



The Effect of STEM (Science, Technology, Engineering, and Mathematics) Based Learning Approach on Critical Thinking Skills and Cognitive Learning Outcomes of Class X SMA Negeri 1

Ipah Budi Minarti¹, M. Anas Dzakiy², Dila Nilautama³

¹ Universitas Persatuan Guru Republik Indonesia Semarang, Indonesia

² Universitas Persatuan Guru Republik Indonesia Semarang, Indonesia

³ Universitas Persatuan Guru Republik Indonesia Semarang, Indonesia

Corresponding Author: Ipah Budi Minarti, E-mail: ipeh_mi2n@yahoo.co.id

Received: May 6, 2022

Revised: May 22, 2022

Accepted: May 23, 2022

Online: May 23, 2022

ABSTRACT

21st century learning refers to students for 4C (Critical Thinking, Communication, Collaboration, and Creativity) namely skills that students must have, such as problem solving skills, critical thinking skills, teamwork skills and communication skills. Critical thinking skills are something that must be instilled in students so that students are able to explore a problem and can solve it effectively and efficiently. Efforts that can be made to improve the quality of learning involve students to be able to build their knowledge and be able to solve a problem. One way to overcome this is by using the STEM (Science, Technology, Engineering, and Mathematics) approach. This study aims to determine the effect of the STEM approach in learning to improve critical thinking skills and cognitive learning outcomes of class X SMA Negeri 1 Tahunan. The subjects in this study were students of class X MIPA. The sampling technique used in this research is cluster random sampling. This research method is True Experimental Design research using the Pretest and Posttest Control Group method. There are two classes in this study, namely the experimental class and the control class. Analysis of the t test data is used to see the difference in the mean between the two samples. The t-test of the cognitive learning outcomes of students in the experimental class and control class in the pretest obtained ttable t_{count} , namely $1.66 < 6.11$. The t-test of the cognitive learning outcomes of students in the experimental class and control class in the Posttest obtained ttable $1.66 < t_{count} 6.145$. The results of research between critical thinking and student learning outcomes there are significant differences, so this study can be concluded that the STEM approach is effective for improving critical thinking and student learning outcomes.

Keywords: *Cognitive Learning, Critical Thinking, STEM Approach.*

Journal Homepage

<https://ejournal.iainbatanghari.ac.id/index.php/attasyrih/index>

This is an open access article under the CC BY SA license

<https://creativecommons.org/licenses/by-sa/4.0/>

How to cite:

Ipah, B. M., Dzakiy, A. M., Nilautama, D. (2022). The Effect of STEM (Science, Technology, Engineering and Mathematics) Based Learning Approach on Critical Thinking Skills and Cognitive Learning Outcomes of Class x Negeri 1. *At-Tasyrih: Jurnal Pendidikan dan Hukum Islam*, 8(2), 126-136. <https://doi.org/10.55849/attasyrih.v8i2.151>

Published by:

Pusat Penelitian dan Pengabdian Masyarakat, Institut Agama Islam Nusantara Batang Hari

INTRODUCTION

21st century learning is a transitional curriculum in which learning develops from teacher-centered to student-centered (Dongre & Weinberg, 2019; Schuster dkk., 2019). This is of course to answer future challenges where students must be able to innovate in solving the problems they face. 21st century learning refers to students for 4C (Critical

Thinking, Communication, Collaboration, and Creativity) namely skills that students must have, such as problem solving skills, critical thinking skills, teamwork skills and communication skills (Madjid dkk., 2020; Waldman dkk., 2020). One of the government's goals in implementing the 2013 curriculum is an effort to achieve the educational goals listed in Government Regulation No. 17 of 2010 which is to develop the potential of students who are devoted to God Almighty, knowledgeable, capable, critical, creative and innovative, and sensitive to the social environment.

High-level thinking is one of the abilities to solve problems in the 21st century. High-level thinking requires critical thinking skills as a scientific process, Larasati & Hidayati, (2018). So critical thinking skills are something that must be instilled in students so that students are able to explore a problem and can solve it effectively and efficiently Madden et al., (2013). Critical thinking refers to the ability to analyze information, determine the relevance of the information collected and then interpret it in solving problems (Chaudhuri dkk., 2020; Leng dkk., 2020; Yang dkk., 2020). With the existence of critical thinking skills one can also solve complex problems that are being faced by creating new and unpublished ideas that function to learn knowledge by identifying problems and finally being able to find creative problem solving.

Critical thinking skills are important for students to have, especially in studying science, especially in Biology subjects, which contain a lot of exploratory activities. When students think critically they will be encouraged to think for themselves (Ghaben & Scherer, 2019; Hochhaus dkk., 2020), formulate hypotheses, analyze and synthesize events, to go further by developing new hypotheses and testing their hypotheses against facts Karakoç, (2016). In improving it, it is necessary to use the right model and approach so that there is a need for good experiments and can improve critical thinking skills (Amado-Alonso dkk., 2019; Rahmah dkk., 2022). Higher order thinking skills include critical thinking, logical, reflective, metacognitive, and creative thinking King, (1997).

Learning outcomes are a very important factor that must be considered by every teacher, because the learning outcomes achieved by students show how far students are able to master or understand a subject matter that has been given by the teacher in learning (DeFilipp dkk., 2019). To find out the learning outcomes it is necessary to do an evaluation at the end of a lesson. Sudjana, (2016). Learning outcomes are the abilities possessed by students after students receive learning experiences. Susanto (2016: 5) states that student learning outcomes are abilities that children acquire after going through learning activities (Dianovi dkk., 2022; Najeed dkk., 2022; Rohmalimna dkk., 2022). According to Benjamin Bloom in Sudjana (2016) three domains (domains) of achieving learning outcomes are cognitive, affective and psychomotor.

The cognitive domain is the realm that includes mental (brain) activity. According to Bloom, all efforts related to the brain are included in the cognitive domain, there are six levels of thinking (Avgerinos dkk., 2019; Facon dkk., 2019), starting from the lowest level to the highest level, namely: knowledge, understanding, application, analysis, synthesis. (synthesis), and evaluation (evaluation) Daud, (2012: 250). The first two aspects are called low-level cognitive and the next four aspects are high-level cognitive. Cognitive learning

outcomes are students' ability to learn a concept at school and are expressed in scores through Susanto's test results, (2013) to determine the level of success in learning achievement Dimiyati and Mujiono, (2006).

One approach that is able to train and improve critical thinking skills and cognitive learning outcomes is STEM (Science, Technology, Engineering, and Mathematics) (Hartini dkk., 2022; Nopiana dkk., 2022). STEM is a learning approach that connects four fields, namely science, technology, engineering, and mathematics into one holistic whole, Roberts, (2012). According to Roberts (2012) the advantages of the STEM approach include: (1) increasing understanding of the relationship between principles, concepts, and disciplinary skills, (2) arousing students' curiosity in triggering students' creative imagination and critical thinking, (3) helping students to experience and understand the process of scientific inquiry, (4) encourage collaborative problem solving and work together in groups, (5) develop the relationship between critical thinking and learning (Hickson dkk., 2019; Hua dkk., 2019). One of the factors supporting the success of the learning process, teachers need to help students to improve their learning outcomes and critical thinking skills through a STEM approach that can support students to learn actively.

RESEARCH METHODOLOGY

The research was conducted at SMA Negeri 1 Tahun class X MIPA. This study used cluster random sampling (area sampling). The choice of this technique was due to the fact that the samples taken in this study were not individual classes. It is known that the classes that are the sample have the same abilities. The equivalence test is carried out first. The research was conducted at SMA Negeri 1 Tahunan class X MIPA. This study used cluster random sampling (area sampling). The choice of this technique was because the samples taken in this study were not individual classes. Classes that are sampled are known to have the same ability to do a compatibility test first.

This research was carried out using quantitative experimental research, the True Experimental type of design is the Pretest-Posttest Control Group Design (Sugiyono, 120: 2010). In this study it was designed to strengthen critical thinking skills and cognitive learning outcomes. By applying the STEM approach to improve critical thinking skills and cognitive learning outcomes in the experimental class. The following is the research design used in the study:

Table 1. Research Design

Group	<i>Pretest</i>	Treatment	<i>Posttest</i>
E	O1	X	O3
K	O2		O4

Information:

E : Experimental group

K : Control Group

O1: The results of experimental class students before learning STEM

O2: The learning outcomes of control class students before conventional learning O3: The experimental class student learning outcomes after STEM learning

O4: Student learning outcomes in the control class after conventional learning

X: Treatment of learning using STEM

The data collection instrument was using multiple choice questions which were carried out in a pretest where students were given questions that measured critical thinking skills and cognitive learning outcomes. This is done to measure students' initial abilities, then learning is carried out using the STEM approach with virus material. And giving a posttest to measure improvement after learning with the STEM approach. Data analysis using normality and homogeneity tests as prerequisite tests and t-tests. After obtaining valid and reliable data results, a t-test was then carried out to determine differences in critical thinking skills and cognitive learning outcomes of students in the experimental and control classes.

RESULT AND DISCUSSION

Data on cognitive learning outcomes in this study were obtained from pretest scores before being given treatment and posttest scores after being given treatment. The experimental class was treated using the STEM approach, while the control class was only treated using conventional learning. The following is Table 2. Which shows the results of the pretest and posttest homogeneity tests.

Table 2.1. Experimental and Control Class Pretest Homogeneity Test

Class	S^2	F_{hitung}	F_{tabel}	Conclucion
Experiment	31,036	1,97	3,98	Homogen
Control	15,700			

Calculation data from cognitive learning outcomes, experimental class pretest scores and control class Fcount (1.97) and Ftable (3.98) so that it can be concluded that Fcount < Ftable, based on the calculation results, the two classes are said to be homogeneous.

Table 2.2. Posttest Homogeneity Test of Experimental and Control Classes

Class	S^2	F_{hitung}	F_{tabel}	Conclucion
Experiment	-24,553	0,74	3,98	Homogen
Control	-3,308			

Calculation data from cognitive learning outcomes, posttest values of the experimental class and control class Fcount (0.74) and Ftable (3.98) so that it can be concluded that Fcount < Ftable, based on the calculation results, the two classes are said to be homogeneous.

The following is Table 3 which shows the results of the pretest and posttest normality tests.

Table 3.1. Experimental and Control Class Pretest Normality Test

Class	N	X_{hitung}	X_{tabel}	Conclucion
Experiment	36	2,45	11,08	Normal
Contr ol	36	1,83	11,0 8	Norm al

From the calculation of the normality test for the experimental class using the chi squared formula, it was obtained $X_{count} = 2.45$ and $X_{table} = 11.07$ at a significance level of $\alpha = 5\%$ with $dk = 6-1 = 5$, while the control class used the chi squared formula obtained $X_{count} = 1,83$ and $X_{table} = 11.07$ at a significance level $\alpha = 5\%$ with $dk = 6-1 = 5$. The criterion used is that H_0 is accepted if $X_{count} < X_{table}$. The data obtained from the calculations show that the experimental class and control class are normally distributed.

Table 3.2. Posttest Normality Test of Experimental and Control Classes

Class	N	X_{hitung}	X_{tabel}	Conclucion
Experiment	36	5,91	11,08	Normal
Control	36	2,22	11,08	Normal

From the calculation of the normality test for the experimental class using the chi squared formula, it was obtained $X_{count} = 5.91$ and $X_{table} = 11.07$ at a significance level of $\alpha = 5\%$ with $dk = 6-1 = 5$, while the control class used the chi squared formula obtained $X_{count} = 2,22$ and $X_{table} = 11.07$ at a significance level $\alpha = 5\%$ with $dk = 6-1 = 5$. The criterion used is that H_0 is accepted if $X_{count} < X_{table}$. The data obtained from the calculations show that the experimental class and control class are normally distributed. The following is Table 4 which shows the results of the pretest and posttest t tests.

Table 4.1 Experimental and Control Class Pretest t test

Class	Rata-rata	t_{hitung}	t_{tabel}	Conclucion
Experiment	55,72	6,11	1,66	signifikan
Control	48,78			

Based on the calculation above, it is obtained $t_{count} = 6.11$ and $t_{table} 1.66$ for a significant level $\alpha = 5\%$ and $dk = n_1 + n_2 - 2$, $t_{table} (1.66) > t_{count} (6.11)$ then H_0 is rejected and H_1 is accepted.

Table 4.2 Posttest Class Experiment and Control t test

Class	Rata-rata	t_{hitung}	t_{tabel}	Conclucion
Experiment	68,75	6,14	1,66	signifikan
Control	63,36			

Based on the calculation above, it is obtained $t_{count} = 6.14$ and $t_{table} 1.66$ for a significant level $\alpha = 5\%$ and $dk = n_1 + n_2 - 2$, $t_{table} (1.66) > t_{count} (6.14)$ then H_0 is rejected and H_1 is accepted. The following is Table 4. Which shows the average results of pretest and posttest scores based on indicators of critical thinking skills in the experimental class.

Table 4.1. Pretest and Posttest Results Percentage of Critical Thinking Skills

Experiment Class			
No	Critical thinking skills indicator	Pretest	Posttest
1	Give a simple explanation	62%	74%
2	Build basic skills	69%	92%
3	Conclude	42%	89%
4	Provide further explanation	49%	70%
5	Set strategy and tactics	74%	77%
Rata-rata		59,2%	80,4%

Table 4.2 Percentage of Control Class Pretest and Posttest Critical Thinking Skills Results

No	Critical thinking skills indicator	<i>Pretest</i>	<i>Posttest</i>
1	Give a simple explanation	48%	70%
2	Build basic skills	50%	79%
3	Conclude	31%	67%
4	Provide further explanation	45%	55%
5	Set strategy and tactics	60%	53%
Rata-rata		46,8%	65%

Based on the results of the research described above, an explanation of the STEM (Science, Technology, Engineering, and Mathematics)-based learning approach to critical thinking skills and cognitive learning outcomes of students can be described as follows:

STEM Approach to Students' Critical Thinking Skills

Aspects of Providing a Simple Explanation

The initial ability of critical thinking skills in the aspect of giving a simple explanation is that the experimental class is 62% and the control class is 48% with a difference of 14%.

The final ability of the students' critical thinking skills in the experimental class after being given the application of learning using the STEM approach became 74%. While the ability of students in the control class after being given the application of conventional learning to 70%.

The experimental class has been trained to develop critical thinking skills during learning. Examples of questions presented are several questions that make students have to analyze so that students are able to produce varied answers because students are able to see problems from different perspectives (Aldape dkk., 2019; Weiss & Dahlke, 2019). It is able to stimulate knowledge independently. While the control class has developed critical thinking skills and there is also less developed critical thinking skills.

The experimental class has been trained to develop critical thinking skills during learning (Myers & Miller, 2021). Examples of questions presented are several questions that make students have to analyze so that students are able to produce varied answers because students are able to see problems from different perspectives (Firman dkk., 2022; Ilham dkk., 2022; Safitri dkk., 2022). It is able to stimulate knowledge independently. While the control class has developed critical thinking skills and there is also less developed critical thinking skills.

Aspects of Building Critical Thinking Skills

The initial ability of critical thinking skills in the aspect of giving a simple explanation is that the experimental class is 69% and the control class is 50% with a difference of 19%.

The final ability of the students' critical thinking skills in the experimental class after being given the application of learning using the STEM approach became 92%. While the ability of students in the control class after being given the application of conventional learning to 79%.

Amanda (2012) said the STEM approach can instill critical problem-solving techniques and can generate creativity and curiosity in students. Meanwhile, students in the control class experienced difficulties because in the control class they used

conventional learning (Gabriela dkk., 2022; Kartel dkk., 2022; Qureshi dkk., 2022), the teacher played an active role in explaining all the subject matter and did not involve student activities during the learning process which resulted in students in the control class not practicing their critical thinking skills in the learning process. Arinda (2015) said that current learning still does not provide access to students independently to develop thinking processes because conventional learning is still dominated by teachers, so students become less active in learning.

Aspects of Making Inferences

The initial ability of critical thinking skills in the aspect of giving a simple explanation is that the experimental class is 42% and the control class is 31% with a difference of 11%.

The final ability of the students' critical thinking skills in the experimental class after being given the application of learning using the STEM approach became 89%. While the ability of students in the control class after being given the application of conventional learning to 67%.

Imam (2016) said students collect data from experimental results, activities will continue in group discussion activities (Dewi S dkk., 2022; Keshav dkk., 2022), overall this stage will fulfill students' curiosity about the phenomena around them, through this stage students will adjust the results obtained with the theory found previously.

Aspects of Making Further Explanations

The initial ability of critical thinking skills in the aspect of making further explanations is 49% in the experimental class and 45% in the control class with a difference of 4%. The final ability of the students' critical thinking skills in the experimental class after being given the application of learning using the STEM approach became 70%. While the ability of students in the control class after being given the application of conventional learning to 55%. The final ability of the students' critical thinking skills in the experimental class after being given the application of learning using the STEM approach became 70%. While the ability of students in the control class after being given the application of conventional learning to 55%.

Aspects of Set Strategy and Tactics

The initial ability of critical thinking skills in aspects of managing strategies and tactics is 74% in the experimental class and 60% in the control class with a difference of 14%. The ultimate ability of thinking skills

The STEM Approach to Students' Cognitive Learning Outcomes

Based on the research results it is known that the STEM approach can improve cognitive learning outcomes, this is because the application of STEM-based biology learning involves students in discussions, experiences, discoveries for knowledge in groups. According to Bybee in Nida'ul (2019), the STEM approach aims to develop students who have the knowledge to identify questions and problems. The approach applied in improving students' cognitive learning outcomes is the STEM approach. According to Becker & Park in Lutfi et al., (2017) The integration of STEM aspects can

have a positive impact on learning, especially in improving students' cognitive learning outcomes in science and technology (Anoum dkk., 2022; Demina dkk., 2022; Hikmah dkk., 2022). Therefore, the use of the STEM learning approach is very suitable to be applied to improve students' cognitive learning outcomes. The STEM approach is very relevant to the development of 21st century skills, which are called 4C: (Critical Thinking, Communication, Collaboration, and Creativity) Hamdu et al., (2020). According to Wang in Widayoko, (2020) STEM itself is an interdisciplinary learning approach between science, technology, engineering, and mathematics. The application of STEM-based learning will further motivate students to excel and get the best grades and can motivate students to be more active in discussions.

CONCLUSION

Based on the results of the research and discussion, it can be concluded that there is an influence of the STEM approach on critical thinking skills and cognitive learning outcomes. The increase in cognitive learning outcomes of the experimental class is in the moderate (effective) category. Based on the research results, the authors provide the following suggestions: The application of STEM-based biology learning needs to be applied to develop students' critical thinking skills and cognitive learning outcomes.

REFERENCES

- Aldape, K., Brindle, K. M., Chesler, L., Chopra, R., Gajjar, A., Gilbert, M. R., Gottardo, N., Gutmann, D. H., Hargrave, D., Holland, E. C., Jones, D. T. W., Joyce, J. A., Kearns, P., Kieran, M. W., Mellinghoff, I. K., Merchant, M., Pfister, S. M., Pollard, S. M., Ramaswamy, V., ... Gilbertson, R. J. (2019). Challenges to curing primary brain tumours. *Nature Reviews Clinical Oncology*, 16(8), 509–520. <https://doi.org/10.1038/s41571-019-0177-5>
- Amado-Alonso, D., León-del-Barco, B., Mendo-Lázaro, S., Sánchez-Miguel, P., & Iglesias Gallego, D. (2019). Emotional Intelligence and the Practice of Organized Physical-Sport Activity in Children. *Sustainability*, 11(6), 1615. <https://doi.org/10.3390/su11061615>
- Anoum, P., Arifa, F., & May, C. (2022). Strategies to Increase the Motivation of Tahfidz Al-Quran. *Journal International Inspire Education Technology*, 1(2), 74–85. <https://doi.org/10.55849/jiiet.v1i2.88>
- Avgerinos, K. I., Spyrou, N., Mantzoros, C. S., & Dalamaga, M. (2019). Obesity and cancer risk: Emerging biological mechanisms and perspectives. *Metabolism*, 92, 121–135. <https://doi.org/10.1016/j.metabol.2018.11.001>
- Chaudhuri, O., Cooper-White, J., Janmey, P. A., Mooney, D. J., & Shenoy, V. B. (2020). Effects of extracellular matrix viscoelasticity on cellular behaviour. *Nature*, 584(7822), 535–546. <https://doi.org/10.1038/s41586-020-2612-2>
- DeFilipp, Z., Bloom, P. P., Torres Soto, M., Mansour, M. K., Sater, M. R. A., Huntley, M. H., Turbett, S., Chung, R. T., Chen, Y.-B., & Hohmann, E. L. (2019). Drug-Resistant *E. coli* Bacteremia Transmitted by Fecal Microbiota Transplant. *New*
-

-
- England *Journal of Medicine*, 381(21), 2043–2050. <https://doi.org/10.1056/NEJMoa1910437>
- Demina, D., Rexy, T., & Danyl, A. (2022). The Use of Quranic Learning Strategies Through the Wafa Method in Elementary Schools. *Journal International Inspire Education Technology*, 1(2), 62–73. <https://doi.org/10.55849/jiiet.v1i2.91>
- Dewi S, Y., Rasyid Umar, A., Ali Khan, A., & Aziz, A. (2022). Fun Arabic Teaching With Media Song For Early Child Education School. *Journal International of Lingua and Technology*, 1(2), 140–156. <https://doi.org/10.55849/jiltech.v1i2.80>
- Dianovi, A., Siregar, D., Mawaddah, I., & Suryaningsih, S. (2022). Guidance and Counselling in Education. *World Psychology*, 1(2), 27–35. <https://doi.org/10.55849/wp.v1i2.95>
- Dongre, A., & Weinberg, R. A. (2019). New insights into the mechanisms of epithelial–mesenchymal transition and implications for cancer. *Nature Reviews Molecular Cell Biology*, 20(2), 69–84. <https://doi.org/10.1038/s41580-018-0080-4>
- Facon, T., Kumar, S., Plesner, T., Orłowski, R. Z., Moreau, P., Bahlis, N., Basu, S., Nahi, H., Hulin, C., Quach, H., Goldschmidt, H., O'Dwyer, M., Perrot, A., Venner, C. P., Weisel, K., Mace, J. R., Raje, N., Attal, M., Tiab, M., ... Usmani, S. Z. (2019). Daratumumab plus Lenalidomide and Dexamethasone for Untreated Myeloma. *New England Journal of Medicine*, 380(22), 2104–2115. <https://doi.org/10.1056/NEJMoa1817249>
- Firman, F., Alef, R., & Eric, M. (2022). Use Of Zoom Meeting Applications to Memorize the Qur'an Online. *Journal International Inspire Education Technology*, 1(2), 99–110. <https://doi.org/10.55849/jiiet.v1i2.92>
- Gabriela, M., Cicerchi, G., Colin, H., & Ana, C. (2022). The Role of Parents in Helping Arabic Teachers to Improve Students' Vocabulary. *Journal International of Lingua and Technology*, 1(2), 131–139. <https://doi.org/10.55849/jiltech.v1i2.83>
- Ghaben, A. L., & Scherer, P. E. (2019). Adipogenesis and metabolic health. *Nature Reviews Molecular Cell Biology*, 20(4), 242–258. <https://doi.org/10.1038/s41580-018-0093-z>
- Hartini, S., Alie, E., & March, J. (2022). The Relationship Between Authoritarian Parenting and Aggressive Behavior of Adolescents in Nagari Bungo Tanjung. *World Psychology*, 1(2), 18–26. <https://doi.org/10.55849/wp.v1i2.98>
- Hickson, L. J., Langhi Prata, L. G. P., Bobart, S. A., Evans, T. K., Giorgadze, N., Hashmi, S. K., Herrmann, S. M., Jensen, M. D., Jia, Q., Jordan, K. L., Kellogg, T. A., Khosla, S., Koerber, D. M., Lagnado, A. B., Lawson, D. K., LeBrasseur, N. K., Lerman, L. O., McDonald, K. M., McKenzie, T. J., ... Kirkland, J. L. (2019). Senolytics decrease senescent cells in humans: Preliminary report from a clinical trial of Dasatinib plus Quercetin in individuals with diabetic kidney disease. *EBioMedicine*, 47, 446–456. <https://doi.org/10.1016/j.ebiom.2019.08.069>
- Hikmah, D., Petoukhoff, G., & Papaioannou, J. (2022). The Utilization Of The Animiz Application As A Media For Arabic Language Learning On Students. *Journal*
-

-
- International of Lingua and Technology*, 1(2), 157–171. <https://doi.org/10.55849/jiltech.v1i2.84>
- Hochhaus, A., Baccarani, M., Silver, R. T., Schiffer, C., Apperley, J. F., Cervantes, F., Clark, R. E., Cortes, J. E., Deininger, M. W., Guilhot, F., Hjorth-Hansen, H., Hughes, T. P., Janssen, J. J. W. M., Kantarjian, H. M., Kim, D. W., Larson, R. A., Lipton, J. H., Mahon, F. X., Mayer, J., ... Hehlmann, R. (2020). European LeukemiaNet 2020 recommendations for treating chronic myeloid leukemia. *Leukemia*, 34(4), 966–984. <https://doi.org/10.1038/s41375-020-0776-2>
- Hua, H., Kong, Q., Zhang, H., Wang, J., Luo, T., & Jiang, Y. (2019). Targeting mTOR for cancer therapy. *Journal of Hematology & Oncology*, 12(1), 71. <https://doi.org/10.1186/s13045-019-0754-1>
- Ilham, S., Adelir, D., & Delr, Q. (2022). The Benefits of Whatsapp as a Medium in Depositing Memorization of the Qur'an. *Journal International Inspire Education Technology*, 1(2), 86–98. <https://doi.org/10.55849/jiiet.v1i2.90>
- Kartel, A., Charles, M., Xiao, H., & Sundi, D. (2022). Strategies for Parent Involvement During Distance Learning in Arabic Lessons in Elementary Schools. *Journal International of Lingua and Technology*, 1(2), 99–113. <https://doi.org/10.55849/jiltech.v1i2.82>
- Keshav, M., Julien, L., & Miezal, J. (2022). The Role Of Technology In Era 5.0 In The Development Of Arabic Language In The World Of Education. *Journal International of Lingua and Technology*, 1(2), 79–98. <https://doi.org/10.55849/jiltech.v1i2.85>
- Leng, Z., Zhu, R., Hou, W., Feng, Y., Yang, Y., Han, Q., Shan, G., Meng, F., Du, D., Wang, S., Fan, J., Wang, W., Deng, L., Shi, H., Li, H., Hu, Z., Zhang, F., Gao, J., Liu, H., ... Zhao, R. C. (2020). Transplantation of ACE2- Mesenchymal Stem Cells Improves the Outcome of Patients with COVID-19 Pneumonia. *Aging and Disease*, 11(2), 216. <https://doi.org/10.14336/AD.2020.0228>
- Madjid, M., Safavi-Naeini, P., Solomon, S. D., & Vardeny, O. (2020). Potential Effects of Coronaviruses on the Cardiovascular System: A Review. *JAMA Cardiology*, 5(7), 831. <https://doi.org/10.1001/jamacardio.2020.1286>
- Myers, J. A., & Miller, J. S. (2021). Exploring the NK cell platform for cancer immunotherapy. *Nature Reviews Clinical Oncology*, 18(2), 85–100. <https://doi.org/10.1038/s41571-020-0426-7>
- Najeed, M. A., Hakonarson, C., & Mentch, G. (2022). Learning Tahfiz with Talaqqi Method Using Whatsapp Application. *Journal International Inspire Education Technology*, 1(2), 125–137. <https://doi.org/10.55849/jiiet.v1i2.86>
- Nopiana, N., Egie, J., & Mers, O. (2022). The Impact of Internet Addiction on Introvert Personality. *World Psychology*, 1(2), 1–17. <https://doi.org/10.55849/wp.v1i2.97>
- Qureshi, M., Mahdiyyah, D., Mohamed, Y., & Ardchir, M. (2022). Scale For Measuring Arabic Speaking Skills In Early Children's Education. *Journal International of Lingua and Technology*, 1(2), 114–130. <https://doi.org/10.55849/jiltech.v1i2.81>
-

-
- Rahmah, A., Rouns, E., & Luck, A. (2022). The Effect of Self-Development Program for Improving Independence in Defective Students in SLB N 1 Lima Kaum Batusangkar. *World Psychology*, 1(2), 46–53. <https://doi.org/10.55849/wp.v1i2.96>
- Rohmalimna, A., Yeau, O., & Sie, P. (2022). The Role of Parental Parenting in the Formation of the Child's Self-Concept. *World Psychology*, 1(2), 36–45. <https://doi.org/10.55849/wp.v1i2.99>
- Safitri, S., Alii, M., & Mahmud, O. (2022). Murottal Audio as a Medium for Memorizing the Qur'an in Super-Active Children. *Journal International Inspire Education Technology*, 1(2), 111–124. <https://doi.org/10.55849/jiiet.v1i2.87>
- Schuster, S. J., Bishop, M. R., Tam, C. S., Waller, E. K., Borchmann, P., McGuirk, J. P., Jäger, U., Jaglowski, S., Andreadis, C., Westin, J. R., Fleury, I., Bachanova, V., Foley, S. R., Ho, P. J., Mielke, S., Magenau, J. M., Holte, H., Pantano, S., Pacaud, L. B., ... Maziarz, R. T. (2019). Tisagenlecleucel in Adult Relapsed or Refractory Diffuse Large B-Cell Lymphoma. *New England Journal of Medicine*, 380(1), 45–56. <https://doi.org/10.1056/NEJMoa1804980>
- Waldman, A. D., Fritz, J. M., & Lenardo, M. J. (2020). A guide to cancer immunotherapy: From T cell basic science to clinical practice. *Nature Reviews Immunology*, 20(11), 651–668. <https://doi.org/10.1038/s41577-020-0306-5>
- Weiss, A. R. R., & Dahlke, M. H. (2019). Immunomodulation by Mesenchymal Stem Cells (MSCs): Mechanisms of Action of Living, Apoptotic, and Dead MSCs. *Frontiers in Immunology*, 10, 1191. <https://doi.org/10.3389/fimmu.2019.01191>
- Yang, L., Shi, P., Zhao, G., Xu, J., Peng, W., Zhang, J., Zhang, G., Wang, X., Dong, Z., Chen, F., & Cui, H. (2020). Targeting cancer stem cell pathways for cancer therapy. *Signal Transduction and Targeted Therapy*, 5(1), 8. <https://doi.org/10.1038/s41392-020-0110-5>
-

Copyright Holder :

© Ipah Budi Minarti et al. (2022).

First Publication Right :

© At-Tasyrih: Jurnal Pendidikan dan Hukum Islam

This article is under:

