ISSN-p 2306-7365
ISSN-e 2664-0686

UDC 167; IRSTI 15.81.21
https://doi.org/10.47526/2022-1/2664-0686.07

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EFFECTIVENESS OF BLENDED LEARNING IN HOTS FOR SCIENCE IN ELEMENTARY SCHOOL

Abstract. The purpose of this study was to determine the effectiveness of blended learning on HOTS (Higher Order Thinking Skills) for fifth-grade students in science learning. This study uses experimental research methods. The subjects in this study were fifth-grade students at Public Primary School Number 2 Rejosari and Public Primary School Ngegot with 56 students as the experimental class and Class V at Public Primary School Number 1 and 3 Rejosari in Mijen Demak District with 46 students as the control class. The effectiveness of this blended learning model can be seen from the results of the N-Gain score test where the experimental class has an average increase in student learning outcomes of 0.43 in the medium category and the control class in the low category with an average of 0.15. While the results of the Wilcoxon test are known as Asymp.Sig. (2-tailed) is worth 0.000. So, it can be concluded that there is a difference between the pre-test and post-test learning outcomes of the experimental and control classes. These differences were analyzed by the Mann-Whitney Test. Based on the Mann-Whitney test, it is known that the value of Asymp.Sig. (2-tailed) of 0.000 is smaller than < 0.05 probability value. So, it can be concluded that there is a HOTS difference between the experimental and control classes, where the average of the experimental group is more than the average of the control group. It can be concluded that the application of blended learning has a significant impact on student HOTS in science lessons for grade V elementary. The article analyzes the results of this study.

Keywords: Blended learning, higher-order thinking skills, science, experiment, test.

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Бізге дұрыс сілтеме жасаңыз:
Idawat T., Murtono, Utaminingsih S., Suleimen S.B. Effectiveness of Blended Learning in HOTS for Science in Elementary School // *Ясауи университетінің хабаршысы*. – 2022. – №1 (123). – Б. 81–91. https://doi.org/10.47526/2022-1/2664-0686.07
Cite us correctly:
Idawat T., Murtono, Utaminingsih S., Suleimen S.B. Effectiveness of Blended Learning in HOTS for Science in Elementary School // *Iasaui universitetinin habarshysy*. – 2022. – №1 (123). – B. 81–91. https://doi.org/10.47526/2022-1/2664-0686.07

Бастауыш мектептегі ғылымға арналған жоғары ретті ойлау дағдыларындағы аралас оқытудың тиімділігі

Аңдатпа. Бұл зерттеудің мақсаты бесінші сынып оқушыларының жаратылыстану пәндерін оқытудағы жоғары ретті ойлау дағдылары бойынша аралас оқытудың тиімділігін анықтау болды. Бұл зерттеуде эксперименталды зерттеу әдістері қолданылады. Бұл зерттеудің субъектілері №2 мемлекеттік бастауыш мектебінің бесінші сынып оқушылары Режосари және Нгегот мемлекеттік бастауыш мектебінің 56 оқушысы эксперименталды сынып ретінде және Мижен Демак ауданындағы №1 және 3 Режосари мемлекеттік бастауыш мектебінің V сыныбың 46 оқушысы бақылау тобында болды. Бұл аралас оқыту моделінің тиімділігін N-Gain балл тесті нәтижелерінен көруге болады, мұнда эксперименттік сыныпта орташа санаттағы оқушылардың оқу нәтижелерінің 0,43-ке, ал төменгі санаттағы бақылау сыныбы орташа 0,15-ке өскені байқалады. Wilcoxon тестінің нәтижелері Asymp.Sig ретінде 0,000 екені белгілі. Сонымен, эксперименталды және бақылау сабақтарының тестке дейінгі және кейінгі оқу нәтижелерінің арасында айырмашылық бар деп қорытынды жасауға болады. Бұл айырмашылықтар Манн-Уитни сынағы арқылы талданған. Mann-Whitney тесті негізінде Asymp.Sig мәні белгілі, 0,000 ықтималдық мәні <0,05-тен кіші. Сонымен, эксперименталды және бақылау сыныптары арасында жоғары дәрежелі ойлау дағдыларының айырмашылығы бар деп қорытынды жасауға болады, мұнда эксперименталды топтың орташа мәні бақылау тобының орташасынан жоғары. Аралас оқытуды қолдану бастауыш V сыныптағы жаратылыстану сабақтарында оқушылардың жоғары дәрежелі ойлау дағдыларына айтарлықтай әсер етеді деп қорытынды жасауға болады. Мақалада аталмыш зерттеудің нәтижелері талданады.

Кілт сөздер: аралас оқыту, жоғары деңгейлі ойлау дағдылары, ғылым, эксперимент, тест.

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Эффективность смешанного обучения в навыках мышления высшего порядка для естественных наук в начальной школе

Аннотация. Цель этого исследования состояла в том, чтобы определить эффективность смешанного обучения навыкам мышления высшего порядка для учащихся пятого класса при изучении естественных наук. В данном исследовании используются экспериментальные методы исследования. Субъектами этого исследования были учащиеся пятого класса государственной начальной школы №2 Реджосари и государственной начальной школы Нгегот с 56 учащимися в качестве экспериментального класса и класс V государственной начальной школы №1 и 3 Реджосари в районе Миджен-Демак с 46 учащимися в качестве экспериментального класса. Эффективность этой модели смешанного обучения можно увидеть из результатов теста N-Gain score, где в экспериментальном классе средний прирост результатов обучения учащихся составляет 0,43 в средней категории, а в контрольном классе – в низкой категории со средним показателем 0,15. В то время как результаты теста Уилкоксона известны как Asymp.Sig. (двусторонний) 0,000. Таким образом, можно сделать вывод, что существует разница между дотестовыми и послетестовыми результатами обучения экспериментальных и контрольных классов. Эти

ISSN-p 2306-7365
ISSN-e 2664-0686

различия анализировали с помощью критерия Манна-Уитни. На основании критерия Манна-Уитни известно, что значение Asymp.Sig. (двусторонний) 0,000 меньше значения вероятности <0,05. Таким образом, можно сделать вывод, что существует разница в навыках мышления высшего порядка между экспериментальным и контрольным классами, где среднее значение экспериментальной группы больше, чем среднее значение контрольной группы. Можно сделать вывод, что применение смешанного обучения оказывает значительное влияние на навыки мышления учащихся высшего порядка на уроках естествознания в V классе начальной школы. В статье анализируются результаты данного исследования.

Ключевые слова: смешанное обучение, навыки мышления высшего порядка, наука, эксперимент, тест.

Introduction

The world of education is now faced with a new problem, namely the presence of Corona Virus Disease or better known as the corona virus or Covid-19. Various efforts have been deployed in the context of prevention to cut the chain of the spread of the corona virus. These efforts are proven by the government having implemented new policies. The new policy implemented by the government also applies to the education sector. In the education sector, the government and the education management team have formulated new policies as well as possible so that teachers and students can continue to carry out teaching and learning activities as they should [1]. The government has issued an official circular letter from the Ministry of Education and Culture, namely Circular Letter Number 4 of 2020 concerning the Implementation of Education Policies in the Emergency Period for the Spread of Corona Virus Disease (Covid-19). In the circular, it is explained about the implementation of the learning process from home or online distance learning (within the network) and offline (outside the network).

The impact of studying at home is that children prefer to play on cellphones than study, they forget their duties as students. Every day they only play cellphones, tasks that should be done at home are not done. This makes their thinking power low because they have forgotten the lessons they should learn. Whereas in the 2013 curriculum that is currently developing in Indonesia, the government demands a learning process that emphasizes Higher Order Thinking Skills (HOTS) [2]. This is in accordance with Government Regulation Number 32 of 2013 which states that the learning process in educational units is carried out interactively, inspiring, fun, challenging and motivating students to participate actively, as well as providing sufficient space for initiative, creativity, logic, independence according to talent interests and physical and psychological development of students.

The learning process that emphasizes the Higher Order Thinking Skill (HOTS) applies 5 competencies that must be mastered by students. These competencies are critical thinking, creative and innovative, collaboration and confidence [3]. The reality that occurs in the field is that many students have not mastered the HOTS competence, this is because students are not familiar with the HOTS learning process. However, the HOTS assessment module with the application of 4C in learning can lead students to think critically in problem solving [4]. Likewise, HOTS-based scientific learning can improve students' concepts and skills effectively [5].

Apart from student factors, teachers also have an important role in determining student success in learning. The teacher's lack of responsiveness in taking advantage of what students like today must be understood by the teacher, because by understanding the preferences of our students, we know what students want. Today's students are closer to Android phones, therefore we must use cellphones as a learning bridge that is close to the world of students, by using cellphones, student learning becomes fun, not boring, full of motivation, enthusiasm and attracts attention. For the learning process, teachers must master the HOTS-oriented learning process which includes aspects

of knowledge transfer, critical and creative thinking and problem solving. Teachers do not only use monotonous lectures in learning.

Based on the results of observations and interviews with fifth-grade teachers in several elementary schools in Dabin I, Mijen sub-district, Demak Regency, the environmental theme of Sahabat Kita, the fifth grade elementary school students, has not been as expected, which has not met the minimum completeness criteria (KKM) set by the school, namely 70. This is because their thinking power is low so that students do not understand the material that has been taught by educators and this has an impact on the difficulty of students analyzing Higher Order Thinking Skills questions.

Widana [6] reveals that the ability of students in Indonesia is very low. This ability is seen in understanding complex information, understanding theory, analysis, ability to carry out investigations, ability to use tools, procedures, and problem solving. The results of the international study PISA (Program for International Student Assessment) which includes reading literacy activities, mathematical literacy, and scientific literacy. Malang [7] also revealed that Indonesian students have very low achievements in: (1) understanding complex information; (2) theory, analysis, and problem solving; (3) use of tools, procedures and problem solving; and (4) conduct an investigation.

Trilling & Fadel [8] stated that the main skills that must be possessed in the context of the 21st century are the ability to think creatively, communicate, collaborate and solve problems. The use of appropriate learning models can improve students' higher-order thinking skills.

Based on several existing problems, this is what encourages researchers to conduct research that discusses the application of the blended learning model, which is expected to improve students' higher-order thinking skills in learning science. The researcher wants to do the research with the title "Development of a Blended Learning Model to Improve Higher Order Thinking Skills the Environmental Theme of Our Friends for Class V Elementary School Students.

Conceptual Framework. According to Brady in Ekawarna [9] states that the definition of a learning model is a blueprint (basic framework) that can be used as a guide for making or compiling learning preparations and then implementing them. Meanwhile, according to Joy & Well in Rusman [10] states that the learning model is a design that can be used to develop learning plans in the long term. So, the learning model is the basic framework that is used as a guide for preparing long-term learning plans.

Husamah [11] said that blended learning is a term that comes from English, which consists of two syllables, blended and learning. Blended means a good mixture or combination. Blended learning is basically a combination of the advantages of learning that is carried out face-to-face and virtually. Meanwhile, according to Singh [12] blended learning is defined as a learning process that utilizes various approaches. The approach taken can utilize various kinds of media and technology, where students and educators interact directly, each can exchange information about teaching materials), independent learning (learning with various modules that have been provided) and online independent learning. From some of the opinions above, it can be concluded that blended learning is a combination of the advantages of learning that is carried out face-to-face and virtual whose approach is carried out by utilizing various kinds of media and technology, as well as online independent learning.

Semler in Husamah [11] asserts that: «Blended learning combines the best aspects of online learning, structured face-to-face activities, and real-world practice. Online learning systems, classroom exercises, and on-the-job experiences will provide valuable experiences for them. Blended learning uses an approach that empowers other sources of information».

While Stein & Graham [13] stated «Blended course as a combination of onsite (i.e face-to-face) with online experiences to produce effective, efficient, and flexible learning». From this definition it is said that blended learning is a combination of conventional learning (face to face) with online learning to produce effective, efficient and flexible learning. Blended learning can

ISSN-p 2306-7365
ISSN-e 2664-0686

combine the positive aspects of two learning environments, namely learning done in the classroom with learning with technology media.

According to John Watson in Husamah [11] the characteristics of blended learning are as follows; (1) Learning that combines various delivery methods, teaching models, learning styles and various technology-based media. (2) As a combination of direct or face-to-face teaching, independent learning, and online learning. (3) Learning that is supported by an effective combination of delivery methods, teaching methods and learning styles. (4) Teachers and parents of learning participants have the same important role, teachers as facilitators, and parents as supporters.

According to McCabe & Gonzalez-Flores [14] states that higher order thinking skills are a capacity above the information provided, a critical attitude to evaluate, have metacognitive awareness and have problem solving abilities. According to Stein in Conklin [15] higher order thinking uses complex, non-algorithmic thinking to complete a task, some of which are unpredictable, using a different approach to the existing task and different from the example. Based on some of these opinions, it can be concluded that higher order thinking skills are a complex thought process in solving a problem and critical in evaluating both in existing tasks and those that are different from examples.

Aspects of higher order thinking skills are divided into three parts, namely transfer of knowledge, critical and creative thinking and problem solving [16].

Zusi Hermawati & Anugraheni [17] states that the implementation of the blended learning model in mathematics learning towards higher order thinking skills and student learning activities of class VII SMP 2 Bangsri in data presentation material has been successful, this can be seen by increasing student learning activity at each meeting, namely 15 .18% for the second meeting and 12.09% for the third meeting. Overall, the average percentage of student learning activity is 83.33% in the high category.

Waisah et al. [18] stated that there was an effect of POE based on blended learning on Higher Order Thinking Skills in junior high school students. The results showed that the posttest value of Higher Order Thinking Skills was obtained t count = 5.256, with t table = 1.673 (t count > t table) so that the Blended-based POE learning model had a significant difference compared to the STAD type cooperative model. Analysis with simple linear regression test obtained a regression equation, Y = 4.305 + 0.960 X which indicates that learning activities using the blended-based POE model have a positive effect.

Research Objectives. The aims of this study are Analyzing the effectiveness of the blended learning model to improve students' Higher Order Thinking Skills in the water cycle material for science lessons for elementary school students in Mijen sub-district, Demak Regency.

Research methods

Research Design. The research approach used is quantitative. The quantitative approach is research whose data is in the form of numbers and the analysis uses statistics [19]. This study uses experimental research methods. Experimental research is research that examines causal relationships. This type of research is a true experiment with a pretest posttest control group design. This study uses experimental research methods. The subjects in this study were fifth grade students at Public Primary School Number 2 Rejosari 2 and Public Primary Schoo Ngegot with 56 students as the experimental class and Class V at Public Primary School Number 1 Rejosari and 3 in Mijen Demak District with 46 students as the control class.

Respondents of the Study. According to Sugiyono [20] population is an object or subject that has certain qualities and characteristics in the area of generalization, applied to be studied and then concluded by researchers. In this study, the population was all elementary schools in Demak Regency, totaling 476 public elementary schools and 147 private elementary schools. According to Sugiyono [20], the sample is a population that has part of the number and characteristics. The

sample in this study was 23 students from Public Primary School Number 1 Rejosari, 26 from Public Primary School Number 2 Rejosari, 23 from Public Primary School Number Number 3 Rejosari and 30 students from Public Primary School Ngegot, Mijen District, Demak Regency.

Results and Discussion

In this effectiveness test, it is carried out by means of a statistical test of normalized gain score or N-Gain score based on student learning outcomes. The N-Gain score aims to determine the effectiveness of using a method in one group pretest posttest design research and research using experimental and control groups. Gain score is the difference between the posttest and pretest scores. In a one group pretest posttest design study, the N-Gain score test can be used when there is a significant difference between the average pretest and posttest scores. This research shows that the experimental class and control class come from a population with an abnormal distribution, so that the comparative test uses the Wilcoxon Test and the Mann Whitney Test.

In addition, the effectiveness of the implementation of the development of this learning model is also presented descriptively based on the results of observations during the learning process. The application of this model development is effective in learning with the result that student scores are higher than those that do not use the blended learning model. The learning process is efficient, where teachers are able to convey learning through various media, students are able to follow directions from the teacher, students are able to work together with students, students are able to solve problems well. With the effectiveness of the learning process, the learning objectives are achieved optimally. The application of the learning model is said to be effectives; it can be seen from the learning process. The effectiveness of the developed model was measured using a comparison of the improvement in student learning outcomes given in the early learning and final learning using the blended learning model.

Normality Test. The results of calculating the normality of the data in the experimental class and control class are presented in table 1 below.

Table 1 – Normality Test Results

Tests of Normality							
		Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Kelas	Statistic	df	Sig.	Statistic	df	Sig.
Student learning outcomes	Pre-Test Experiment	.275	56	.000	.762	56	.000
	Experimental Test Post	.254	56	.000	.878	56	.000
	Pre-Test Control	.271	46	.000	.754	46	.000
	Control Test Post	.224	46	.000	.896	46	.001
a. Lilliefors Significance Correction							

Based on Table 1 Tests of Normality Kolmogorov-Smirnov obtained a significance value of Sig. = 0.00 in the experimental class and the control class. When compared with = 0.05, the value of Sig <, so it can be concluded that the experimental class and control class come from populations with abnormal distributions, so that the comparative test uses the Wilcoxon Test and Mann Whitney Test.

Homogeneity Test. The homogeneity test was used to determine whether there was a similarity in variance between the experimental class and the control class. Homogeneity test results are presented in Table 2 below.

Table 2 – Test of Homogeneity of Variances

Student learning outcomes			
Levene Statistic	df1	df2	Sig.
1.793	1	100	.184

ISSN-p 2306-7365
ISSN-e 2664-0686

Table 2 above shows that the score variance (Sig.) is 0.184 at the significance level = 0.05. Thus, the calculated score is greater than = 0.05. This proves that the experimental class and control class come from the same variance class.

N-Gain Test. The average increase in student learning outcomes can be seen from the difference between the pretest and posttest results. The results of the increase were measured using the normalized gain test. Details of the results of individual improvement in the experimental class and control class can be seen in Table 3.

Table 3 – Increasing the Gain Index of Student Learning Outcomes

No	Improvement Category	Experiment Class		Control Class	
		Average Increasing	the number of students	Average Increasing	the number of students
1	High	0,82	8	0	0
2	Medium	0,51	29	0,46	10
3	Low	0,14	19	0,07	36
Overall average		0,43 (medium category)		0,15 (low category)	

From the results of Table 3 it can be seen that in the experimental class 8 students experienced an increase in the high category, 29 students experienced an increase in the medium category, and 19 students experienced an increase in the low category. The average increase in student learning outcomes is 0.43 in the medium category. In the control class there were no students who experienced an increase in gain in the high category, 10 students experienced an increase in the medium category, and 36 students in the low category with an average of 0.15 in the low category. This indicates that the use of the Blended Learning model is proven to be able to improve student learning outcomes in the experimental class by using HOTS questions.

Comparative Test. The increase in student learning outcomes in the experimental and control classes was analyzed using the Wilcoxon test. The experimental class Wilcoxon test results are listed in Table 4 below.

Table 4 – Wilcoxon Test Results Experimental Class Student Learning Results

Test Statistics[a]	
	Postest - Pretest
Z	-6.272[b]
Asymp. Sig. (2-tailed)	.000
a. Wilcoxon Signed Ranks Test	
b. Based on negative ranks.	

Based on the output of the Wilcoxon test in Table 4 above, it is known that Asymp.Sig. (2-tailed) is worth 0.000. Because the value of 0.000 is smaller than <0.05, it can be concluded that there is a difference between the pre-test and post-test learning outcomes of the experimental class, so it can be concluded that the use of the Blended Learning model has an effect on the learning outcomes of the experimental class.

Table 5 – Wilcoxon Test Results Student Learning Outcomes Control Class

Test Statistics[a]	
	Postest - Pretest
Z	-4.786[b]
Asymp. Sig. (2-tailed)	.000
a. Wilcoxon Signed Ranks Test	
b. Based on negative ranks.	

Based on the output of the Wilcoxon test in Table 5 above, it is known that Asymp.Sig. (2-tailed) is worth 0.000. Because the value of 0.000 is smaller than <0.05, it can be concluded that there is a difference between the pre-test and post-test learning outcomes of the control class. Differences in student learning outcomes in the experimental class with the control class were analyzed by the Mann Whitney Test. The results of the Mann Whitney test are listed in Table 6 below.

Table 6 – Mann-Whitney Test Results Student Learning Outcomes

Test Statistics[a]	
	Student learning outcomes
Mann-Whitney U	686.000
Wilcoxon W	1767.000
Z	-4.144
Asymp. Sig. (2-tailed)	.000
a. Grouping Variable: Class	

Based on the output of the Mann Whitney Test Table 6 above, it is known that the value of Asymp.Sig. (2-tailed) of 0.000 is smaller than < 0.05 probability value. So, it can be concluded that there is a difference in learning outcomes between the experimental class using the blended learning model and the control class, where the average of the experimental group is more than the average of the control group.

The results of this study are in accordance with the research conducted by Wulandari & Purwanta [21] stating that based on the results of the calculations obtained from this study, the calculation of the normality test, and the homogeneity test of the data obtained were homogeneous and normal, then continued with the parametric test hypothesis test showing a significance level of 0.003 smaller than Sig < 0.005 which means that Ho is rejected and HI is accepted. Then the second result of the data on the Self Confidence hypothesis test with the Independent Sample T test shows a significance level of 0.000 which is smaller than Sig < 0.005 which means that Ho is rejected and HI is accepted. The results of the statistical test above show that there are differences in higher order thinking skills after and before the Quipper School-based Blended Learning model. Looking at the average results of the Posttest experimental class 1 compared to the experimental class 2, it can be concluded that the Quipper School-based Blended Learning model affects students' higher-order thinking skills on the subject of Harmonic Vibration.

Yusuf et al. [22] states that one of the main purposes of using blended learning in the learning process is to motivate students. The results of the literature review on motivation in the context of learning with blended learning and the use of multimedia, show that researchers and practitioners consider a number of important aspects to ensure that motivation is an integral part of learning resources to optimize student experience. The results showed that 46% of students liked the use of multimedia in learning, followed by 35% happy. Learning media that are in accordance with the needs are learning media that can help teachers and students in the process of transfer of knowledge.

A similar study was also conducted by Cobanoglu & Yurdakul [23] with the title "The effect of blended learning on students' achievement, perceived cognitive flexibility levels and self-regulated learning skills" which concludes that: (1) The results of the study show that there is a significant difference between motivation and student achievement. using the blended learning model and students using the face-to-face learning model, (2) there is a significant increase in student motivation and achievement due to the application of the blended learning model and (3) there is no interaction effect of the application of the learning model and motivation on student achievement.

ISSN-p 2306-7365
ISSN-e 2664-0686

Research conducted by Farihah et al. [24] suggests that the blended learning model affects student motivation and learning outcomes, where with the use of the blended learning model students look more enthusiastic and motivated to learn because the use of technology facilitates the learning process where learning resources can be accessed. anytime and anywhere. Student motivation data generated in the experimental class using blended learning obtained an average score of 3.4 higher than the average score of students in the control class using direct learning, which was 2.7. While student learning outcomes in the experimental class showed a percentage of 91.66% and the control class of 59.09%.

Chontesa [25] states that there is an effect of the blended learning model on Higher Order Thinking Skills and class X biology learning independence. The main problem that occurs in the field is the low level of Higher Order Thinking Skills and student learning independence. This study aims to determine the effect of the blended learning model. on Higher Order Thinking Skills and learning independence in biology class X. This type of research is quantitative research with the Quasy method. This research was carried out at SMAN 3 Bandar Lampung in class X. Using the Direct Instruction model. The instruments used in this study were essay questions to measure Higher Order Thinking Skills, questionnaires to measure student learning independence, and field notes to describe the conditions that occurred during the study. The results showed that there were differences in the n-gain value of Higher Order Thinking Skills and the learning independence of students who used the blended learning model was higher than the Direct Instruction model. Based on the results of this study, it can be concluded that there is an effect of the blended learning model on Higher Order Thinking Skills and student learning independence. Pratama et al. studied a better achievement of competence and the developed teaching aids successfully had a positive impact on improving student achievement [26].

In line with the research conducted by Raviany [27] which states that there is an effect of applying blended learning on WhatsApp-based static electricity material on the components of students' higher-order thinking skills. This study aims to describe the effect of whatsapp-assisted blended learning on static electricity material on critical thinking skills and problem-solving abilities. This research is included in the quasi-experimental research or quasi-experimental design with the type of the non-equivalent control group design. All test data obtained data with normality distribution, homogeneity and independent sample t-test so that the data can be said to have significant differences in critical thinking skills and problem-solving abilities of students in the experimental class using blended learning and the control class using direct instruction learning. The conclusion of this study is that blended learning is able to improve students' critical thinking skills and problem-solving abilities, which can be seen from the test results of the two classes before and after learning.

Conclusions and Recommendations

The conclusion of this study is that the use of the blended learning model is proven to be effective in improving students' HOTS results. The effectiveness of this blended learning model can be seen from the results of the N-Gain score test which the result is that in the experimental class the average increase in student learning outcomes is 0.43 in medium category and in the control class in the low category with an average of 0.15. While the results of the Wilcoxon test are known as Asymp.Sig. (2-tailed) is worth 0.000. Because the value of 0.000 is smaller than <0.05, it can be concluded that there is a difference between the pre-test and post-test learning outcomes of the control class. Differences in student learning outcomes in the experimental class with the control class were analyzed by the Mann Whitney Test. Based on the Mann Whitney test, it is known that the value of Asymp.Sig. (2-tailed) of 0.000 is smaller than < 0.05 probability value. So, it can be concluded that there is a difference in learning outcomes between the experimental class using the blended learning model and the control class, where the average of the experimental group is more than the average of the control group. So, from these results it can be concluded that the application

of the blended learning model has a significant impact on students' HOTS in science lessons for grade V elementary school.

Acknowledgement. The researcher would like to thank the participation of Public Primary School Number 1, 2, 3 Rejosari and Public Primary School Ngegot in Mijen District, Demak Regency. The researcher would also like to thank the postgraduate student and supervisior of Muria Kudus University for their guidance and direction towards the result of this research.

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