affective, and psychomotor aspects.

Empirical research examining the effect of implementing a combination of these two models in the Islamic Senior High School environment, especially in Malang city, is still very limited. In fact, the potential for synergy between Problem Based Learning and Deep Learning is very large in creating an active, reflective, and contextual learning climate, in accordance with the characteristics of students in madrasahs. The purpose of this research is to analyze the effectiveness of the Problem Based Learning and Deep Learning learning models on the learning outcomes of Islamic Senior High School students in Malang and to identify the extent to which the integration of these two models has a positive influence on students' conceptual understanding and critical thinking skills, as well as to examine empirical findings regarding: (1) differences in learning outcomes between groups of students who participate in learning using Problem Based Learning and groups of students who participate in

learning using Deep Learning, (2) differences in learning outcomes between groups of students who have high prior knowladge and groups of students who have low initial abilities, (3) interactions between the use of learning models and initial abilities on student learning outcomes.

METHOD

Research Approach and Type The research used a quantitative descriptive approach with a quasi-experimental research type (Sugiyono, 2023). This approach was chosen because the purpose of the research was to determine the effect of two learning models on student learning outcomes in a measurable and objective manner. The design used was a 2x3 factorial version of the Nonequivalent Control Group Design, where the research population was grade XI Islamic Senior High School students in Malang City in the 2024/2025 academic year. There were two experimental groups, 30 students in the group treated with the Problem Based Learning model and 26 students in the group treated with the Deep Learning model. The learning implementation was carried out in 9 meetings, with a time allocation of 4 x 45 minutes for each meeting. The data obtained were analyzed using the Two Way Anova statistical technique (Creswell, 2014). In hypothesis testing, analysis prerequisite tests are required, namely normality and homogeneity tests. If the analysis prerequisite tests are met, then hypothesis testing with Two Way Anova analysis can be continued using SPSS software. The significance level set is $\alpha = 0.05$, while the decision-making procedure is to look at the magnitude of the p-value or sig. If the sig. value < α, then H0 is rejected, and if the sig. value > α, then H0 fails to be rejected.

RESULTS AND DISCUSSION

RESULTS

Description of student learning outcomes between groups of students who participated in learning using Problem-Based Learning and Deep Learning. Regardless of initial ability factors, the learning outcomes of Problem-Based Learning students. Based on Table 1, the description of the learning outcomes of the Problem-Based Learning and Deep Learning groups is known to have differences in mean, standard deviation, median, minimum value, maximum value, range, and variance. Descriptively, this means that the average learning outcomes of the Deep Learning group are higher than those of the Problem-Based Learning group.

Table 1. Student learning outcomes of Problem Based Learning and Deep Learning

Treatment	N	Mean	Std. Dev	Median	Min	Max	Range	Variance
PBL	30	81.62	6.5	81.8	70.6	95.1	24.5	42.32
Deep Learning	26	83.65	5.4	84.0	73.0	99.0	26.0	29.43

Source: Output SPSS 30 For Windows (2025)

Description of student learning outcomes between groups of students with high, medium, and low initial abilities. Student learning outcomes in the Problem-Based Learning group.

Table 2. Student learning outcomes between those with high, medium, and low initial abilities

Treatment	N	Mean	Std. Dev	Median	Min	Max	Range	Variance
PBL (tinggi)	13	85.15	5.33	84.00	79.30	95.10	15.80	28.46
Deep Learning (tinggi)	9	85.77	5.56	85.00	78.00	99.00	21.00	30.94
PBL (sedang)	11	81.71	5.51	84.20	72.40	89.20	16.80	30.41
Deep Learning (sedang)	11	86.54	4.45	87.00	80.00	91.00	11.00	19.87
PBL (rendah)	6	73.81	3.28	72.95	70.60	79.20	8.60	10.77
Deep Learning (rendah)	6	79.66	4.67	78.50	73.00	86.00	13.00	21.86

Source: Output SPSS 30 For Windows (2025)

Based on Table 2, the description of the learning outcomes of the Problem-Based Learning group that has high, medium and low initial abilities in the Deep Learning group in students who have high, medium initial abilities, and it is known that there are differences in the mean value, standard deviation, median, minimum value, maximum value, range, and variance tend to be the same. Descriptively, this means that the average learning outcomes of the Problem-Based Learning and Deep Learning groups at high initial abilities have the same results with a comparison of the number of students who are more in Deep Learning, at medium abilities are higher in Deep Learning, while at low abilities are also higher in Deep Learning.

Data normality and homogeneity tests were conducted using the Kolmogorov-Smirnov and Leven's tests, respectively. The results showed that both groups of data were normally and homogeneously distributed, as shown in Tables 3 and 4.

Table 3. Data Normality Test

Tested data	Asymp. Sig. (2-tailed)	Significant level	Information
Prior Knowladge	0.172	0.05	Normally Distributed
Learning Outcomes	0.857	0.05	Normally Distributed

Source: Output SPSS 30 For Windows (2025)

Based on the results of table 1, showing the Asymp. Sig. (2-tailed) value > 0.05, it can be concluded that the initial abilities and learning outcomes of students in the Deep Learning and Problem-Based Learning classes are normally distributed.

Table 4. Results of Homogeneity Test

Tested data	Levene statistics	Sig.	Information
Prior Knowladge	0.195	0.661	Homogen
Learning Outcomes	0.942	0.336	Homogen

Source: Output SPSS 30 For Windows (2025)

Based on the results in Table 4, which shows a Sig. value > 0.05, it can be concluded that the initial abilities and learning outcomes of students in the Deep Learning and Problem-Based Learning classes are homogeneous.

This study was tested simultaneously using a two-way ANOVA analysis. After the prerequisite test results showed that all data were normally distributed and the variance between groups was homogeneous, the hypothesis testing could proceed.

Table 5. Results of Two Ways ANOVA analysis

Tests of Between-Subjects Effects

Dependent Variable: Learning_Outcomes

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	1219.493[a]	5	243.899	15.223	.000
Intercept	350136.628	1	350136.628	21853.775	.000
Deep Learning_Problem-Based Learning	86.180	1	86.180	5.379	.025
Prior Knowladge	970.642	2	485.321	30.291	.000
*Deep Learning_Problem-Based Learning**Prior Knowladge	114.749	2	57.375	3.581	.035
Error	801.090	50	16.022		
Total	383797.840	56			
Corrected Total	2020.582	55			

a. R Squared = .604 (Adjusted R Squared = .564)

Source: Output SPSS 30 For Windows (2025)

It is known that the F-calculated coefficient value is 5.379 with a p-value of 0.25, based on the p-value <0.05 means H0 is rejected and H1 is accepted, so it can be concluded that there is a significant difference in student learning outcomes between the group of students who take part in learning using Problem-Based Learning and the group of students who take part in learning using Deep Learning. It is known that the F-calculated

coefficient value is 30.291 with a p-value of 0.00, based on the p-value <0.05 means H0 is rejected and H1 is accepted, so it can be concluded that there is a significant difference in student learning outcomes between the group of students who have high, medium, and low initial abilities in the group of students who take part in learning using Problem-Based Learning and the group of students who take part in learning using Deep Learning.

DISCUSSION

1. The influence of problem based learning and deep learning models on learning outcomes. Problem-Based Learning also demonstrates a positive impact on student learning outcomes. This model positions students as active learners challenged to solve real-life problems and then collaboratively seek solutions. Rahmayanti & Munawaroh (2024) found that Problem-Based Learning significantly improved the critical thinking skills of social studies students in Islamic Senior High School, with both teachers and students positively perceiving the method. According to Savery (2006), Problem-Based Learning can improve critical thinking, communication, and collaboration skills. In the Madrasah Aliyah context, where education is directed at character and moral development, Problem-Based Learning provides ample opportunity for students to internalize Islamic values through real-life situations, not just theory. However, its effect is slightly lower than that of Deep Learning. This may be due to limited time for in-depth exploration or students' lack of full adaptation to the open-ended problem-solving approach. A meta-analysis by Nurhadi, et al. (2023) showed that Problem-Based Learning effectively improves problem-solving and critical thinking skills compared to conventional learning, although its impact on mastery of theoretical material varies depending on implementation and context.

   The Deep Learning model significantly impacts the learning outcomes of Islamic Senior High School students. Statistical tests showed that the group treated with this model demonstrated a higher average improvement in grades. Deep Learning is not merely "deep" learning in terms of terminology, but conceptually, it is a model that guides students to connect new information with previous experiences, understand meaning conceptually, and reflect on knowledge in real-world contexts (Nurhadi et al., 2023). This approach demands high cognitive engagement, not just memorization, thus impacting long-term retention and application of knowledge in everyday life.

   This study agrees with Zhang et al. (2025), a systematic review of global literature that concluded that deep learning has a positive impact on conceptual understanding, personalized learning, and the effectiveness of real-time feedback. Furthermore, Prihantini et al. (2025) stated that deep learning supports adaptation to student learning styles and increases engagement and motivation to learn through interactive digital environments. This is in line with Andayanie et al. (2025) who stated that the Deep Learning model effectively encourages students to

think critically, reflectively, and analytically. In the context of Islamic Religious Education (PAI) learning, this is highly relevant because PAI not only aims to convey religious knowledge but also shapes students' character and spiritual attitudes.

2. Learning outcomes between high initial ability and low prior knowledge. Increased student learning outcomes at high, medium, and low pripor knowledge between groups of students with Problem Based Learning and groups of students who participated in learning using Deep Learning. In the Problem Based Learning group, students with high pripor knowledge tended to experience improvements in their learning outcomes, and those who participated in learning using Deep Learning tended to improve learning outcomes in groups with medium and low pripor knowledge. Problem Based Learning and Deep Learning provide a more constructivist approach, in accordance with Vygotsky theory (1978) which emphasizes that learning occurs through social interaction and meaningful experiences.

   The Deep Learning model excels in building reflective meaning and personalization, while Problem-Based Learning is highly effective in developing creativity, collaboration, and discussion skills. The combination of the two provides a more optimal contribution to Islamic Religious Education learning: Deep Learning facilitates meaningful reflection, while Problem-Based Learning encourages the application of Islamic values in real-life contexts. This is in line with Chen & Singh (2024) who stated that students who learn with the Deep Learning model show improvements in critical thinking and strong metacognitive abilities, namely awareness of their own learning process, so they are able to regulate and evaluate learning strategies independently. Conventional learning is generally based on lectures and direct instruction from teachers. This model tends to be passive, where students receive information without many opportunities to think critically or interact deeply with the material. As a result, levels of understanding and retention of concepts tend to be low, and the ability to develop higher-order thinking skills is lacking (Mcdougall & Cheryl, 1996). In the context of Madrasah Aliyah, conventional methods are often unable to meet the needs of 21st-century learning that demands analytical, synthetic, and collaborative skills (Andayanie et al., 2025).
3. Interaction between the Use of learning models and students' pripor knowledge on student learning outcomes. There is an interaction between the use of the Problem-based learning model and the group of students who participate in learning using Deep learning and prior knowledge on student learning outcomes. This indicates the presence of a factor in prior knowledge, in which prior knowledge for learning outcomes Problem-based learning is more dominant than Deep learning, while for the medium and low prior knowledge factor on learning outcomes the influence of Deep learning is higher than Problem-based learning. Achieving high learning outcomes is not only with the learning model alone. However, high prior knowledge can

support students in achieving high learning outcomes as well. As stated by Bahri & Nasution (2019), prior knowledge is a factor that influences students' cognitive learning outcomes. This review is supported by the results of Cristache et al. (2025) research which proves that prior knowledge has a mediating role in driving constructive activities. In addition, Zambrano et al. (2019) found a significant difference in scores between groups with prior knowledge and those without prior knowledge. These findings indicate that the learning model has an influence on learning outcomes, while prior ability has little influence on learning outcomes.

CONCLUSION

The problem-based learning and deep learning models have a positive influence on improving the learning outcomes of Islamic Senior High School students, especially in Islamic religious education subjects. The deep learning model has proven to be more effective than problem based learning and conventional learning, because it is able to build deep understanding, encourage critical reflection, and link religious concepts to students' real experiences. Meanwhile, the problem based learning model also makes a significant contribution to improving learning outcomes, especially in developing critical thinking, collaboration, and problem-solving skills through a contextual approach. Both of these models are superior to conventional learning which is passive and teacher-centered. Thus, the application of the deep learning and problem based learning models can be a relevant and effective learning strategy to improve the quality of the process and learning outcomes of Islamic Senior High School students, both from an academic aspect and Islamic character values.

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