

Implementation of Levels of Inquiry Model in Improving Students' HOTS on Fluid Material**Tia Kuraesin¹, Lina Aviyanti², Harun Imansyah³, Amalia Weka Gani⁴**

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KeywordsFluid, Higher Order
Thinking Skills (HOTS),
Levels of Inquiry (LoI)**Abstract**

This research is motivated by the low level of students' higher order thinking skills (HOTS) in physics. The purpose of this study is to determine how the application of Levels of Inquiry (LoI) learning model in improving students' HOTS. The research design used was a quasi-experiment involving grade XI students in one of the high schools in Bandung City with a research sample of 35 students in the experimental class and 25 students in the control class. The instruments used in this study were higher order thinking skills test in the form of two-level multiple choices for fluid material and observation sheet of learning model implementation. Data analysis techniques include N-Gain, hypothesis testing and effect size. The results of the analysis showed that the application of the LoI learning model in the experimental class was in the excellent category and could improve students' HOTS in the moderate category with an N-gain value of 0.53. In the control class, the application of the conventional learning model can improve students' HOTS in the low category with an N-gain score of 0.18. In addition, the analysis of the Mann-Whitney test results showed that there was a significant difference in students' HOTS between the experimental group and the control group with an effect size in the very large category. This research proves that the application of the LoI learning model is effective in improving students' HOTS in fluid materials.

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**INTRODUCTION**

Education in the industrial revolution 4.0 has an important role in advancing a nation. Quality education that is relevant to the demands of the times and is able to meet the needs of the world of work is needed to prepare students to be able to compete in the era of globalization. Education should be able to produce human resources who have the abilities or soft skills needed in the 21st century. The characteristics of 21st century education are students who have high-level thinking skills and are able to innovate, master the use of various learning media, and utilize information (Abidin 2014). Meanwhile, there are two basic elements in the Independent Curriculum that students must have, namely critical thinking and creative thinking (Culture 2020).

21st century education requires a paradigm shift in the learning process that focuses on providing students with skills that are competitive and able to face the demands of the times. Barr and Tagg (1995) stated that the 21st century educational paradigm is based on paradigms learning. Students are said to be able to solve a problem if they can use their knowledge in new situations and are able to research a problem. This ability is known as Higher Order Thinking Skills (HOTS) or high-level thinking skills.

HOTS students reflect skills in thinking critically, creatively and analytically regarding information and data, as well as the ability to solve problems (Jannah et al. 2022). Brookhart (2010) defines HOTS as the process of transferring a problem and then using critical thinking to find a solution to the problem. In addition, Bloom (in Anderson and

Krathwohl, 2010) explains that thinking is part of the cognitive domain which is classified into six cognitive hierarchies, namely knowledge, understanding, application, analysis, assessing. (Evaluation), and creating (create) (Elmrabit et al. 2020);(Bonavantura and Senudin 2020). In general, the cognitive domain is divided into Lower Order Thinking Skills (LOTS), namely the ability to remember (C1), understand (C2), and apply (C3), while Higher Order Thinking Skills (HOTS) abilities include the ability to analyze (C4), evaluate (C5), and creating (C6) (Anderson and Krathwohl, 2001, p.30).

The ability to think at a higher level and develop critical thinking requires training related to finding methods, compiling explanations, making hypotheses, generalizing, and documenting findings supported by evidence (Eggen & Kauchak, 2012). Learning that involves students in higher level thinking requires the use of learning strategies that lead to active students (student centered), and inquiry activities so that students have the opportunity to observe various phenomena and carry out further investigations.

This approach is characteristic of the Merdeka Curriculum and the 2013 Curriculum. Effective learning strategies will help students to hone and improve high-level thinking skills (HOTS). Therefore, teachers play a very important role in determining appropriate learning strategies or approaches in the learning and teaching process in the classroom. As stated in Law no. 14 of 2005 which states that "teachers are professional educators with the main task of educating, teaching, guiding, directing, training, assessing and evaluating students in early childhood education in formal education, basic education and secondary education" (Ariani 2021) ;(Elwy et al. 2020)

Physics is a complex branch of science, so studying it requires high-level thinking skills (HOTS). According to Azmi et al. (2016), physics learning consists of product aspects that contain a combination of knowledge about generalizations, concepts, principles, laws, physical theories, as well as a process consisting of a series of scientific activities in investigating physical phenomena and developing knowledge (Azmi, Rahayu, and Hikmawati 2016). Therefore, teachers are expected to be able to facilitate HOTS learning for students by utilizing appropriate media, models, methods and learning strategies that are related to the characteristics of the material and conditions of the students' learning environment, and can create a fun and meaningful learning atmosphere.

According to the results of research conducted by Sutrisno (2021), there is a problem that is often faced by students, namely the low level of high-level thinking skills of high school students, especially in physics lessons (Saddia et al. 2021) ;(Hermino and Arifin 2020);(Pang et al. 2018). In this research, factors were found that caused students' low level of high-level thinking skills, including learning tools that were less innovative, learning delivery that did not involve students' thinking skills and activeness. Ariansyah's (2019) research results show that high school students' HOTS in physics lessons is still in the low category with an average score of 39%. This is based on student achievement in each HOTS indicator, namely analyzing, evaluating, creating which is still low (Ariansyah and Arsyid 2019) . Therefore, HOTS students need to be trained and improved in classroom learning activities.

Based on the results of a preliminary study at one of the public high schools in Bandung in the form of class observations and interviews with physics teachers, it was found that student learning outcomes were unsatisfactory and there were obstacles faced by physics teachers in training students' HOTS in the classroom. The first problem is that students are rarely trained to think at a higher level in physics learning, so they are less accustomed to solving physics problems that require HOTS.

Second, students are not facilitated to conduct learning experiences that hold higher order thinking skills due to the lack of utilization of laboratory equipment and experimentation or investigation activities in the classroom due to limited practical equipment (Muhajirah 2020). Students tend to listen and pay attention to illustrations given by the teacher (teacher-centered) (Greenhow and Askari 2017). In fact, teachers do not provide opportunities and involve students in the learning process, so students are less trained in using and conveying the results of their thinking based on their understanding and

knowledge (Fink 2003). The interview results provide information that the teacher realizes that students' higher order thinking skills (HOTS) are still lacking and need to be improved.

The solution that is seen to be able to overcome problems related to students' low level of high-level thinking skills (HOTS) is through the application of inquiry -based learning. One inquiry learning method that is systematic and comprehensive, and can hone students' high-level thinking skills, is the Levels of Inquiry (LoI) learning model. The LoI learning model provides students with the opportunity to ask questions, investigate, and gain a deeper understanding of the material being studied. In addition, through the application of the LoI learning model, students are gradually given the opportunity to carry out experiments, apply concepts to real world situations, and gain knowledge through a collaborative process (Ariansyah and Arsyid 2019) . Inquiry learning activities that follow the Levels of Inquiry hierarchy will first train simpler skills before practicing more complex skills (Wenning, 2005).

One of the physics materials that high school students consider abstract is fluids. As stated by Jannah et al .) . Exploration of material can be seen in the surrounding environment, but students have difficulty connecting the material obtained in class with applications in real life. Based on the background that has been explained, researchers are interested in investigating whether the application of the Levels of Inquiry learning model can increase high school students' HOTS, especially in fluid material.

RESEARCH METHODS

The research method used is a quantitative method with the matching-only pretest posttest control group design as shown in Figure 1.

Table 1. Matching-only pretest posttest research design control group design

Treatment Group	m	O	X	O
Control Group	m	O	C	O

with:

- M = matched for the experimental class and control class
- O = initial measurement and final measurement
- X = Levels of Inquiry (LoI) learning model treatment
- C = conventional learning model treatment

The sampling technique used purposive sampling where two classes were selected as research samples, namely the experimental class with 35 students and the control class with 25 students. The students selected as research samples were students who had not received learning about Fluid material. The instrument used in this research is a test of higher order thinking skills (HOTS) in the form of two-tier multiple choices which is distributed during the pretest and posttest. The observation sheet for the implementation of the LoI learning model is used to assess the implementation of learning based on the syntax of the LoI learning model applied in the experimental class.

Test the construct validity of the HOTS items using the Aiken's V index involving experts (lecturers and physics subject teachers) by filling in the validation sheet for repair quality instrument HOTS test which used in this research. Measuring expert validation sheet three aspects which include material, construct and grammar aspects. The results of construct validity are presented in Table 1 below.

Table 2. Construct Validity Results of the HOTS Instrument

Assessment Aspects	Fluid	
	Average V Value	Category
Material Aspects	0.85	Very Valid
Construction Aspects	0.90	Very Valid
Grammar	0.87	Very Valid

Based on Table 1, the results of the average V value for each aspect of the assessment of the HOTS instrument show a value above 0.80, so it can be concluded that the HOTS question items on Fluid material in all aspects are in the very valid category and are worthy of being tested.

The empirical validity of the HOTS question items was tested on 48 students at one of the state high schools in Bandung who had received Fluid material. The results of testing the HOTS items showed that a total of 27 HOTS items were declared valid and reliable in the very high category with a Cronbach's alpha reliability coefficient of 0.9. Thus, the HOTS instrument was used for further research during the pretest and posttest.

In this research, the application of the LoI model was used in the experimental class, while in the control class the conventional model was applied to determine the increase in students' HOTS in Fluid material through N-Gain analysis. The equation used to calculate the N-Gain score is as follows.

$$N - Gain = \frac{\text{Skor posttest} - \text{Skor pretest}}{\text{Skor ideal} - \text{Skor pretest}} \quad (1)$$

With:

The ideal score is the highest score.

The N-Gain score data obtained was then interpreted based on the categories in Table 3.

Table 3. Interpretation of N-Gain scores (Sundayana, 2014)

N-Gain Score	Interpretation
$G < 0.7$	Tall
$0.3 \leq G \leq 0.7$	Currently
$G < 0.3$	Low

The data collected from the pretest and posttest results were processed using statistical tests consisting of prerequisite tests and hypothesis tests with the help of IBM SPSS software version 26. The prerequisite test consists of normality and homogeneity tests. Normality test was conducted to determine whether the pretest and posttest data were normally distributed. The normality test used in this study is Saphiro-Wilk. The basis for decision making in the Saphiro-Wilk normality test is as follows: (1) if the significance value (Sig.) is greater than 0.05 then the data is normally distributed; (2) if the significance value (Sig.) is smaller than 0.05 then the data is not normally distributed. The homogeneity test was conducted to determine whether there was variance in the research data. The decision-making basis for the homogeneity test used is as follows: (1) if the significance value (Sig.) on based on mean is more than 0.05, then the data is homogeneous; (2) if the significance value (Sig.) on based on mean is less than 0.05, then the data is not homogeneous.

After the prerequisite testing is fulfilled, then the hypothesis test is carried out. The hypothesis test interpretation criteria used are as follows: (1) if the Asymp. Sig. value is smaller than 0.05, then H_0 is rejected and H_1 is accepted; (2) if the Asymp. Sig. value is greater than 0.05, then H_0 is accepted and H_1 is rejected. The hypotheses proposed in this study are:

H_0 : There is no significant difference in the improvement of higher order thinking skills (HOTS) between groups of students who get Levels of Inquiry (LoI) learning and groups of students who get conventional learning.

H_1 : There is a significant difference in the improvement of higher order thinking skills (HOTS) between groups of students who received Levels of Inquiry (LoI) learning and groups of students who received conventional learning.

Furthermore, the calculation of the effectiveness value of the learning model is used to determine how much difference between the experimental class and the control class for the variable of higher order thinking skills which is analyzed based on the results of the effect size calculation. The equation used to calculate the effect size in this study is using Cohen's equation shown in the following equation (Ialongo 2016).

(2)

$$d = \frac{|\bar{x}_{\text{pretest}} - \bar{x}_{\text{posttest}}|}{\sqrt{\frac{s^2_{\text{pretest}} + s^2_{\text{posttest}}}{2}}}$$

With

$\bar{x}_{\text{pretest}}$: average student pretest score

$\bar{x}_{\text{posttest}}$: average posttest score of students

s^2_{pretest} : variance of students' pretest results

s^2_{posttest} : variance of students' posttest results

Then, the results of Cohen's d calculations are interpreted based on Table 3 below.

Table 4. Interpretation of Cohen's d values (Ialongo 2016)

Cohen's d value	Interpretation
$0.80 \leq d \leq 2.00$	Big
$0.50 \leq d < 0.80$	Currently
$0.20 \leq d < 0.50$	Small
$0.00 \leq d < 0.20$	Not enough

The implementation of the LoI learning model syntax was obtained from the results of filling in the observation sheet involving three observers during four meetings. The answer options in the observation sheet are implemented and not implemented. The implemented option gets a score of 1 and the option that is not implemented gets a score of 0. Then the results are processed using a percentage calculation of the total number of implementations of the LoI learning model with the following equation.

$$\% \text{Keterlaksanaan} = \frac{\sum \text{aspek yang diamati terlaksana}}{\sum \text{keseluruhan aspek yang diamati}} \times 100\% \quad (3)$$

The calculation results are then interpreted in the classification of learning implementation in Table 4 below.

Table 5. Classification of Learning Implementation

Implementation of Learning (%)	Category
$87,6 < x \leq 100$	Very good
$62,6 < d \leq 87,6$	Good
$37,6 < d \leq 62,6$	Enough
$25,0 < d \leq 37,6$	Not enough
$0 \leq d \leq 25,0$	Very less

Koswara (in Clarisa, 2020)

RESULTS AND DISCUSSION

Data collected through the pretest and posttest are processed using statistical tests consisting of prerequisite tests, hypothesis tests, and N-gain tests. The prerequisite tests consist of a normality test and a homogeneity test. The results of the normality test are shown in Table 6 below.

Table 6. Normality Test of Higher Order Thinking Skills (HOTS)

Data Group	Learning model	Kolmogorov-Smirnov			Conclusion
		Statistics	et al	sig.	
Pretest	Levels of Inquiry	0.148	35	0.050	Normal
	Conventional	0.177	25	0.042	Abnormal
Posttest	Levels of Inquiry	0.141	35	0.075	Normal
	Conventional	0.193	25	0.017	Abnormal

The pretest and posttest significance values for the Levels of Inquiry learning model (experimental class) are greater than 0.05 so it can be concluded that the data is normally distributed. Meanwhile, the pretest and posttest data for the conventional learning model (control class), both have a significance value smaller than 0.05, so it can be concluded that the data is not normally distributed. Next, a homogeneity test was carried out to determine whether there was variance in the data. Table 6 shows the results of the homogeneity test for each class.

Table 7. Homogeneity Test of Higher Order Thinking Skills (HOTS)

Data Group	Levene Statistics	df1	df2	Sig.	Conclusion
Experimental Class and Control Class	0.993	1	58	0.32	Homogeneous

The homogeneity test results in Table 7 show that the significance value of the experimental class and control class data is 0.32. The significance value obtained is greater than 0.05 so it can be concluded that the data obtained is distributed homogeneously. The results of the prerequisite test concluded that the data was not normally distributed, so the hypothesis test used was non-parametric statistics, namely the Mann-Whitney test.

In this study, the Mann Whitney test was used to determine whether there was a difference in the averages of two unpaired (independent) samples, namely in the experimental class and the control class. The results of the Mann-Whitney test with the help of IBM SPSS version 26 software are shown in Table 8.

Table 8. Mann-Whitney Test Results

Posttest Experimental Class and Control Class	
Mann-Withney U	174,500
Asymp. Sig. (2-tailed)	0,000
Conclusion	There are Differences

Table 8 shows the results of the posttest data processing of higher order thinking skills (HOTS) in experimental and control classes. The value of Asym. Sig. (2-tailed) value obtained is 0.000 which is smaller than the specified significance value (0.05). Thus, the null hypothesis (Ho) is rejected, and the alternative hypothesis (H1) is accepted, so it can be concluded that there is a significant difference in the improvement of higher order thinking skills (HOTS) between groups of students using the Levels of Inquiry (LoI) learning model and groups of students using conventional learning models.

These results are supported by Wenning (2012) who states that using the Levels of Inquiry learning model can provide opportunities for students to build their own knowledge through inquiry activities with learning steps that form a learning cycle (observation, manipulation, generalization, verification, and applications). Whereas in conventional learning, teachers tend to dominate the class and provide little space for students to be actively involved in learning or conducting experimental activities to conduct an investigation. Students become very passive in class because they only receive information from the teacher. Therefore, the conventional learning model does not train students' HOTS.

Further analysis related to the effectiveness of using Levels of Inquiry learning model in improving students' higher order thinking skills (HOTS) was analyzed using Cohen's d effect size by comparing control and experimental classes. Effect size test results for posttest data of experimental and control classes on fluid materials are presented in Table 9 below.

Table 9. Effect Size Calculation Results

	d-effect	Category
Posttest Experimental Class and Control Class	1,285	Very large

Based on Table 9, the d-effect value obtained is 1.285 which is included in the very large category. This shows that the Levels of Inquiry learning model is effective in improving students' higher order thinking skills (HOTS). These results are supported by Andrini (2016) who states that the application of the inquiry learning model is effective in learning because

it can provide students with the opportunity to ask questions, carry out investigations systematically, critically, logically, analytically, so that students are able to formulate and reconstruct their own knowledge (Andrini 2016) .

Next, to determine the average increase in student HOTS for the experimental class and control class, an N-Gain score test was carried out. The results of the N-Gain test for higher order thinking skills (HOTS) in the experimental class and control class are shown in Table 10 below.

Table 10. N-Gain Score of Higher Order Thinking Skills (HOTS)

Data Group	N-Gain Score	Category
Experimental Class	0.53	Currently
Control Class	0.18	Low

Based on Table 10, the average N-Gain score in the experimental class is 0.53 which is in the medium category, while the average N-Gain score in the control class is 0.18 which is in the low category. Based on the results of the N-Gain analysis, it can be concluded that students in the experimental class experienced a higher increase in higher-level thinking skills (HOTS) than students in the control class. The difference in the increase in HOTS of students in the experimental and control classes is due to the effect of the application of the Levels of Inquiry learning model which has certain advantages when compared to conventional learning models. According to Wenning (2011), one of the advantages of the Levels of Inquiry learning model is that it is able to present a comprehensive and systematic range of learning styles from the simplest to the most complex.

The effectiveness of the LoI learning model is also supported by the results of the calculation of the percentage of the implementation of the Levels of Inquiry model in the experimental class which includes the stages of discovery learning, interactive demonstration, inquiry lesson, inquiry laboratory, and real world applications. The results of data analysis of the implementation of the LoI model show a percentage of implementation of 100% which is in the very good category. Each syntax or stage of the learning model and learning activities contained in the observation sheet was considered to have been implemented very well by the three observers. The activities carried out at each stage of the Levels of Inquiry by learning model are as follows.

1) Discovery Learning

During building knowledge, students identify various answers through question and answer activities and discussions related to a concept or principle discovered. After that, students connect and communicate the conclusions they have obtained through group discussions to answer the questions contained in the LKPD. At the discovery learning stage, the aspect of high-level thinking skills (HOTS) that is trained is the analyzing aspect (C4).

2) Interactive Demonstration

At the interactive demonstration stage, the teacher is assisted by group representatives to carry out demonstrations to investigate the correctness of students' concepts and predictions related to previous activities at the discovery learning stage. Students also engage in explanation (giving reasons) and hypothesis generation. Students collect information, recognize variables, and discuss it with group friends. During this activity, students predict and propose hypotheses regarding the relationship of variables in the experiment. After that, each group answers the questions in the LKPD. At the interactive demonstration stage, the aspect of high-level thinking skills (HOTS) that is trained is the aspect of making hypotheses (C6).

3) Inquiry Lesson

The inquiry lesson stage occurs when students identify investigation variables (experiments) related to the problems they face in the Archimedes' Law (buoyancy force) experiment. Then students analyze the relationships between variables and determine how to measure these variables. Students conduct group discussions to plan experiments to investigate relationships between variables. The activity of planning experiments requires students to formulate various alternative solutions to problem solving. At the inquiry lesson

stage, the aspects of high-level thinking skills (HOTS) that are trained are aspects of analyzing (C4) and designing experiments (C6).

4) Inquiry Laboratory

In the inquiry laboratory stage, students work together with their group mates in conducting experiments to formulate the relationship between variables for the Archimedes' Law experiment (buoyancy force). Students collect data, then the data is interpreted, analyzed, and concluded together with their group mates. In conducting experiments, students apply the concepts and principles they already have to solve problems. In addition, in conducting experiments, several alternative solutions were tried by students to prove the hypothesis they had proposed. Not infrequently, students experience failure in carrying out evidence, thus training students to evaluate the experimental steps taken and learn from mistakes. In the inquiry laboratory stage, the aspects of higher order thinking skills (HOTS) that are trained are the aspects of analyzing (C4) and evaluating solutions (C5).

5) Real World Application

At the real world application stage, students connect the concepts, principles and laws they have learned to real-life problems related to fluids. Next, students find answers to the problems they formulate through group activities using a problem-based approach. This activity requires students to have the skills to synthesize a problem. At the real world application stage, the aspects of high-level thinking skills (HOTS) that are trained are the analyzing (C4) and evaluating (C5) aspects. Excerpts of students' answers on the LKPD related to questions on aspects of higher order thinking skills (HOTS) at this stage are shown in Figure 2 below.

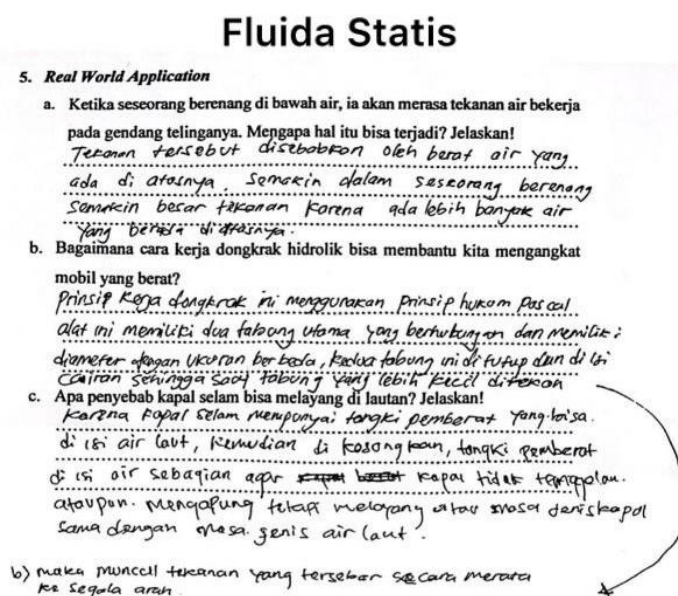


Figure 1. Excerpts of students' answers to the analyzing (C4) and evaluating (C5) aspects.

The results of this research show that the Levels of Inquiry learning model has an effect on improving students' higher order thinking skills (HOTS), especially in Fluid material. This is in accordance with research conducted by Puspita (2019) which revealed that the Levels of Inquiry learning model can train students' thinking skills in stages, from basic level thinking to higher level thinking and also changes the learning center from the teacher to the student, so that students have more freedom in carrying out activities in class learning. In addition, each stage of the Levels of Inquiry learning process supports students' competency training to explain phenomena scientifically, evaluate and design scientific research, and interpret data and evidence scientifically (Aprilia, Suryanti, and Suprpto 2021).

According to Hugerat and Kortam (2014), HOTS cannot be developed by students and teachers only through conventional learning, but HOTS needs to be taught explicitly through good learning designs, one of which is by implementing inquiry -based learning (Hugerat and Kortam 2014) . A similar thing was stated by Nurkholik & Yonata (2020) that the inquiry -based learning model is one of the learning models that is a solution for training students' HOTS (Ariansyah and Arsyid 2019) . Thus, the implementation of the Levels of Inquiry learning model is proven to be able to train students to think at a higher level in Physics lessons.

CONCLUSION

Based on the results of the analysis and discussion, this study shows a significant difference in the average HOTS of students between the experimental class and the control class from the Mann-Whitney hypothesis test with the effect size results in the very large category. In addition, the increase in students' higher order thinking skills (HOTS) in the experimental class was in the medium category with an N-Gain score of 0.53, while the control class was in the low category with an N-Gain score of 0.18 . The implementation of the Levels of Inquiry (LoI) learning model on Fluid material is included in the very good category. This research indicates that the implementation of the Levels of Inquiry (LoI) model on Fluid material has provided opportunities for students to improve higher order thinking skills (HOTS) better than conventional learning.

REFERENCES

- Abidin, Yunus. 2014. *Desain Sistem Pembelajaran Dalam Konteks Kurikulum 2013*. Refika Aditama.
- Andrini, Vera Septi. 2016. "The Effectiveness of Inquiry Learning Method to Enhance Students' Learning Outcome: A Theoretical and Empirical Review." *Journal of Education and Practice* 7(3): 38–42.
- Aprilia, Puspa Wulan, Suryanti Suryanti, and Nadi Suprpto. 2021. "Pembelajaran Inkuiri Untuk Melatih Literasi Sains Siswa Pendidikan Dasar." *Jurnal MUDARRISUNA: Media Kajian Pendidikan Agama Islam* 11(2): 250–68.
- Ariani, Nada. 2021. "Definisi Konsep Profesi Keguruan." *Seri Publikasi Pembelajaran* 1(2): 1–8.
- Ariansyah, Ariansyah, and Syaiful B Arsyid. 2019. "Analisis Kemampuan Menyelesaikan Soal Hots Fisika Materi Getaran Harmonis Di Sma Kristen Immanuel Pontianak." *Jurnal Pendidikan dan Pembelajaran Khatulistiwa (JPPK)* 8(6).
- Azmi, Muhamad Khairul, Satutik Rahayu, and Hikmawati Hikmawati. 2016. "Pengaruh Model Problem Based Learning Dengan Metode Eksperimen Dan Diskusi Terhadap Hasil Belajar Fisika Ditinjau Dari Sikap Ilmiah Siswa Kelas X MIPA SMA N 1 Mataram." *Jurnal Pendidikan Fisika dan Teknologi* 2(2): 86–94.
- Anderson, L. W. & Krathwohl, D. R. (2010). A foundational framework for learning, teaching and assessment: A revision of Bloom's taxonomy of education . Student Library.
- Andrini, VS (2016). The Effectiveness of Inquiry Learning Method to Enhance Students' Learning Outcome: A Theoretical and Empirical. *Journal of Education and Practice* , 7 (3). doi: www.iiste.org
- Ariansyah. (2019). Analysis of the Ability to Solve HOTS Physics Problems in Harmonic Vibration Material at Immanuel Christian High School, Pontianak . (Thesis). Tanjungpura University, Pontianak.

- Bonavantura, N. Nggarang, and Putriatri Krimasusini Senudin. 2020. "Evaluation of the Implementation of Toddler Posyandu in the Work Area of the La'o Puskesmas, Manggarai Regency." *Journal of Health Insights* 1(1): 99–106.
- Directorate General of Higher Education, Ministry of Education and Culture. (2020). Guide to preparing a higher education curriculum in the industrial era 4.0 to support independent learning - independent campus. Ministry of Education and Culture of the Republic of Indonesia . [On line]. Accessed from <https://dikti.kemdikbud.go.id/wp-content/uploads/2020/10/Buku-Panduanpenyusunan-Kurikulum-Pendidik-Tinggi-Mbkm.pdf>
- Elmrabit, Nebrase, Feixiang Zhou, Fengyin Li, and Huiyu Zhou. 2020. "Evaluation of Machine Learning Algorithms for Anomaly Detection." In *2020 International Conference on Cyber Security and Protection of Digital Services (Cyber Security)*, IEEE, 1–8.
- Elwy, A Rani et al. 2020. "Using Formative Evaluation Methods to Improve Clinical Implementation Efforts: Description and an Example." *Psychiatry research* 283: 112532.
- Fink, L. Dee. 2003. *Creating Significant Learning Experiences*. 3rd ed. Jossey-Bass.
- Greenhow, Christine, and Emilia Askari. 2017. "Learning and Teaching with Social Network Sites: A Decade of Research in K-12 Related Education." *Education and information technologies* 22: 623–45.
- Hermiono, Agustinus, and Imron Arifin. 2020. "Contextual Character Education for Students in the Senior High School." *European Journal of Educational Research* 9(3): 1009–23.
- Hugerat, Muhamad, and Naji Kortam. 2014. "Improving Higher Order Thinking Skills among Freshmen by Teaching Science through Inquiry." *Eurasia Journal of Mathematics, Science and Technology Education* 10(5): 447–54.
- Ialongo, Cristiano. 2016. "Understanding the Effect Size and Its Measures." *Biochemia medica* 26(2): 150–63.
- Jannah, Fathul et al. 2022. "Pembelajaran Hots Berbasis Pendekatan Lingkungan Di Sekolah Dasar."
- Jannah, F., Radiansyah, R., Sari, R., Kurniawan, W., Aisyah, S., Wardini, S. & Fahlevi, R. (2022). HOTS learning based on an environmental approach in elementary schools. Primary: Journal of Elementary School Teacher Education, 11 (1), 189–197. doi: <https://doi.org/10.33578/jpfkip.v11i1.8533>
- Kebudayaan, Kementerian Pendidikan. 2020. "Rencana Strategis (Renstra) Kementerian Pendidikan Dan Kebudayaan 2020-2024."
- Muhajirah, Muhajirah. 2020. "Basic of Learning Theory:(Behaviorism, Cognitivism, Constructivism, and Humanism)." *International Journal of Asian Education* 1(1): 37–42.
- Pang, Christopher et al. 2018. "Socially Challenged Collaborative Learning of Secondary School Students in Singapore." *Education Sciences* 8(1): 24.
- Saddia, Andi, Sutrisno Sutrisno, Muhammad Saldi, and Muhammad Nurkhalis Agriawan. 2021. "Analisis Kemampuan Menyelesaikan Soal Hots Fisika Siswa Sma Di Kota Majene." *PHYDAGOGIC: Jurnal Fisika Dan Pembelajarannya* 4(1): 1–5.

Wenning, C. J. (2011). The levels of inquiry model of science teaching. *Journal of Physics Teacher Education Online*, 6 (2), 9-16. [on line]. Retrieved from <http://www2.phy.ilstu.edu/~wenning/jpteo/issues/sum2011.html>

Willenda, Z., Kuntarto, Eko. & Zahyuni, Violita. (2024). Analysis of Class I Students' Ability in Solving HOTS Questions in Indonesian Language Lessons. *Journal of Early Childhood Education*, 8(1), 12-20. doi: [10.31004/obsession.v8i1.4908](https://doi.org/10.31004/obsession.v8i1.4908)