J. Pijar MIPA, Vol. 17 No.5, September 2022: 609-617 ISSN 1907-1744 (Cetak)
DOI: 10.29303/jpm.v17i5.3607 ISSN 2460-1500 (Online)

ANALYSIS OF HIGHER-ORDER THINKING SKILLS OF SCIENCE STUDENTS AT MADRASYAH TSANAWIYAH MUSLIM NAHDATUL ULAMA DURING THE COVID-19 PANDEMIC

Adinda Dwi Saputri Sugino* and Erman
Department of Science Education, Faculty of Mathematics and Natural Sciences, Universitas Negeri Surabaya, Indonesia
*Email: Adinda.18021@mhs.unesa.ac.id

Received: June 2, 2022. Accepted: August 15, 2022. Published: September 30, 2022

Abstract: This study aims to describe the higher-order thinking skills of Muslim students of Madrasyah Tsanawiyah Muslim Nahdatul Ulama Sidoarjo Indonesia during the Covid-19 pandemic. The type of research is descriptive analysis with a quantitative approach by analyzing students' higher-order thinking skills on the structure and function of plant tissues, vibrations and waves, and the circulatory system. The subjects of this study were one science teacher and 36 students in the eighth grade. The research instrument consisted of a HOTS test sheet, questionnaire, and interview sheet. The interview sheet consists of 9 questions analyzed with NVIVO 12 software and a test containing five questions on each material, including the HOTS indicator. The data analysis technique used is descriptive statistics. The results showed a decrease in students' HOTS abilities during the pandemic. It is marked by the achievement of average scores and students' abilities in the creative component, which tended to be low in the three materials measured. The decline in students' HOTS abilities before and during the pandemic occurred in the three indicators with the most significant reduction, namely the creating indicator, followed by analysis and evaluation. During the pandemic, the implementation of HOTS-based learning takes place with various forms of adaptation. The difference in implementing HOTS-based learning lies in the frequency of implementing HOTS-based learning for each material and learning model used, and the learning steps. The results of this study can be used as input for science teachers to implement HOTS-based learning during the pandemic.

Keywords: *Adaptation, HOTS, Covid-19, Pandemic*

INTRODUCTION

The Covid-19 pandemic has significantly impacted survival in terms of economic, social, cultural, and educational [1]. The education sector has the most significant impact [2]. Conventional face-to-face learning methods are instantly converted into online or in-network learning [3].

Thinking is a basic ability for students to achieve learning goals [4]. High-order thinking skills are thinking skills that are more than just memorizing facts or concepts. The HOTS indicator consists of the ability to analyze (analyze), which is the ability to specify elements or materials, evaluate (evaluate), and create (create) [5]. The cognitive realms of C4 and C5 include critical thinking skills, while C6 is included in creative thinking [6].

According to the Ministry of Education and Culture, the ability to think at a high level is one of the critical competencies in the modern world, so every learner must own it. Critical and creative thinking is needed in solving problems because the rapid development of knowledge and technology has resulted in the challenges and problems humans will face in the 21st century becoming more complex [7]. Therefore, HOTS is the correct answer to prepare future generations for the challenges of the 21st century. Wardhani and Pohl concluded the results of testing HOTS Indonesian students by PISA and TIMSS showed that Indonesian students had not reached HOTS. The ability of hots students is getting lower during the pandemic while the challenges of the 21st century are increasing due to pandemic conditions that affect various sectors that require schools to produce students who can think critically and creatively in finding solutions to a problem. Therefore, HOTS-based learning during the pandemic is very important to do to improve the effectiveness of learning and students' thinking skills.

Science subjects are closely related to high-level thinking skills. In science learning, HOTS is a foundation by the nature of science, namely scientific processes, scientific products, and scientific attitudes [8]. Improving high-level thinking skills has become one of the priorities in science learning [9].

The application of HOTS-based learning in science learning during the pandemic conducted online should be able to improve students' high-level thinking skills. Implementing online learning will use digital technology and platforms that are more attractive to students. Online learning has flexibility in its implementation and can also encourage the emergence of learning independence and motivate to be more active in learning [10]. The process of studying facilitates learning and students' knowledge through meaningful action and interaction [11]. Especially now, through the internet, students can find more information and various learning media packaged

more interestingly through videos, games, and quizzes. Of course, this makes it easier for students to learn and develop their thinking skills. However, the conditions in the field are inversely proportional, and students' high-level thinking ability is getting lower during HOTS-based learning. It is based on the initial observation data of researchers at Madrasyah Tsanawiyah Bilingual Muslimat NU Pucang Sidoarjo.

Madrasah Tsanawiyah Bilingual Muslimat NU Pucang Sidoarjo is a school that, since 2018, has been carrying out HOTS-based learning. Learning is carried out with a scientific approach and 5C learning methods (Critical Thinking, Creative, Communication, and Collaboration). The implementation of HOTS-based learning that has taken place has been forced to undergo adaptation due to the Covid-19 pandemic. During online learning, the school set a policy to transition teaching materials that were originally in the form of books into digital teaching materials. Before the pandemic, many activities were oriented to student HOTS such as practicum. However, the activities were not implemented during the pandemic. Practicum activities can stimulate students' ability to analyze, provide arguments, evaluate and make conclusions where the four points affect the student's HOTS ability [12].

The incompatibility of the expected conditions with the reality in the field resulted in researchers wanting to study the ability of HOTS students along with the form of hots-oriented learning implementation during the pandemic, which will be carried out at Madrasyah Tsanawiyah Bilingual Muslimat NU Pucang Sidoarjo, Indonesia. The aim is to determine the cause of the decline in students' HOTS ability during the pandemic.

RESEARCH METHODS

The type of research used is descriptive analysis research by analyzing students' HOTS abilities during the Covid-19 pandemic in science learning in materials 1) Plant Tissue Structure and Function, 2) Circulatory System, 3) Vibrations and Waves and learning implementation that orientates HOTS during the pandemic.

The research was conducted at Madrasyah Tsanawiyah Bilingual Muslimat NU Pucang Sidoarjo with a science teacher and 36 students in the eighth grade. The science teacher is a three-material mixer that will be measured by applying HOTS-based science learning during the pandemic with adaptations. Class VIII-I students are students who overall participate in online learning starting from the 2020/2021 school year. Research sample acquisition techniques use purposive sampling techniques.

This research instrument consists of questionnaires, interviews, and tests. The questionnaire sheet contains a statement about the achievements of students' HOTS abilities. Five statements represent each indicator. The questionnaire uses the Likert scale criteria, which consist of four answer options, namely Strong Disagree (SD), Disagree (D), Agree (A), and Strongly Agree (SA). The description of the HOTS capability indicator is presented in Table 1.

Table 1. Student HOTS Ability Questionnaire Indicator

Indicator	Question Number
Analysis	1,2,3,4,5
Evaluation	6,7,8,9,10
Created	11,12,13,14,15

Questionnaire instruments are tested for validity and reliability before being used in research. The validity test is performed with Product Moment Pearson correlation analysis. The result shows $r_{calculate} > r_{table}$ on each statement at a significance level of 5%, so the instrument can be said to be valid. The reliability test was conducted with Alpha Cronbach analysis and obtained a significance value of 0.667. If the value of $\alpha > 0.6$, the instrument can be said to be reliable [13].

The test instrument contains five essay questions in each material with the cognitive realms of C4, C5, and C6. The test question instrument is a question that the school has used for determining students' HOTS capabilities before the pandemic. The supervisor has approved it as a research instrument. The test was given to know students' ability to solve HOTS-based questions resulting from learning during the pandemic. The results of the student writing test can be seen through the score obtained by the student, which is with a maximum score of 100.

Table 2. Student HOTS Test Indicator

HOTS Indicator	Question Number
Analysis	1,2
Evaluation	3,4
Created	5

Test the validity of the test using Pearson's Product Moment correlation technique resulted in $r_{calculate} > r_{table}$ at a significance level of 0.05, which is declared valid. The reliability test was conducted with Alpha Cronbach analysis, obtaining a significance value of 0.698. An $\alpha >$ value of 0.6 is concluded that the test instrument is reliable.

Interview sheets are structured using structured interview types. The student interview instrument contains the student's HOTS ability. Meanwhile, the teacher interview contained the implementation of learning and HOTS-based learning barriers during the pandemic. The question

in the interview is adapted from the statement on the questionnaire. The interview sheet instrument has been tested for validity using a construct validity test obtained by being tested by an expert lecturer, namely a supervisor.

Data collection techniques used are tests, observations, interviews, and documentation. The implementation of research consists of pre-field stages, research, and data analysis. The pre-field stage includes interviews with science teachers at school to find out the process of student learning activities during the pandemic.

The next stage is the research stage which begins with test activities, interviews, observations, and documentation. The test is done offline with a working time of 90 minutes. The next stage is observations made indirectly. The observation was carried out by providing questionnaires for implementing HOTS-based learning for teachers, and student response questionnaires were given online.

In the next stage, interviews with teachers and students are conducted online through google meet. The interview technique used is a structured interview using question guidelines that have been adjusted to the context of the discussion in the research. Interviews will be conducted with students with the five highest and lowest grades on each material.

The data of test results, questionnaires, and interviews are corroborated with documentation data. The documentation used is a learning device in the form of RPP before and during the pandemic, data on students' HOTS ability before the pandemic obtained from test scores provided by schools, and teaching materials used during learning before the pandemic and during the pandemic.

The method used in data processing is statistically descriptive. Student response questionnaire results data are presented as descriptive statistical data. The results of the student's answer on each statement will be calculated in numbers to obtain the total score result, which is then calculated using the percentage formula. Furthermore, students' HOTS abilities obtained through questionnaires will be categorized with criteria according to Table 3.

Table 3. Percentage Value Category

Percentage Interval Limit	Rating Categories
0% - 20%	Very Low
21% - 40%	Low
41% - 60%	Keep
61% - 80%	High
81% - 100%	Very high

Data on HOTS test scores before and during the pandemic are presented statistically descriptively to obtain maximum, minimum, and average value data on each material tested in the test. The results of the student's answer will be calculated as a large percentage of each HOTS indicator on the question. Furthermore, to categorize students' HOTS abilities through the average value data of each material, the criteria are used in Table 4. The results of the analysis of students' HOTS ability categories before the pandemic and during the pandemic will be compared to find out the increase or decrease in achievement [14].

Table 4. High Level of Thinking Ability Level Category

Student Grades	High Level of Thinking Ability Level
80 < value ≤100	Excellent
60 < value ≤ 80	Good
40 < value ≤ 60	Enough
20 < value ≤ 40	Less
0 < value ≤ 20	Very Lacking

Student interview data is analyzed using Nvivo 12 software. Nvivo 12 software can encode data effectively and efficiently. The data processing step is to start by collecting interview data and then imported into NVivo 12 software. Then the interview data coding step is carried out and chooses the Matrix Coding Comparison feature to assist researchers in analyzing categories on each hots capability indicator. The interview analysis data will be compared with the student's answers on the questionnaire sheet, and the test results are then analyzed to whether the questionnaire data is relevant to the interview data. If all three are relevant, then the interview data can strengthen the answers to the student questionnaire. Teacher interview data is only used to support the achievement of students' HOTS abilities, so they are only presented descriptively.

The next step is analyzing the lesson plan on all three materials before and during the pandemic. This lesson plan analysis focuses on methods and steps that show the implementation of HOTS-based learning.

RESULT AND DISCUSSION

The results of data on students' high-level thinking skills in science learning during the pandemic are presented in descriptive statistical data in Table 5.

Table 5 shows that in the material of the Circulatory System, an average value of 72.75 categories is obtained, both with a minimum value of 50 and a maximum of 95. The material Structure and Function of Plant Tissue obtained an average

value of 68.47 categories, both with a minimum value of 55 and a maximum of 85. Vibration and Wave Material obtained an average value of 65 categories, both with a minimum value of 45 and a maximum of 80. The highest average value achievement is in the material of the circulatory system, and the lowest is in the vibrational and wave material.

Table 5. Descriptive Analysis of Students' HOTS Proficiency Test Results During Online

Descriptive Statistics	Circulatory System	Structure and Function of Plant Tissues	Vibrations and Waves
Valid	36	36	36
Missing	0	0	0
Mean	72.75	68.47	65.00
Std. Deviation	11.724	7.636	7.559
Variance	137.450	58.313	57.143
Range	45	30	35
Minimum	50	55	45
Maximum	95	85	80

Table 6. Percentage of Student HOTS Ability Test Results During Online

HOTS Capability Indicator	Material	Percentage	Category
Analysis	Circulatory System	76%	High
Evaluation		80%	High
Created	Structure and Function of Plant Tissues	68%	High
Analysis	Material	80%	High
Evaluation		76%	High
Created		68%	High
Analysis	Circulatory System	74%	High
Evaluation		67%	High
Created		56%	Keep

Table 6 shows that the material of the Blood Circulation System that the highest ability is in the evaluation question indicator of 80%, followed by the analysis of 76%, and finally created 68%. The material The Structure and Function of Plant Tissue obtained the largest percentage, namely the indicator of the analysis problem by 80%, followed by an evaluation of 76% and creating 68%. In vibration and wave matter, the largest percentage is analysis at 74%, followed by evaluation at 76% and creating at 56%. Of the three materials tested, the percentage of questions with the lowest value achievement is in the creating indicator. All indicators get a good category unless the indicator creates vibrational material and waves that are categorized sufficiently.

Table 7. Descriptive Analysis Results of Student HOTS Ability Questionnaires Reviewed from All Indicators

Descriptive Statistics	HOTS Capability Questionnaire
Valid	36
Missing	0
Mean	45.39
Std. Deviation	8.110
Variance	9.673
Range	14
Minimum	37
Maximum	51

HOTS capabilities are analyzed with three indicators, namely 1) analysis, 2) evaluation, and 3) creating. The percentage of students' HOTS ability in science learning during the pandemic period is presented in Table 8.

Table 8. Percentage of student HOTS Ability

HOTS capability indicator	Percentage of Achievement (%)	Category
Analysis	85	Very High
Evaluation	76	High
Created	60	Keep

Based on Table 5, it is known that the average score of the student's HOTS ability questionnaire of 45.39 Standard deviations is 8,110, with maximum and minimum values of 37 and 51. The percentage of students' HOTS ability in table 6, the highest percentage of HOTS capability achievement is in the analysis indicator of 85%, which belongs to the excellent category, followed by an evaluation indicator of 76% good categories and finally creating 65% of good categories. Based on the results on the results of student test scores and evidenced by the student's ability questionnaire, the analysis indicator is highly rated. This is evidenced by the results of student interviews analyzed in Figure 1.

Figure 1 indicates that in the sub-indicators of analysis with the highest achievements, students can rationalize and correlate problems with the information, followed by the ability to identify problems.

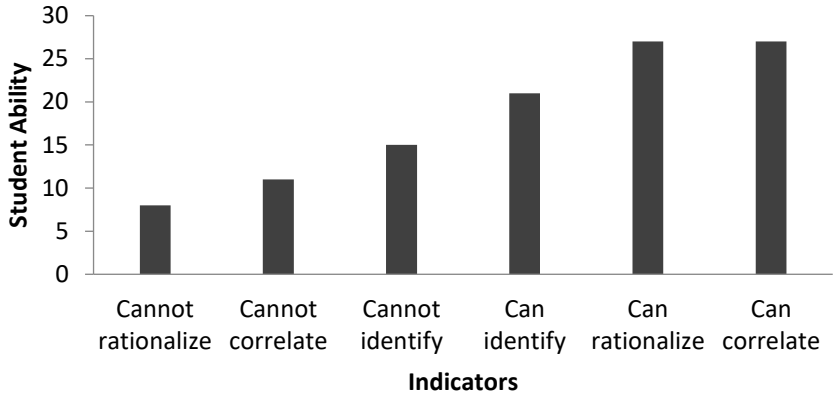

Figure 1. Comparison of sub-categories on analysis indicators

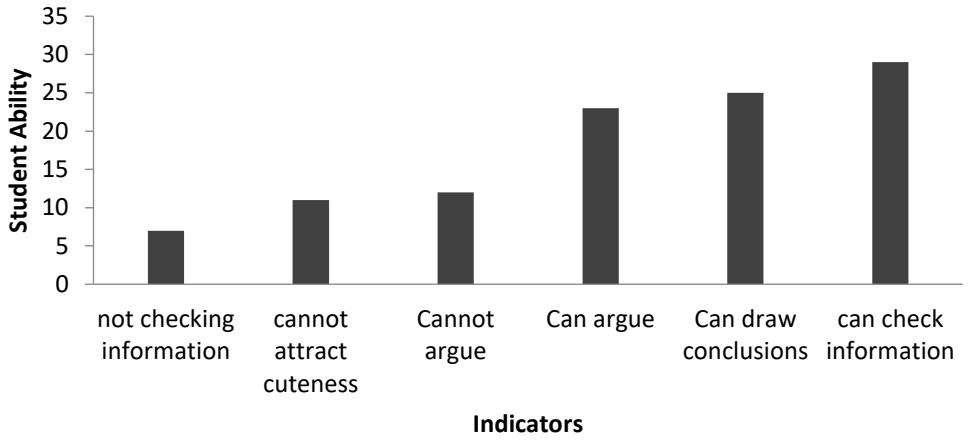

Figure 2. Comparison of sub-indicators on evaluation indicators

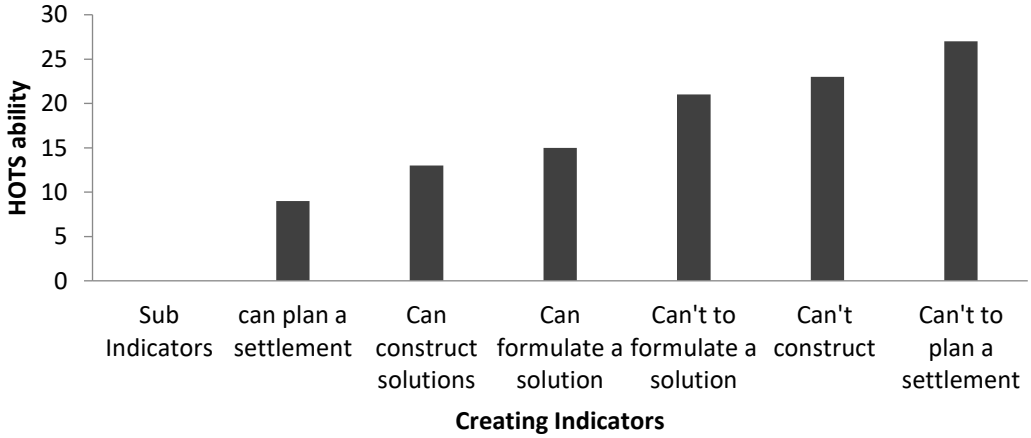

Figure 3. Comparison of Sub-indicators on Creating Indicators

Figure 2 shows that the evaluation indicator of the results of the student interview states that the highest ability is in the sub-indicator to check the information followed by concluding to decide the acceptance or rejection of the concept to be used to solve the problem found, the last is to be able to argue or convey criticism about the information.

Based on the results of the percentage of students' HOTS ability in table 8, it is obtained that the indicator with the lowest achievement is a creating indicator (C6). Figure 3 indicates that the results of student interviews are obtained that more students are less able to plan for completion, then they cannot construct completions and cannot formulate solutions.

Supporting the data of test results, questionnaires, and interviews that show that all three materials obtained the lowest ability in the creating indicator. The matter of creating indicators (C6) always consists of evaluation indicators (C5) and analysis (C4). The following is an example of the results of students' answers to the HOTS indicator problem created on each material.

Table 9. Student Answer Results on Creating Indicator Questions

Material	Question	Answer
Circulatory System	*Someone who often feels tired has a weak, irregular heartbeat and often faints, one of the characteristics of people with disorders of the circulatory system. Identify what disease you are suffering from and what solutions can be given!*	*The person suffers from anemia caused by a lack of red blood cells or red blood cells not functioning properly. The solution that can be done is to consume healthy food to accelerate the regeneration of red blood cells.*
Structure and Function of Plant Tissues	*The science teacher of Tisya and Excel ask them to do an experiment to know how the effect of the spectrum color of light on the rate of photosynthesis. They should prepare some materials and tools such as Hydrilla plant, stopwatch, colorful plastic, Erlenmeyer, and water. Help them to make an experiment design!*	*Title: the effect of the light spectrum on the rate of plant photosynthesis.* *Problem: how is the effect of the light spectrum on the rate of plant photosynthesis?* *Objective: To know the effect of the light spectrum on the rate of plant photosynthesis* *Hypothesis: The spectrum color of yellow can make the rate of photosynthesis faster.*
Vibrations and Waves	*A cork was floating in the water and formed two crests and two valleys with a distance of* 100 cm *in* 10 s. *My teacher asked all of the students to count the velocity of the wave. My answer is different from my seatmate's. Help me to construct the answer of my seatmate.* *This is the answer of my seatmate* T = $\frac{n}{ot} = \frac{2}{10} = 0.5\ s$ V = $\frac{\lambda}{T} = \frac{100\ \text{cm}}{0.5\ s}$ = 200 cm/s	*Given :* s = 100cm t = 10 s n = 2 *Question :* v = …… ? *Answer :* V = λ . f

Table 10. Descriptive Analysis of Student HOTS Proficiency Test Results

Descriptive Statistics	Circulatory System	Structure and Function of Plant Tissues	Vibrations and Waves
Valid	36	36	36
Missing	0	0	0
Mean	82.89	78.82	78.61
Std. Deviation	7.501	8.655	7.561
Variance	56.259	74.911	57.164
Range	25	40	35
Minimum	70	55	60
Maximum	95	95	95

Table 9 shows that students' answers to the question of creating indicators (C6) of each material are not completed completely. The overall data obtained from the results of the analysis of students' HOTS abilities during online learning during the next pandemic was compared to the results of students' HOTS abilities before the pandemic in Table 10.

Table 10 shows that the material of the circulatory system obtains the highest average of 82.89, followed by the material structure and function of plant tissue of 78.82 and finally vibration and waves of 78.61. All three materials

obtained the "good" or high HOTS capability category.

The implementation of HOTS-based learning at MTs. Bilingual Muslimat NU Pucang Sidoarjo before the pandemic took place quite optimally with the frequency of HOTS-based learning at least three times in one topic of discussion, the learning model used includes problem-based learning and inquiry with a scientific approach and methods supporting where 21st-century learning is learning oriented HOTS that can stimulate students' thinking skills as well as position students more active in learning [15]. Teachers provide learning evaluations in the form of HOTS-based questions of at least five items per meeting as reflection material for learning activities in the future. Practicum is also carried out as an activity to support the implementation of HOTS-based learning, followed by results discussion activities and report preparation. During the pandemic, the implementation of HOTS-based learning has changed, including the frequency of HOTS-based learning, which is at least given once in one discussion topic, learning models with problem-based learning but using lecture methods so that students can be less active in learning activities. The provision of learning evaluations in the form of HOTS questions is only given when the material has been discussed in its entirety. Practicum activities are changed only by the provision of worksheets containing orders to conduct literature studies over the internet regarding the material discussed.

The student's HOTS ability on three materials obtained different average results with the lowest scores on vibration and wave material, according to table 5. The difference in grades is associated with the results of teacher interviews; it is stated that vibration and wave material is difficult because it involves many formulas and concepts that are difficult for students to understand. The vibrational matter is abstract, so it requires high thinking skills to understand concepts and compare them with symptoms in everyday life [16].

HOTS capability indicators are divided into analysis, evaluation, and creation. Table 6 shows that in each material, the indicator creates obtaining the lowest percentage, especially in vibrational and wave materials with sufficient categories. The test results are also supported by the results of the percentage of student questionnaires with the lowest creation indicators, according to Table 6. Furthermore, these results are confirmed by the results of student interviews that have been analyzed using the NVivo application. Indicators of student analytical skills are presented in figure 1 that students with High category analysis abilities can identify a problem by observing, sorting, and determining patterns of informational relationships with problems [17]. The results are also supported by the teacher's statement that during online learning, teachers more often provide exercises about problem analysis so that students' ability on these indicators tends to be high.

Figure 2 shows that the ability of students on the evaluation sub-indicators. The results of the sub-indicator analysis support the results of a thorough analysis of the ability of student evaluation indicators obtained a percentage value of 76% in the high category. Students with the ability of high category evaluation indicators have been able to examine and criticize and draw conclusions in terms of deciding the selection of concepts used against a solution to the problem encountered.

Figure 3 obtained the results of the analysis of sub-indicators created, which obtained the lowest percentage value of the three materials. Overall, students are less able to formulate, plan and construct a solution or concept of matter. Students with ability categories on low indicators are less likely to be able to formulate, structure, plan, and illustrate a solution [16]. The results are also supported by the teacher's statement that during the pandemic, students are less directed to draw up plans and frameworks for solving problems. Teachers stated that the shortage of students achieving the ability to create because online students are rarely given problem-based descriptions. The low intensity of students working on story questions results in a lack of student ability to compile solutions which is the cognitive ability of C6 (creating) [6].

Based on the results that have been discussed, the form of students' HOTS ability in each material and each student has a different pattern, but the similarity is in the achievement of the created indicator that has the lowest percentage in each material obtaining a percentage of hots ability indicators analyze 46%, evaluating 27% and creating 23% [6] then the indicator analyzes by 45%, evaluates by 33%, and creates 22%. The results of the study on these three materials by categorizing HOTS ability from the average test score results of each material obtained in the good or high category with the high HOTS (T) ability category are only able to overall meet the C4 and C5 levels while not yet able to meet the overall C6 level [17].

The indicator created with the lowest percentage on each material made the researcher further analyze the student's answers regarding the given questions, as presented in Table 9. In the material of the Circulatory System, students can solve the problem by identifying the form of the disease and the cause to provide a solution. Therefore, the ability to create in the material of the Circulatory System is calculated to be the greatest. In the material structure and function of plant

tissue, students have been able to choose the title and topic of investigation to be carried out, along with the formulation of problems, goals, and hypotheses that indicate students have been able to meet the C4 and C5 indicators. However, students cannot write down the steps of the investigation. In the vibration material gan wave, students are asked to construct the concept according to the problem encountered. Students can write known and asked, which is an ability in analytical indicators. Furthermore, students can also write the appropriate formula to solve problems on questions that are interpreted by students to meet the ability of the C5 indicator. Furthermore, on the C6 indicator, students cannot continue solving the problem by searching the magnitudes λ and f to determine the value v sought.

Table 10 shows that there is a decrease in the average value of students' HOTS ability during the pandemic compared to before the pandemic. Based on the results of teacher interviews, the decline in the student's HOTS ability is most likely due to a form of adaptation during learning during the pandemic. The online learning lesson plan uses a problem-based learning model with lecture methods. Another difference is the learning step. For example, learning the Circulatory System material and lesson plan before the teacher pandemic provides an initial stimulus by inviting students to feel their pulse, while the teacher's online learning provides an initial stimulus in the form of analysis. This is influential because learning by providing experience to students will be more meaningful if students directly feel what is learned or observed [18]. Meaningful learning in science materials successfully improves critical and creative thinking skills [19]. Analysis Component before the pandemic, the teacher provided freedom for students to look for an event or problem related to the material topic. Meanwhile, during the pandemic, this activity was adapted with teachers providing worksheets through google classroom, which contained a description of the problem, and students only found the main problem of the problem. In the evaluation component, the activities carried out are by discussing and giving rebuttals or suggestions to the opinions of friends after making a presentation of the results of discussions or practicum reports. In the creating component, before the pandemic, the teacher asked students to discuss drafting a solution to a problem or devising a step to identify a problem that has been selected in the problem analysis activity. The difference in the implementation of HOTS-based science learning before the pandemic and during the pandemic is also due to time constraints. Online learning time is very limited, while science materials are quite a lot [20]. The decline in HOTS ability can also be due to the influence of the student's personality. Internal and external factors of students can affect learning conditions. Internal factors consist of attention, intelligence, interest, motivation, readiness, and fatigue of students. External factors include the atmosphere of the house and the surrounding environment, the state of the economy, and teachers as teachers.

The results of this study are thorough by Dhiniaty's research, that online learning during the Covid pandemic affects the decline in thinking skills, including thinking mathematically.

CONCLUSION

Based on research that has been conducted at MTs. Bilingual Muslimat NU Pucang Sidoarjo, it was obtained that students' HOTS abilities decreased during the pandemic. The lowest HOTS capability achievement is in vibration and wave material, while in analysis based on indicators, the lowest achievement is owned by the indicator created on each material. The decline in HOTS ability is influenced by the form of adaptation of HOTS-based online learning as well as the internal factors of students who lose learning motivation during the pandemic. HOTS-based learning is a necessity in the field of education today to meet the challenges of the 21st century. Indonesia must prepare the next generation of the nation with the ability to think critically, creatively, and capably of solving problems. HOTS-based learning can be carried out optimally during online learning by carrying out several innovative actions, including the creation of digital learning media that is interesting and easily accessible to students. Teachers can function as digital platforms as a means of two-way communication between teachers and students. Students' ability on very low C6 indicators can be improved by using project-based learning during online learning.

REFERENCES

[1] Sun, L., Tang, Y., & Zuo, W. (2020). Coronavirus pushes education online. *Nature Materials*, *19*(6), 687-687.

[2] Wang, G., Zhang, Y., Zhao, J., Zhang, J., & Jiang, F. (2020). Mitigate the effects of home confinement on children during the COVID-19 outbreak. *The Lancet*, *395*(10228), 945–947.

[3] Rochman, C., & Pertiwi, C. S. R. (2020). Learning at Covid-19 Pandemic Era : Science Technology Engineering and Mathematic Competencies and Covid-19 : Kompetensi Science Technology Engineering and Mathematic dan Karakter. *Science Education Journal*, *4*(2), 129–142.

[4] Fatimahtuzzahroh, A. M., Mustadi, A., & Wangid, M. N. (2021). Implementation HOTS Based-Learning during Covid-19 Pandemic in Indonesian Elementary School. *Jurnal Pendidikan Progresif,11*(1), 96-111.

[5] Hasyim, M., & Andreina, F. K. (2019). Analisis high order thinking skill (hots) siswa dalam menyelesaikan soal open ended matematika. *FIBONACCI*: *Jurnal Pendidikan Matematika dan Matematika*, 5(1), 55-64.

[6] Saraswati, P. M. S., & Agustika, G. N. S. (2020). Kemampuan berpikir tingkat tinggi dalam menyelesaikan soal HOTS mata pelajaran matematika. Jurnal Ilmiah Sekolah Dasar, 4(2), 257-269.

[7] Driana, E., Susilowati, A., Ernawati, E., & Ghani, A. R. A. (2021). Assessing Students' Higher-Order Thinking Skills: Knowledge and Practices of Chemistry Teachers in Vocational Senior Secondary Schools. *Jurnal Pendidikan Teknologi dan Kejuruan*, *27*(1), 37-47.

[8] Afandi dan Sajidan. (2017). Stimulasi Keterampilan Berpikir Tingkat Tinggi.Surakarta: UNS Press.

[9] Azam, I. F., & Rokhimawan, M. A. (2020). Analisis Materi Ipa Kelas Iv Tema Indahnya Kebersamaan Dengan HOTS. *Jurnal Ilmiah Didaktika: Media Ilmiah Pendidikan dan Pengajaran*, *21*(1), 100-110.

[10] Ali Sadikin & Afreni Hamidah. (2020). "Pembelajaran Daring Di Tengah Wabah Covid-19." *Jurnal Ilmiah Pendidikan Biologi* 6(2):214–24.

[11] Hulukati, W. & Djibran, M. R. (2018). Analisis tugas perkembangan mahasiswa fakultas ilmu pendidikan universitas negeri gorontalo. Jurnal Bikotetik, 2(1), 73-114

[12] Agustien, F., (2012), Pengaruh Praktikum Terhadap Keterampilan Berfikir Kritis Siswa Pada Materi Indera Di Sman 1 Dukupuntang, skripsi, Fakultas Tarbiyah Jurusan Tadris Ipa Biologi, IAIN Syekh Nurjati, Cirebon.

[13] Sugiyono. (2016). Metode Penelitian Kuantitatif, Kualitatif dan R&D. Bandung: PT Alfabet.

[14] Nurmadinah, N. (2017). *Pengembangan Instrumen Tes Higher Order Thinking Skill (HOTS) Pokok Bahasan Operasi Hitung Bentuk Aljabar Serta Persamaan Dan Pertidaksamaan Linear Satu Variabel Kelas VII MTs Guppi Samata* (Doctoral dissertation, Universitas Islam Negeri Alauddin Makassar).

[15] Arifin, Z. (2017). Mengembangkan Instrumen Pengukuran Critical Thinking Skills Siswa pada Pembelajaran Matematika Abad 21. *Jurnal THEOREMS 1*(2), 92-100.

[16] Ariansyah, A., & Arsyid (2019). Analisis Kemampuan Menyelesaikan Soal Hots Fisika Materi Getaran Harmonis Di Sma Kristen Immanuel Pontianak. *Jurnal Pendidikan dan Pembelajaran Khatulistiwa*, *8*(6)halaman 6-8

[17] Wahyuddin, W., Satriani, S., & Asfar, F. (2021). Analisis Kemampuan Menyelesaikan Soal High Order Thinking Skills Ditinjau Dari Kemampuan Berpikir Logis. *AKSIOMA: Jurnal Program Studi Pendidikan Matematika*, *10*(2), 521-535.

[18] Hasanuddin, M. I. (2020). Pengetahuan Awal (Prior Knowledge): Konsep dan Implikasi dalam Pembelajaran. *Edisi*, *2*(2), 217-232.

[19] Al Fath, A. M. (2015). Peningkatan Kemampuan Berpikir Kritis-Kreatif pada Kelas IVMelalui Model Pembelajaran Bermakna Dengan Lembar Kerja Siswa Divergen diSDN Pendem 2 Sumberlawang, Sragen. *Jurnal Tunas Bangsa*, *2*(2), 78-89.

[20] Hamadi, A.A.L., Priyayi, D.F. dan Astuti, S.P. (2018). Pemahaman Guru Terhadap Keterampilan Proses Sains (KPS) dan Penerapannya dalam Pembelajaran IPA SMP di Salatiga. *Jurnal Pendidikan Sains & Matematika*, 6(2), 42-53.

[21] Susmiati, E. (2020). Meningkatkan Motivasi Belajar Bahasa Indonesia Melalui Penerapan Model Discovery Learning dan Media Video Kondisi Pandemi Covid-19 bagi Siswa SMPN 2 Gangga. *Jurnal Paedagogy*, *7*(3),210-215.

[22] Nurhayati, I., Ratnaningsih, N., & Nimah, K. (2022). Analysis of vocational high school student metacognitive capabilities on geometry topics during the Covid-19 Pandemic. *Jurnal Pijar Mipa*, *17*(3), 285-291.