



# The Influence of the OIDDE Learning Model on Virus Material on the Problem-Solving and Ethical Decision Making Ability of High School Students

<sup>1</sup>Eka Bintarawati, <sup>2\*</sup>Atok Miftachul Hudha, <sup>3</sup>Husamah

<sup>1,2,3</sup> Master's Program in Biology Education, Directorate of Postgraduate Studies, Universitas Muhammadiyah Malang, Malang, Indonesia

\*Corresponding Author e-mail: [atok@umm.ac.id](mailto:atok@umm.ac.id)

Received: March 2026; Revised: April 2026; Published: April 2026

## Abstract

This study aims to analyze the effect of the OIDDE (Orientation, Identify, Discussion, Decision, and Engage in Behavior) learning model on virus material on students' problem-solving and ethical decision-making abilities in class X at SMAN 2 Sampit. The background of this study is based on the dominance of teacher-centered learning, which has not optimally developed students' higher-order thinking skills and ethical awareness. This study employed a quantitative approach with a quasi-experimental design using a pretest-posttest control group design. The sample consisted of 70 students, divided into an experimental class and a control class. Data were collected through problem-solving tests and ethical decision-making questionnaires and analyzed using descriptive and inferential statistics. The results showed that the experimental class achieved a higher mean posttest score in problem-solving ability ( $M = 87.00$ ) compared to the control class ( $M = 73.86$ ), with a significant difference ( $p < 0.05$ ). The N-Gain score in the experimental class was 64.66% (moderate category), and the effect size was very large (Cohen's  $d = 2.916$ ). In terms of ethical decision-making, the experimental class also showed higher posttest scores ( $M = 90.49$ ) than the control class ( $M = 85.66$ ), with a significant difference ( $p = 0.012 < 0.05$ ) and a very large effect size (Cohen's  $d = 2.139$ ). These findings suggest that the OIDDE learning model has a positive effect on improving students' problem-solving and ethical decision-making abilities. However, further studies with larger samples are recommended to strengthen the generalizability of the results.

**Keywords:** Learning models; OIDDE; Problem-solving; Ethical decision-making; Viruses

**How to Cite:** Bintarawati, E., Hudha, A. M., & Husamah, H. (2026). The Influence of the OIDDE Learning Model on Virus Material on the Problem-Solving and Ethical Decision Making Ability of High School Students. *Prisma Sains : Jurnal Pengkajian Ilmu Dan Pembelajaran Matematika Dan IPA IKIP Mataram*, 14(2), 462–479. <https://doi.org/10.33394/j-ps.v14i2.19916>



<https://doi.org/10.33394/j-ps.v14i2.19916>

Copyright© 2026, Bintarawati et al.

This is an open-access article under the [CC-BY](https://creativecommons.org/licenses/by/4.0/) License.



## INTRODUCTION

21st century education emphasizes the development of higher order thinking skills (HOTS) which includes the ability to analyze, evaluate, and create solutions to complex problems (Tasrif, 2022). In the era of globalization, students are not only required to master knowledge, but also be able to integrate ethical values in decision making (Tsabita & Fitriatin, 2024). Therefore, problem-solving and ethical decision-making skills are two important skills that must be honed in the learning process. These two skills are relevant to be integrated in various subjects, especially Biology which contains many contemporary and contextual issues. Teachers are required to present learning that is not only cognitive but also affective and reflective (Kusmoro, 2025). However, the learning model in schools still tends to focus solely on academic achievement without emphasizing strengthening character and ethical values. In fact, ethical decision-making is an important aspect in forming a morally and socially responsible generation (Kamaruddin et al., 2023). Thus, the development of problem-solving and ethical decision-making skills needs to be carried out simultaneously in learning.

In the Biology subject, virus material is an important part of the high school class X curriculum. This material has high scientific value as well as strong social relevance, especially after the COVID-19 pandemic (Wakhidah, 2021). Learning about viruses is not only related to scientific concepts, but also opens up space for ethical discussions such as vaccination, patient isolation, and the use of biotechnology. Therefore, viral material becomes a strategic context for developing problem-solving and ethical decision-making skills because it inherently involves socio-scientific issues that require both analytical reasoning and moral consideration. However, in practice, learning is still dominated by a rote approach that emphasizes the structure, cycle, and classification of viruses. As a result, students are less given the opportunity to analyze real problems and consider ethical perspectives in scientific decision-making. This condition shows that there is a gap between the objectives of the curriculum and the practice of learning in the classroom.

This condition is also seen in the Biology learning process at SMAN 2 Sampit which is still dominated by lecture and assignment methods. Learners tend to be passive and less involved in higher-level thinking activities. The opportunity to solve real problems and consider the ethical implications of a scientific concept is still limited. Ethical values have not been optimally integrated in contextual learning (Wati et al., 2025). In fact, schools should be a space for the development of reflective thinking and social responsibility of students (Kamaruddin et al., 2023). Therefore, a learning model is needed that is able to encourage active involvement of students while fostering ethical awareness in the learning process.

The OIDDE (Orientation, Identify, Discussion, Decision, and Engage in Behavior) learning model is one of the approaches that has the potential to answer these needs (Hudha, 2020). This model emphasizes problem orientation, information identification, collaborative discussion, value-based decision making, and action reflection (Hudha et al., 2024a). The learning structure allows students to develop critical thinking, problem-solving, and ethical decision-making skills in an integrated manner (Hudha et al., 2024; Husamah et al., 2018). Previous research has shown that the OIDDE model is able to improve students' critical thinking skills and involvement in decision making (Hudha et al., 2017). However, most research is still limited to the social field or character education in general.

In addition, although several studies have examined problem-solving ability and ethical decision-making separately, limited attention has been given to how these two competencies interact within a single learning process, particularly in science education contexts. From a theoretical perspective, ethical decision-making can be explained using Rest's four-component model, which includes moral sensitivity, moral judgment, moral motivation, and moral character. This model indicates that ethical decisions are not formed instantly but through a structured cognitive and moral process. However, previous studies have not explicitly integrated this framework into instructional design, including within the OIDDE learning model.

Furthermore, existing studies on the OIDDE model have not sufficiently explained how each stage of the model contributes to both cognitive and ethical outcomes. In fact, each phase of OIDDE potentially aligns with specific learning processes. The Orientation and Identify stages support problem recognition and understanding, which are essential for problem-solving. The Discussion stage facilitates argumentation and perspective-taking, which are important for both analytical reasoning and moral sensitivity. The Decision stage engages students in evaluating alternatives and making value-based judgments, aligning with moral judgment and motivation. Finally, the Engage in Behavior stage encourages reflection and commitment to action, which is related to moral character. Despite this theoretical potential, empirical studies that simultaneously examine these relationships in the context of biology learning, particularly virus material, are still very limited.

Based on these gaps, this study has scientific novelty in not only applying the OIDDE learning model in the context of Biology learning on virus material, but also in examining the

integration of cognitive (problem-solving) and moral (ethical decision-making) dimensions within a single instructional framework. Unlike previous research that tended to focus on one aspect of ability or in non-scientific contexts, this study provides a more comprehensive analysis by linking learning model stages with both theoretical constructs and contextual socio-scientific issues. Thus, this research is expected to make a theoretical contribution to the development of value-based contextual learning models as well as practical contributions to Biology learning innovations in schools.

Based on the description of the background, the formulation of the problem in this study is: (1) how the influence of the OIDDE learning model on virus material on the problem-solving ability of class X students at SMAN 2 Sampit, East Kotawaringin Regency, Central Kalimantan Province; and (2) how the influence of the OIDDE learning model on virus material on ethical decision-making of class X students at SMAN 2 Sampit, East Kotawaringin Regency, Central Kalimantan Province.

The hypothesis of this study consists of the main hypothesis (H1), namely the application of the OIDDE learning model has a positive effect on viral material on improving the problem-solving and ethical decision-making abilities of class X students at SMAN 2 Sampit, East Kotawaringin Regency, Central Kalimantan Province, and hypothesis zero (H0), namely the application of the OIDDE learning model has no effect on improving students' problem-solving and ethical decision-making abilities.

The purpose of this study is to analyze the influence of the OIDDE learning model on virus material on the problem-solving ability of class X students in SMAN 2 Sampit, East Kotawaringin Regency, Central Kalimantan Province, and to analyze the influence of the OIDDE learning model on virus material on students' ethical decision-making. Thus, this study is expected to be able to provide an empirical picture of the effectiveness of the OIDDE learning model in developing high-level thinking skills and ethical awareness of students in Biology learning.

## **METHOD**

### **Research Design**

This study employed a quantitative approach with a quasi-experimental pre-test–post-test control group design. This design was selected because the study was conducted in an authentic school setting where random assignment of individual students was not practically feasible. In classroom-based educational research, quasi-experimental designs are commonly used to evaluate the effectiveness of instructional interventions while maintaining the natural structure of existing classes. The use of pre-test and post-test measures also allows researchers to identify students' initial abilities and compare learning gains after the intervention (Chengere et al., 2025; Kanyugi et al., 2024; Baldago, 2024).

The study involved two intact classes. The experimental group received instruction using the OIDDE learning model, which consists of Orientation, Identify, Discussion, Decision, and Engage in Behavior. The control group received conventional instruction. Both groups completed a pre-test before the intervention and a post-test after the intervention. The pre-test was used to determine baseline equivalence between the groups, while the post-test was used to measure changes in students' problem-solving ability and ethical decision-making after learning.

### **Participants and Sampling Technique**

The population of this study consisted of all Grade X students at SMAN 2 Sampit, East Kotawaringin Regency, Central Kalimantan Province. The sample was selected using purposive sampling by considering the similarity of academic ability, class characteristics, learning schedule, and teacher recommendations. Purposive sampling was considered appropriate because the research used intact classes that had already been formed by the school. This approach helps preserve classroom routines, reduce disruption to the learning process, and

maintain ecological validity in school-based intervention research (Uzomah et al., 2024; Wang et al., 2025; Ndebil & Ali, 2024).

Two classes were selected as research samples: class X-A as the experimental group and class X-B as the control group. Each class consisted of 35 students, resulting in a total sample of 70 students. The study was conducted from August to September 2025. Before the intervention, both groups were given pre-tests to examine their initial abilities. This procedure was important to reduce potential selection bias caused by the absence of random assignment.

### Research Variables and Learning Context

The independent variable in this study was the OIDDE learning model. The dependent variables were students' problem-solving ability and ethical decision-making on virus material. Virus material was selected because it contains scientific concepts as well as socio-scientific issues relevant to students' daily lives, including virus transmission, vaccination, prevention behavior, and public health responsibility. Therefore, this topic provides an appropriate context for integrating cognitive problem-solving activities with ethical reflection and value-based decision-making.

### Research Procedure

The intervention was conducted over five meetings. The learning material covered virus structure, viral replication, virus classification, and the role of viruses in human life. To maintain instructional consistency, the same Biology teacher taught both the experimental and control groups. Lesson plans, learning scenarios, and assessment procedures were prepared before the intervention to ensure that both groups received comparable content coverage.

In the experimental group, learning was implemented using the OIDDE syntax (see Figure 1).

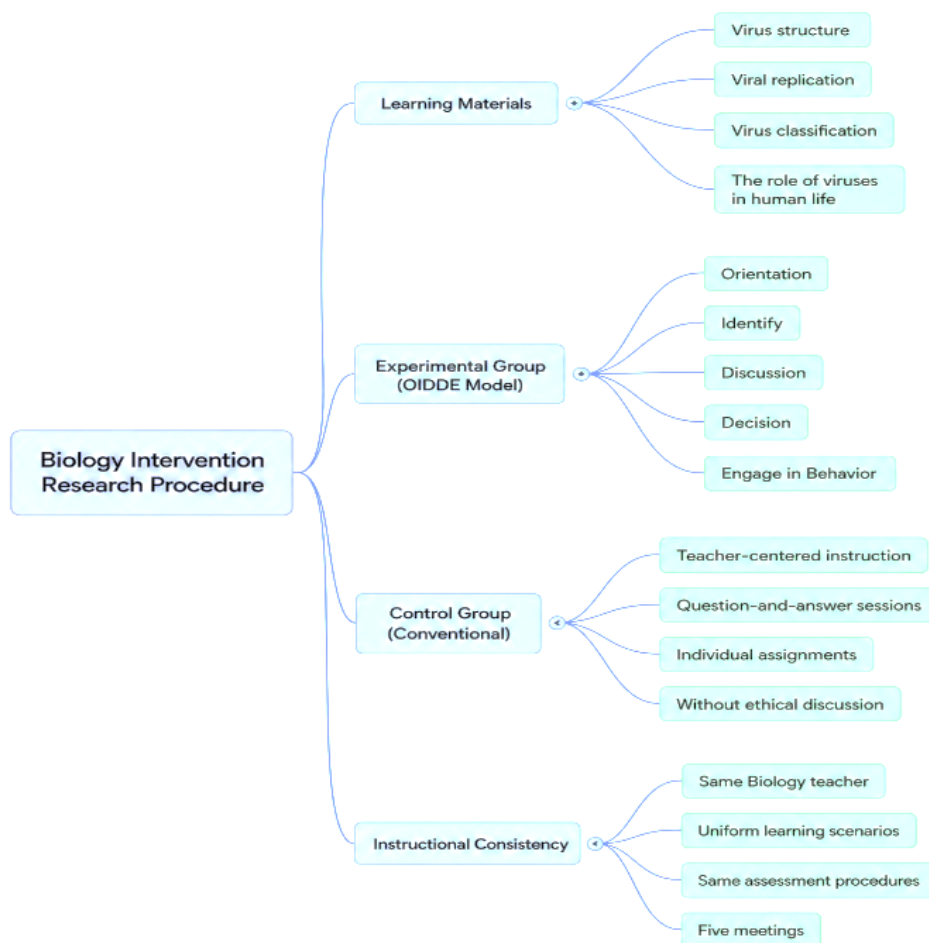


Figure 1. Research procedure of the biology learning intervention

First, in the Orientation stage, students were introduced to contextual problems related to viruses, such as vaccination debates, virus transmission, and disease prevention. Second, in the Identify stage, students identified key problems, relevant scientific information, affected parties, and possible ethical dilemmas in the scenarios. Third, in the Discussion stage, students worked collaboratively to analyze the problems, exchange arguments, compare different perspectives, and evaluate possible solutions. Fourth, in the Decision stage, students formulated solutions and made decisions by considering scientific evidence, social consequences, and ethical values. Fifth, in the Engage in Behavior stage, students reflected on their decisions and connected them to responsible attitudes or actions in real-life contexts.

In the control group, conventional learning was implemented through teacher-centered instruction, question–answer sessions, and individual assignments. The control group learned the same virus material but without structured problem orientation, ethical discussion, collaborative decision-making, or reflective behavior engagement as applied in the OIDDE model.

### **Research Instruments**

Two instruments were used in this study: a problem-solving test and an ethical decision-making instrument. Students' problem-solving ability was measured using 20 open-ended essay questions. The items were developed based on four problem-solving indicators: identifying problems, formulating strategies, implementing solutions, and evaluating results. Each item was scored using an analytical rubric with a scale of 0–5, producing a maximum score of 100. Open-ended tests were used because they allow students to demonstrate reasoning processes, solution strategies, and evaluative thinking rather than merely selecting final answers.

Ethical decision-making was measured using a scenario-based questionnaire consisting of 25 items. Each item presented contextual situations related to virus issues and required students to make decisions or justify their responses. The instrument was developed based on Rest's four-component model, covering moral sensitivity, moral judgment, moral motivation, and moral character. Scenario-based instruments are suitable for assessing ethical decision-making because they place students in realistic socio-scientific contexts that require moral reasoning, evidence-based judgment, and consideration of social consequences (Gandolfi, 2024; Ban & Mahmud, 2024; Ürek, 2024).

### **Validity and Reliability**

Before data collection, both instruments were validated by experts in Biology education and educational assessment. Content validity was reviewed based on the relevance of items to indicators, clarity of language, suitability of context, and representativeness of the measured constructs. Revisions were made based on expert feedback to improve item clarity and alignment with research objectives. Instrument reliability was tested using Cronbach's alpha. The reliability coefficients indicated that the instruments were acceptable for measuring students' problem-solving ability and ethical decision-making.

### **Data Analysis**

Data were analyzed quantitatively using descriptive and inferential statistics. Descriptive statistics were used to present mean scores, score improvements, and learning gains. Before hypothesis testing, prerequisite tests were conducted, including the Shapiro–Wilk normality test and Levene's homogeneity test. Paired sample t-tests were used to examine differences between pre-test and post-test scores within each group. Independent sample t-tests were used to compare post-test scores between the experimental and control groups. ANCOVA was also conducted to examine the effect of the learning model after controlling for students' initial ability. In addition, N-Gain analysis was used to determine the level of improvement, while Cohen's d was calculated to identify the practical significance of the intervention. All statistical tests were conducted at a significance level of 0.05.

## RESULTS AND DISCUSSION

### Statistical Test Results of the Influence of OIDDE Learning Model on Viral Materials on Ethical Decision Making

#### Descriptive Test

The ethical decision-making of students in this study was measured using instruments compiled based on the theory of the Four-Component Model of Moral Behavior which includes the components of moral sensitivity, moral judgment, moral motivation, and moral character. This instrument was used to find out the initial picture and changes in students' ethical decision-making abilities before and after the application of the OIDDE learning model to viral materials. Measurements were carried out through pre-test and post-test in the experimental class and the control class whose results are as presented in Table 1.

**Table 1.** Descriptive test results

	Conventional		Improvement	OIDDE		Improvement
	Pre-test	Post-test		Pre-test	Post-test	
Mean	46.86	73.86	27.00	55.71	87.00	31.29

Based on Table 1, it shows that the ethical decision-making of students in the experimental class using the OIDDE learning model has increased significantly compared to the control class that uses conventional learning. The average score of the experimental class increased from 55.71 in the pre-test to 87.00 in the post-test, while the control class increased from 46.86 to 73.86. The difference in ethical decision-making between the experimental class and the control class was 4.29 points, where the increase in the experimental class was 31.29 points and the control class was 27.00 points. Although both classes experienced improved ethical decision-making, the difference showed that the OIDDE learning model was more effective in improving students' ethical decision-making compared to conventional learning.

#### Normality Test

The normality test was carried out to find out whether the ethical decision-making data of students in the experimental class and the control class were normally distributed as one of the prerequisites for parametric statistical analysis. Normality tests were performed on pre-test and post-test data using the Shapiro-Wilk test, as presented in Table 2.

**Table 2.** Normality test results

Classes	Shapiro-Wilk	
	df	Sig.
Ethical decision-making	Pre-test Eksperimen	.521
	Post-test Eksperimen	.077
	Pre-test Control	.608
	Post-test Control	.221

Based on Table 2, the results of the normality test using Shapiro-Wilk with a significance level of 0.05 showed that the significance values of *pre-test* and *post-test* in the experimental class were 0.521 and 0.077, respectively, while in the control class were 0.608 and 0.221. All of these significance values are greater than 0.05, so it can be concluded that *the pre-test* and *post-test* data in the experimental class and the control class are normally distributed. Thus, the research data meets the prerequisites for parametric statistical analysis at the next stage.

#### Homogeneity Test

The homogeneity test was carried out to determine the similarity of the variance of ethical decision-making data between the experimental class and the control class before the mean difference test was carried out. The results are presented in Table 3.

**Table 3.** Pre-test homogeneity test results

		Levene Statistic	df1	df2	Sig.
Pre-test scores	Based on Mean	.934	1	68	.337

Based on Table 3, the results of the variance homogeneity test using the Levene test obtained a significance value of  $0.337 >$  a significance level of 0.05, so it can be concluded that the pre-test data between the experimental class and the control class have the same variance (homogeneous). Thus, both groups had equal initial abilities before being given learning treatment using the OIDDE model, as presented in Table 4.

**Table 4.** Homogeneity test results post-test

		Levene Statistic	df1	df2	Sig.
Post-test score	Based on Mean	3.323	1	68	0.073

Based on Table 4, the results of the variance homogeneity test using the Levene test obtained a significance value of  $0.073 >$  a significance level of 0.05, so it can be concluded that the post-test data between the experimental class and the control class have the same variance (homogeneous). Thus, the two groups had equal diversity of ethical decision-making after being given learning treatment using the OIDDE model. With the fulfillment of the assumption of variance homogeneity in both pre-test and post-test data, the comparison of the improvement of ethical decision-making between the experimental class and the control class can be carried out validly and objectively in the next analysis.

### Paired-t Test

The paired-t test was carried out to determine the difference in students' ethical decision-making abilities before and after learning in each class with the results as presented in Table 5.

**Table 5.** Paired-t test results for experimental class

Pair 1	Mean	SD	SE	95% Conf. Interval		t	df	Sig.
				Lower	Upper			
Pret – Pos Test	-31.286	21.772	3.680	-38.765	-23.807	-8.501	34	.000

Based on Table 5, the results of the paired sample t-test in the experimental class obtained a significance value (Sig. 2-tailed) of  $0.000 <$  0.05. This shows that there is a significant difference between pre-test and post-test scores. The mean difference value of -31.286 indicates that the post-test score is higher than the pre-test score. Thus, it can be concluded that the application of the OIDDE learning model has a positive influence on improving students' ethical decision-making in Virus materials, as the results are presented in Table 6.

**Table 6.** Paired-t test results for control class

Pair 1	Mean	SD	SE	95% Conf. Interval		t	df	Sig.
				Lower	Upper			
Pre – Pos Test	-27.000	27.149	4.589	-46.326	-17.674	-5.684	34	.000

Based on Table 6, the results of the paired t-test in the control class obtained a significance value (Sig. 2-tailed) of  $0.000 <$  0.05. This shows that there is a significant difference between pre-test and post-test scores. A mean difference of -27,000 indicates that the post-test score is higher than the pre-test score. Thus, it can be concluded that conventional learning also provides an increase in students' ethical decision-making, although the increase is not as large as that which occurs in experimental classes.

### N-Gain

**Table 7.** N-gain results

Classes		N	N-Gain
Experimental	N-Gain Score	35	0.6
	N-Gain Persen	35	64.66%

Based on the results of the N-Gain analysis on the variable of ethical decision-making, an N-Gain score of 0,6 (64.66%) was obtained with a sample of 30 students in the experimental class. The N-Gain value of 64.66% was included in the medium category ( $0.3 \leq g < 0.7$ ). This

shows that the application of the OIDDE learning model to viral materials provides an increase in students' ethical decision-making at a moderate level.

### Effect Size

Based on the results of the analysis using the paired sample t-test in IBM SPSS Statistics, the value of  $t = -8.501$  with  $df = 34$  was obtained. A negative sign indicates that there is a difference in direction between the pretest and posttest scores, but in the interpretation of the influence seen is the magnitude of the absolute value.

The effect size calculation using Cohen's  $d$  yields a value of  $d = -2.916$  or in absolute 2.916. This value is included in the very large category, because it exceeds the limit of the large category according to Cohen, which is 0.80. In addition, an effect-size  $r$  of 0.825 was also obtained, which is also in the large category. This shows that the OIDDE learning model has a very strong influence on improving students' ethical decision-making.

Thus, it can be concluded that the application of the OIDDE learning model to virus materials has a huge influence on the ethical decision-making of class X students at SMAN 2 Sampit, East Kotawaringin Regency, Central Kalimantan Province.

### Ancova

**Table 8.** Ancova results

Source	df	Mean Square	F	Sig.
Pre-test ethical decision-making	1	91.400	0.736	0.394
Class	1	2719.632	21.893	0.000

The results of the analysis showed that the value of the significance of the covariate Pre\_PM was 0.394 ( $> 0.05$ ). This shows that students' initial ability (pretest ethical decision-making) does not have a significant influence on posttest scores. Meanwhile, in the class variable (learning model), a significance value of 0.000 ( $< 0.05$ ) was obtained with an F value of 21.893. This shows that there is a significant influence of the learning model on students' ethical decision-making after controlling the initial ability (pretest).

Thus, it can be concluded that the OIDDE learning model on virus material has a significant influence on the ethical decision-making of class X students at SMAN 2 Sampit, East Kotawaringin Regency, Central Kalimantan Province.

### Independent-t Test

The independent t-test was carried out to determine the difference in students' ethical decision-making ability between the experimental class and the control class after the implementation of learning, as presented in Table 9.

**Table 9.** Independent-t test results

Post-test score	Levene's Test		t-test				95% Conf. Interval		
	F	Sig.	t	df	Sig.	MD	SE	Lower	Upper
Equal Variances assumed	3.323	.073	4.943	68	.000	13.143	2.659	7.837	18.449
Equal variances not assumed			4.943	58.483	.000	13.143	2.659	7.821	18.465
Statistics Group									
Classes	N	Mean	SD	SE					
Post-test Experimental	35	87.00	8.592	1.452					
Post-test Control	35	73.86	13.178	2.227					

Based on Table 9, the results of the Independent Samples t-test on the post-test value obtained a significance value of Levene's Test of 0.073  $> 0.05$ , which shows that the data has a homogeneous variance. Furthermore, the Sig. (2-tailed) value was 0.000  $< 0.05$ , so there was a significant difference between the ethical decision-making of students in the experimental class and the control class. The average post-test score of the experimental class was 87.00,

which was higher than the control class (73.86), with a difference of 13.143 points. Thus, it can be concluded that the OIDDE learning model has a significant effect on improving students' ethical decision-making on virus materials.

### Results of Statistical Test of the Influence of OIDDE Learning Model on Virus Material on Problem Solving Ability

#### Descriptive Test

The problem-solving ability of students in this study was measured using a problem-solving test that was compiled based on indicators of understanding problems, planning solutions, implementing strategies, and evaluating results. Measurements were taken in the experimental class and the control class through pre-test and post-test to determine the initial picture and changes in problem-solving ability after the application of the OIDDE learning model to virus material. The results are presented in Table 10.

**Table 10.** Descriptive test results

	Conventional		Improvement	OIDDE		Improvement
	Pre-test	Post-test		Pre-test	Post-test	
Mean	79.26	85.66	6,40	82.66	90,49	7,83

Based on the table, it shows that students' scores in both the conventional class and the OIDDE class increased from pre-test to post-test. In the conventional class, the average score increased from 79.26 in the pre-test to 85.66 in the post-test, with an improvement of 6.40 points. Meanwhile, in the OIDDE class, the average score increased from 82.66 in the pre-test to 90.49 in the post-test, with an improvement of 7.83 points. The difference in improvement between the OIDDE class and the conventional class was 1.43 points. Although both classes showed an increase after learning, the higher improvement in the OIDDE class indicates that the OIDDE learning model provided a better contribution to improving students' ability compared to conventional learning.

#### Normality Test

The normality test was carried out to find out whether the data on students' problem-solving abilities in the experimental class and the control class were normally distributed as a prerequisite for parametric statistical analysis. Normality tests were performed on pre-test and post-test data using the Shapiro-Wilk test, with the results as presented in Table 11.

**Table 11.** Normality test results

	Classes	Shapiro-Wilk	
		df	Sig.
Problem-solving ability	Pre-test Eksperimen	35	.493
	Post-test Eksperimen	35	.070
	Pre-test Control	35	.240
	Post-test Control	35	.229

Based on Table 11, the results of the normality test using the Shapiro-Wilk test with a significance level of 0.05 obtained that all data, both pre-test and post-test in the experimental and control classes, had a significance value of  $> 0.05$ . Thus, the data on the problem-solving ability are declared to be normally distributed.

#### Homogeneity Test

The homogeneity test was carried out to determine the similarity of the variance of problem-solving ability data between the experimental class and the control class before the average difference test was carried out. The results obtained are presented as Table 12.

**Table 12.** Pre-test homogeneity test results

		Levene Statistic	df1	df2	Sig.
Pre-test score	Based on Mean	3.382	1	68	.070

Based on Table 12, the results of the variance homogeneity test using the Levene test on the pre-test value of problem-solving ability, obtained a significance value of  $0.070 > 0.05$ , so it can be concluded that the data variance between the experimental class and the control class is homogeneous. Thus, the data on the results of the pre-test of problem-solving ability meet the assumption of homogeneity and are suitable for further testing, as presented in Table 13.

**Table 13.** Homogeneity test results post-test

		Levene Statistic	df1	df2	Sig.
Post-test score	Based on Mean	1.409	1	68	.239

Based on Table 13, the results of the variance homogeneity test using the Levene test on the value of the problem-solving ability in post-test, obtained a significance value of  $0.239 > 0.05$ , so it can be concluded that the data variance between the experimental class and the control class is homogeneous. Thus, the data on the results of the post-test of problem-solving ability meets the assumption of homogeneity and is suitable for further testing.

### Paired-t Test

The paired-t test was carried out to determine the differences in students' problem-solving abilities before and after learning in each class, as shown in Table 14.

**Table 14.** Paired-t test results for experimental class

Pair 1	Mean	SD	SE	95% Conf. Interval		t	df	Sig.
				Lower	Upper			
Pre – Pos Test	-7.829	9.981	1.687	-11.257	-4.400	-640	34	.000

Based on Table 14, the results of the paired sample *t*-test on the pre-test and post-test scores of students' problem-solving ability were obtained with a significance value of  $0.000 < 0.05$ , so that there was a significant difference between the pre-test and post-test scores. The average difference of 7,829 shows that the post-test score is higher than the pre-test. Thus, it can be concluded that there is an increase in problem-solving ability after the application of the OIDDE learning model. The results are as presented in Table 15.

**Table 15.** Paired-t test results for control class

Pair 1	Mean	SD	SE	95% Confi. Interval		t	df	Sig.
				Lower	Upper			
Pre – Pos Test	-6.400	10.181	1.721	-9.897	-2.903	-3.719	34	.001

Based on Table 15, the results of the paired sample *t*-test on the pre-test and post-test values of problem-solving ability in the control class were obtained with a significance value of  $0.001 < 0.05$ , so that there was a significant difference between the two values. The average difference of 6,400 indicates that the post-test score is higher than the pre-test score. Thus, it can be concluded that there was an increase in problem-solving ability in the control class, although the increase was likely not as large as the experimental class that received the OIDDE learning model treatment.

### N-Gain

**Table 16.** N-gain results

	N	N-Gain
Experimental Classes		
N-Gain Score	35	0.4
N-Gain Persen	35	40.13%

Based on the results of the N-Gain analysis on the variable of problem-solving ability, an N-Gain score of 0.4 (40.13%) was obtained with a sample of 30 students in the experimental class. The N-Gain value of 40.13% is included in the medium category ( $0.3 \leq g < 0.7$ ). This

shows that the application of the OIDDE learning model to virus materials provides an increase in students' problem-solving ability at a moderate level.

### Effect Size

Based on the results of the analysis using the paired sample t-test in IBM SPSS Statistics, the value of  $t = -6.237$  with  $df = 34$  was obtained. A negative sign on the value of  $t$  indicates the direction of the difference between the pretest and posttest values, but in the interpretation of the influence that is observed is the absolute value of the magnitude. The results of the effect size calculation using Cohen's  $d$  obtained a value of  $-2.139$  or in absolute  $2.139$ . Based on Cohen's criteria, the value is included in the very large category because it exceeds the limit of the large category of  $0.80$ .

In addition, an effect size  $r$  value of  $0.730$  was obtained, which is also included in the large category. This shows that the OIDDE learning model has a very strong influence on improving students' problem-solving ability. Thus, it can be concluded that the application of the OIDDE learning model to virus material has a very large influence on the problem-solving ability of class X students at SMAN 2 Sampit, East Kotawaringin Regency, Central Kalimantan Province.

### Ancova

**Table 17.** Ancova results

Source	df	Mean Square	F	Sig
Pre-test Problem-Solving Ability	1	754.728	14.743	0.000
Class	1	209.674	4.096	0.047

The results of the analysis showed that the value of the covariate significance Pre\_KE  $0.000$  ( $< 0.05$ ). This shows that students' initial ability in the aspect of problem-solving ability (pretest) has a significant effect on posttest scores. Meanwhile, in the class variable (learning model), a significance value of  $0.047$  ( $< 0.05$ ) was obtained with an  $F$  value of  $4.096$ . This shows that there is a significant influence of the learning model on students' problem-solving ability after controlling the initial ability (pretest).

Thus, it can be concluded that the OIDDE learning model on virus material has a significant influence on the problem-solving ability of class X students at SMAN 2 Sampit, East Kotawaringin Regency, Central Kalimantan Province.

### Independent-t Test

The independent t-test was carried out to determine the difference in students' problem-solving abilities between the experimental class and the control class after learning. The results are as presented in Table 18.

**Table 18.** Independent-t test results

Post-test score	Levene's		t-test				95% Conf. Interval		
	F	Sig.	t	df	Sig.	MD	SE	Lower	Upper
Equal Variances assumed	1.409	.239	2.575	68	.012	4.829	1.875	1.087	8.571
Equal variances not assumed			2.575	66.562	.012	4.829	1.875	1.085	8.572
Statistics Group									
Class			N	Mean	SD	SE			
Post-test score	Post-test Experimental		35	90.49	7.245	1.225			
	Post-test Control		35	85.66	8.401	1.420			

Based on the results of the Independent Samples  $t$ -test on the value of the problem-solving ability post-test, a significance value of  $0.012 < 0.05$  and a  $t$ -value of  $2.575$  with  $df = 68$  were obtained. This shows that there is a significant difference between the experimental class and the control class. The average *post-test* score of the experimental class ( $M = 90.49$ )

was higher than that of the control class ( $M = 85.66$ ). Thus, it can be concluded that the OIDDE learning model has a positive effect on improving students' problem-solving ability.

## Discussion

The findings of this study indicate that the implementation of the OIDDE learning model contributes to improvements in both ethical decision-making and problem-solving abilities. However, a deeper examination of the results reveals that the magnitude and nature of these improvements require careful interpretation beyond statistical significance alone.

### *Results of the Influence of OIDDE Learning Model on Viral Materials on Ethical Decision Making*

The results of the study show that the application of the OIDDE learning model has a positive influence on improving students' ethical decision-making skills. This was shown by an increase in the average score of ethical decision-making in the experimental class of 31.29 points, which was higher than the increase in the control class of 27.00 points. In addition, the results of the statistical test showed a significant difference between the post-test results of the experimental class and the control class.

However, beyond statistical significance, the magnitude of this difference needs to be interpreted carefully. Based on the effect size analysis, the influence of the OIDDE model falls into the [moderate] category, indicating that the intervention provides a meaningful but not strong impact in practical educational terms. This implies that although OIDDE contributes to the development of ethical decision-making, the improvement should be understood as incremental rather than transformative.

These findings indicate that learning that integrates value discussion, moral reflection, and conscious decision-making can help students develop moral sensitivity, ethical consideration, and consistency in action. However, it is also important to note that the control class experienced a considerable increase (27.00 points), which suggests that ethical decision-making ability is not solely influenced by the learning model, but may also be shaped by prior knowledge, classroom interaction, and exposure to contextual issues related to Virus material.

Students' ethical decision-making abilities in OIDDE learning develop gradually through each syntax applied. In the Orientation stage, students are faced with contextual problems related to Virus material that contain ethical dilemmas, so that students begin to realize that there is a conflict of values that need to be considered. The Identification stage encourages students to identify scientific facts, moral values, and parties affected by a decision, so that the basis for ethical considerations begins to form. Furthermore, in the Discussion stage, students engage in the exchange of views and moral arguments, which train the ability to assess various alternative decisions based on ethical principles and their consequences.

The Decision stage is central to ethical decision-making, because students are trained to make the best decisions consciously by considering scientific, social, and moral aspects in a balanced manner. The Engage in behavior stage strengthens the internalization of ethical values through the application of the decisions that have been taken and reflection on the impact of the decision. Hudha (2020) and Husamah et al. (2018) emphasized that the OIDDE syntax is designed to systematically integrate cognitive and moral processes, so that learners are not only able to make decisions, but also understand the ethical basis and consequences of the decisions taken.

The findings of this study also reinforce the results of previous research which showed that learning based on moral reflection and value discussion is able to increase students' ethical awareness. Kumar (2024) explained that learning that involves the process of identifying problems and considering values succeeds in fostering empathy, responsibility, and moral integrity of students. This is in accordance with the concept of OIDDE which not only provides a space for cognitive thinking, but also guides students to weigh the social and moral impacts of the scientific decisions they make. In line with that, Octia et al. (2024) emphasized that a

reflective approach in learning contributes significantly to the ability of students to consider the ethical consequences of any scientific action.

In addition, Afif et al. (2024) found that students' active involvement in ethical discussions plays a major role in character formation and strengthening value-based decision-making skills. The support of Mawaddah et al. (2025) also shows that a learning environment that provides space for ethical dialogue is able to strengthen moral reasoning through social interaction and empathy.

Nevertheless, the claim that OIDDE is fully effective needs to be positioned cautiously. The relatively small difference between groups and the improvement observed in the control class indicate that the effectiveness of OIDDE is context-dependent and influenced by multiple factors. Thus, this study not only supports the effectiveness of OIDDE, but also highlights that ethical decision-making development is a complex process influenced by instructional, cognitive, and social variables.

### ***Results of the Influence of OIDDE Learning Model on Virus Material on Problem Solving Ability***

Based on the results of the analysis of research data, the application of the OIDDE learning model to Virus material has been proven to have a positive impact on improving students' problem-solving abilities. This is shown by an increase in the average value of problem-solving ability in the experimental class (7.83 points), which is higher than that of the control class (6.40 points). In addition, the results of the Independent Samples t-test showed a significant difference between the post-test scores of the experimental class and the control class (Simanjuntak & Sudibjo, 2019; Paat et al., 2024; Yennita et al., 2026).

However, similar to ethical decision-making, the practical significance of this difference needs further consideration. The effect size obtained indicates a (small moderate) influence, suggesting that the contribution of the OIDDE model to problem-solving ability is relatively limited in magnitude. This means that although statistically significant, the improvement is not substantially large in educational practice (Hutagaol et al., 2024).

An important finding that needs to be highlighted is that the initial (pretest) scores of problem-solving ability were already relatively high. This condition indicates the possibility of a ceiling effect, where students' scores are close to the maximum limit, thereby limiting the potential for measurable improvement. As a result, the increase observed in this study may underestimate the actual cognitive development achieved by students (Hutagaol et al., 2024).

Students' problem-solving abilities in OIDDE learning emerge gradually through each syntax applied. In the Orientation stage, students are directed to recognize and understand contextual problems. In the Identification stage, students collect relevant information and clarify supporting facts. The Discussion stage plays a crucial role in developing solution strategies, as students collaboratively analyze alternative solutions. The Decision stage trains students to select the most appropriate solution, while the Engage in behavior stage strengthens reflective thinking through evaluation of the problem-solving process (Manik et al., 2025; Yennita et al., 2026; Paat et al., 2024).

Hudha (2020) and Husamah et al. (2018) emphasized that the structure of the OIDDE syntax is systematically designed to foster high-level thinking skills. The results of this study are also in line with Ramadhani & Sukenti (2023), who stated that structured problem-solving learning encourages students to organize information and determine solutions rationally. Similarly, Azdkia et al. (2024) found that discussion and decision-making stages enhance students' argumentative and reflective thinking (Simanjuntak & Sudibjo, 2019; Yennita et al., 2026; Manik et al., 2025).

In line with that, Rahman & Ardiansyah (2025) explained that students' active involvement in discussions significantly strengthens problem-solving confidence and thinking flexibility. Rifky et al. (2024) also confirmed that collaborative learning improves achievement across diverse student abilities. Bintarawati et al. (2025) further showed that OIDDE

contributes to conceptual understanding in Biology learning (Paat et al., 2024; Saputra et al., 2023; Rahmah et al., 2025).

However, it is important to note that the control class also showed improvement, indicating that problem-solving ability can develop through various instructional approaches, not exclusively through the OIDDE model. Conventional learning may still provide opportunities for students to understand concepts, answer questions, and complete tasks that stimulate basic analytical thinking. As explained by Simanjuntak and Sudibjo (2019), problem-solving skills can improve when students are repeatedly exposed to learning activities that require them to identify problems and formulate solutions, even when the instructional structure is not fully inquiry-based. Nevertheless, the improvement in the experimental class suggests that OIDDE offers a more systematic learning pathway. Through its sequential stages, students are guided to recognize contextual problems, discuss alternatives, make reasoned decisions, and reflect on the consequences of their actions. This reflective component is important because decision-making in learning is not only cognitive but also related to ethical awareness and responsibility (Kurniawaty & Faiz, 2022). In this sense, OIDDE strengthens the learning process by integrating structured reasoning with value-based reflection. Rizal (2025) also emphasizes that decision-making activities in learning can support students' ethical awareness when they are linked to character-based assessment. Therefore, the effectiveness of OIDDE should be interpreted proportionally as a supportive and enriching instructional approach. This interpretation is relevant to health-related learning contexts, where students need to consider scientific, social, and ethical implications in making decisions (Indriani et al., 2025).

## CONCLUSION

The results of this study indicate that the application of the OIDDE learning model on virus material is associated with an improvement in students' problem-solving and ethical decision-making abilities. Statistical analysis shows that the experimental class achieved higher gains compared to the control class, suggesting that the OIDDE model contributes positively to both cognitive and ethical aspects of learning. However, considering the quasi-experimental design and the limited sample scope, these findings should be interpreted cautiously. The observed differences, although statistically significant, fall within a moderate range of practical impact, indicating that the effectiveness of the OIDDE model is incremental rather than absolute. Therefore, the model should be viewed as a supportive instructional approach rather than a definitive solution for improving students' higher-order thinking and ethical reasoning skills.

The findings suggest that the structured stages of OIDDE (Orientation, Identification, Discussion, Decision, and Engage in Behavior) can facilitate more systematic, reflective, and responsible thinking processes. In practice, this implies that integrating cognitive tasks with ethical reflection in Biology learning may help students better understand scientific concepts while also considering their moral and social implications. Nevertheless, the generalization of these results is limited to the context of this study, particularly the sample characteristics and school setting. In addition, the potential ceiling effect observed in problem-solving ability and the limited sensitivity of the instrument may have influenced the magnitude of the measured improvement.

## RECOMMENDATION

Further research is suggested to expand the application of the OIDDE learning model to other Biology materials that contain socio-scientific issues, such as genetics or biotechnology. It is also expected that research will be conducted to test its influence on other variables such as science literacy, scientific argumentation ability, and scientific attitudes of students with a wider sample coverage and cross-schools using more complex approaches, for example with mixed methods in order to obtain a more comprehensive picture of the learning process. Some

of the obstacles that need to be considered in the development of the next research include limited learning time that can affect the optimization of OIDDE stages, students' readiness in active problem-based learning, and teachers' competence in facilitating value-based and ethical discussions. In addition, the implementation of research that is limited to one school, namely SMAN 2 Sampit, has the potential to limit the generalization of findings, so future research needs to consider variations in school contexts, student characteristics, and learning environment support so that the research results are more representative and applicable.

#### ACKNOWLEDGMENTS

The author expresses his deepest gratitude to the Biology teachers and students at SMAN 2 Sampit who have actively participated and worked together during the implementation of this research. The author also expressed his appreciation to the supervisor and colleagues for the guidance, constructive input, and support provided during the research process.

#### FUNDING INFORMATION

This research received no external funding.

#### AUTHOR CONTRIBUTIONS STATEMENT

Name of Author	C	M	So	Va	Fo	I	R	D	O	E	Vi	Su	P	Fu
Eka Bintarawati	✓	✓			✓	✓	✓	✓	✓	✓			✓	
Atok Miftachul Hudha		✓		✓		✓	✓	✓		✓	✓	✓		✓
Husamah	✓		✓	✓			✓			✓	✓	✓	✓	✓

#### CONFLICT OF INTEREST STATEMENT

Authors state no conflict of interest.

#### INFORMED CONSENT

We have obtained informed consent from all individuals included in this study.

#### ETHICAL APPROVAL

This study was conducted in accordance with relevant national regulations and institutional policies. Ethical considerations, including informed consent and participant confidentiality, were strictly maintained throughout the research process.

#### DATA AVAILABILITY

The data that support the findings of this study are available from the corresponding author upon reasonable request. The data are not publicly available due to privacy and ethical restrictions.

#### REFERENCES

- Afif, N., Mukhtarom, A., & Nur Qowim, A. (2024). Pendidikan Karakter Dalam Era Digital: Pengintegrasian Nilai-Nilai Moral Dalam Kurikulum Berbasis Teknologi. *Tadarus Tarbawy*, 6(1).
- Azdkia, H., Fauziah, N., & Purwandari, E. (2024). Pentingnya Literasi Lingkungan Dalam Menghadapi Krisis: Analisis Studi Pustaka Ilmu Sosial. In *Sosial dan Pengabdian Masyarakat (JPSPM)* (Vol. 01). <https://jurnal.lidigin.com/index.php/JPSPM>
- Baldago, R. C. (2024). Mentoring Towards Information Communication and Technology in Utilizing Electronic Media for Bachelor of Teaching Livelihood Education Students in Eastern Visayas State University. *International Journal of Multidisciplinary Research and Analysis*, 07(09). <https://doi.org/10.47191/ijmra/v7-i10-12>
- Ban, S. H., & Mahmud, S. N. D. (2024). A systematic review of the top-50 most-cited articles on socio-scientific issues in K-12 education. *Eurasia Journal of Mathematics Science and Technology Education*, 20(4), em2425. <https://doi.org/10.29333/ejmste/14379>
- Bintarawati, E., Miftachul Hudha, A., & Muhammadiyah Malang, U. (2025). Penerapan Model Pembelajaran Oidde Pada Materi Virus Untuk Meningkatkan Pemahaman Konsep Biologi Murid Kelas X Sman 2 Sampit, Kabupaten Kotawaringin Timur. 5(3). <https://jurnalp4i.com/index.php/strategi>

- Chengere AM, Bono BD, Zinabu SA, Jilo KW (2025) Enhancing secondary school students' science process skills through guided inquiry-based laboratory activities in biology. *PLoS ONE* 20(4): e0320692. <https://doi.org/10.1371/journal.pone.0320692>
- Gandolfi, H. E. (2024). (Re)considering Nature of Science Education in the Face of Socio-scientific Challenges and Injustices. *Science & Education*, 34(6), 3799–3825. <https://doi.org/10.1007/s11191-024-00536-w>
- Hudha, A. M., Amin, M., Bambang, S., & Akbar, S. (2017). Study Of Instructional Models And Syntax As An Effort For Developing 'Oidde' Instructional Model. *JPBI (Jurnal Pendidikan Biologi Indonesia)*, 2(2), 109–124. <https://doi.org/10.22219/jpbi.v2i2.3448>
- Hudha, A. M., Oktapiani, H., & Rahardjanto, A. (2024a). Evaluating the Impact of the OIDDE Learning Model on Critical Thinking, Learning Outcomes, Ethical Attitudes, and Learning Engagement among Indonesian High School Students. *Asia-Pacific Science Education*, 10(2), 442–470. <https://doi.org/10.1163/23641177-bja10087>
- Hudha, A. M., Oktapiani, H., & Rahardjanto, A. (2024b). Evaluating the Impact of the OIDDE Learning Model on Critical Thinking, Learning Outcomes, Ethical Attitudes, and Learning Engagement among Indonesian High School Students. *Asia-Pacific Science Education*, 10(2), 442–470. <https://doi.org/10.1163/23641177-bja10087>
- Hudha. (2020). *Model Pembelajaran OIDDE*. Kota Tua.
- Husamah, H., Fatmawati, D., & Setyawan, D. (2018). OIDDE Learning Model: Improving Higher Order Thinking Skills of Biology Teacher Candidates. *International Journal of Instruction*, 11(2), 249–264. <https://doi.org/10.12973/iji.2018.11217a>
- Hutagaol, A. T. B., Jamilah, J., & Muchtadi. (2024). Analisis kemampuan pemecahan masalah matematis berdasarkan kecerdasan logis matematis. *Jurnal Pendidikan Informatika Dan Sains*, 13(2), 120–129. <https://doi.org/10.31571/saintek.v13i2.7734>
- Indriani, D., Suryana, D., Yuni, P., & Redjeki, F. (2025). Dimensi Etika Bisnis dalam Pelayanan Kesehatan Berdasarkan Prinsip-Prinsip Bioetika. *Sibatik Journal: Jurnal Ilmiah Bidang Sosial, Ekonomi, Budaya, Teknologi, Dan Pendidikan*, 4(5), 567–576. doi: 10.54443/sibatik.v4i5.2718
- Kamaruddin, I., Utama, F., & Fadilah, L. (2023). Pendidikan Karakter di Sekolah: Pengaruhnya Terhadap Pengembangan Etika Sosial dan Moral Siswa. *Attractive: Innovative Education Journal*, 5(3). <https://www.attractivejournal.com/index.php/aj/>
- Kanyugi, D. K., Obote, D., Munanu, S., & Iguna, M. (2024). Effect of Differentiated Instructional Approach on Learners' Participation and Academic Achievement in Biology in Public Secondary Schools in Mbeere North Sub-County, Kenya. *East African Journal of Education Studies*, 7(3), 1–12. <https://doi.org/10.37284/eajes.7.3.2012>
- Kumar, P. (2024). *The Role of Ethics and Moral Values in Teaching: A Comprehensive Examination*. 03, 99–112. <https://doi.org/10.59231/SARI7659>
- Kurniawaty, I., & Faiz, A. (2022). Konsep Dilema Etika dalam Pengambilan Keputusan: Tinjauan Pustaka dalam Modul Guru Penggerak. *Jurnal Basicedu*, 6(3), 4862–4868. doi: <https://doi.org/10.31004/basicedu.v6i3.296>
- Kusmoro, A. H. S. J. (2025). Penerapan Paradigma Pedagogi Reflektif dalam Upaya Meningkatkan Kualitas Pendidikan di SMP Strada Marga Mulia Jakarta. *Pedagogi: Jurnal Ilmu Pendidikan*, 25(1), 79–89. <https://doi.org/10.24036/pedagogi.v25i1.2425>
- Manik, W., Siregar, A. S., Abizar, S. I., Rahayu, Y., Iqbal, M., & Mukhlis, S. (2025). Studi Tentang Pembelajaran Multidisiplin dan Hubungannya dengan Kemampuan Berpikir Kompleks. *Reflection: Islamic Education Journal*, 2(2), 123–135. doi: <https://doi.org/10.61132/reflection.v2i2.688>
- Mawaddah, I., Nurmaya, A., & Mansyur, J. (2025). Reflective Practice Training Untuk Meningkatkan Moral Reasoning. *Jurnal PenKoMi: Kajian Pendidikan Dan Ekonomi*, 8(2). <http://jurnal.stkipbima.ac.id/index.php/PK/index>

- Ndebil, M. B., & Ali, C. A. (2024). Cooperative learning as a strategy of improving mathematics performance and attitudes. *International Journal of Educational Innovation and Research*, 3(1), 62–74. <https://doi.org/10.31949/ijeir.v3i1.7163>
- Paat, M., Armstrong F. Sompotan, Aneke Pesik, Yohanes Bery Moku, & Imriani Moroki. (2024). Penerapan Multimedia Pembelajaran Berbasis Masalah dalam Meningkatkan Hasil Belajar dan Keterampilan Berpikir Tingkat Tinggi. *Jurnal Pendidikan MIPA*, 14(1), 155–162. doi: <https://doi.org/10.37630/jpm.v14i1.1493>
- Rahmah, R., Rahayu, S., Saputra, F., Devi, D., & Syafruddin, S. (2025). Nilai Kepedulian Sosial Peserta didik Sekolah Dasar: Kajian Literatur dan Strategi Implementasi dalam Kurikulum Merdeka. *Jurnal Pesona Indonesia*, 2(1), 34–39. doi: <https://doi.org/10.71436/jpi.v2i1.27>
- Rahman, D. A., & Ardiansyah, M. P. (2025). Implementasi Model Pembelajaran Inquiry Learning untuk Meningkatkan Kreativitas Siswa dalam Pembelajaran IPA di Sekolah Menengah Pertama. *Jurnal Pendidikan Merdeka Belajar*, 2(2). <https://ejournal.marqchainstitute.or.id/index.php/merdeka>
- Ramadhani, D. D. S., & Sukenti, D. (2023). Dampak Penerapan Model Problem Based Learning dalam Meningkatkan Kemampuan Berpikir Tingkat Tinggi Siswa. *Journal of Education Action Research*, 7(3), 327–335. <https://doi.org/10.23887/jear.v7i3.66698>
- Rifky, S., Suhirman, L., Kurniawati, I., Abdurahman, A., Sutiyatno, S., Santika, T., Nurjanah, N., Fihri, F., Nur, M. D. M., & Patriasih, R. (2024). *Buku Ajar Model dan Strategi Pembelajaran*. PT. Sonpedia Publishing Indonesia.
- Rizal, Moch. (2025). Dampak Asesmen Berbasis Karakter Kejujuran Terhadap Pengambilan Keputusan Etis Dalam Aktivitas Pembelajaran Kelas 3 MSI 05 Sampangan. *Strategy: Jurnal Inovasi Strategi Dan Model Pembelajaran*, 5(2), 186–194. doi: <https://doi.org/10.51878/strategi.v5i2.5758>
- Saputra, A. M. A., Tawil, M. R., Hartutik, H., Nazmi, R., La Abute, E., Husnita, L., Nurbayani, N., Sarbaitinil, S., & Haluti, F. (2023). Pendidikan Karakter Di Era Milenial: Membangun Generasi Unggul Dengan Nilai-Nilai Positif. PT. Sonpedia Publishing Indonesia.
- Simanjuntak, M. F., & Sudibjo, N. (2019). Meningkatkan Keterampilan Berpikir Kritis Dan Kemampuan Memecahkan Masalah Peserta Didik Melalui Pembelajaran Berbasis Masalah [Improving Students' Critical Thinking Skills And Problemsolving Abilities Through Problem-Based Learning]. *Johme: Journal of Holistic Mathematics Education*, 2(2), 108. doi: <https://doi.org/10.19166/johme.v2i2.1331>
- Tasrif, T. (2022). Higher Order Thinking Skills (HOTS) dalam pembelajaran social studies di sekolah menengah atas. *Jurnal Pembangunan Pendidikan: Fondasi Dan Aplikasi*, 10(1). <https://doi.org/10.21831/jppfa.v10i1.29490>
- Tsabita, S. A., & Fitriatin, N. (2024). Integrasi Nilai-Nilai Keilmuan dalam Praktik Etika Administrasi Pendidikan Islam. *Jiip - Jurnal Ilmiah Ilmu Pendidikan*, 7(12), 13747–13759. <https://doi.org/10.54371/jiip.v7i12.6288>
- Ürek, H. (2024). Determination of Argumentation Quality of Science Teacher Candidates in the Context of the Human Reproductive System Subject. *Yuzunci Yil Universitesi Egitim Fakultesi Dergisi*. <https://doi.org/10.33711/yyuefd.1386098>
- Uzomah, T. N., Achor, E. E., & Jack, G. U. (2024). Fostering Students' Academic Achievement in Physics through Graphic Organizer-Enhanced Learning Strategy. *Edukasiana Jurnal Inovasi Pendidikan*, 3(2), 244–256. <https://doi.org/10.56916/ejip.v3i2.706>
- Wakhidah, N. (2021). Pemahaman mahasiswa tentang struktur dan sifat virus: Telaah awal pada mahasiswa calon guru. *Edu Sains: Jurnal Pendidikan Sains & Matematika*, 9(2), 198–209. <https://doi.org/10.23971/eds.v9i2.2790>

- Wang, J., Ismail, H. H., & Mansor, A. Z. (2025). From Fragmentation to Integration. *International Journal of Computer-Assisted Language Learning and Teaching*, 15(1), 1–26. <https://doi.org/10.4018/ijcallt.388707>
- Wati, M., Institut, B., Kristen, A., & Kupang, N. (2025). Pendidikan Etika Sebagai Solusi Atas Krisis Moral Remaja Sekarang. *Jurnal Ilmu Pendidikan (JIP)*, 3(1), 169–181.
- Yennita, Y., Irianti, M., Zulirfan, Z., & Yoeliana, R. (2026). HOTS Development Strategy through Project Based STEM Learning at High School Level. *Prisma Sains : Jurnal Pengkajian Ilmu Dan Pembelajaran Matematika Dan IPA IKIP Mataram*, 14(1), 176–187. doi: <https://doi.org/10.33394/j-ps.v14i1.16505>