Effectiveness of the Cool-Critical-Creative-Meaningful (3CM) Learning Model on Enhancing Students' Critical Thinking Skills

Kintoko[1]*, Deny Hadi Siswanto[2]
[1] Mathematics Education, PGRI Yogyakarta University, kintoko@upy.ac.id
[2] Muhammadiyah Mlati Senior High School, denysiswanto11@guru.sma.belajar.id
* Korespondensi Penulis. E-mail: kintoko@upy.ac.id

Abstrak

Penelitian ini bertujuan untuk mengkaji efektivitas model pembelajaran *Cool-Critical-Creative-Meaningful* (3CM) terhadap kemampuan berpikir kritis siswa kelas X-A SMA Muhammadiyah 1 Sleman. Model ini diharapkan dapat mendorong pembelajaran yang bermakna dan meningkatkan kemampuan berpikir tingkat tinggi siswa. Penelitian ini menggunakan pendekatan kuantitatif dengan desain eksperimen Pre-Experimental Design tipe One-Group Pretest-Posttest. Sampel dalam penelitian ini adalah siswa kelas X-A yang berjumlah 28 siswa. Instrumen berupa tes berpikir kritis yang disusun berdasarkan indikator *Focus*, *Reason*, *Inferences*, *Situation*, *Clarity*, dan *Overview* serta telah diuji validitas dan reliabilitasnya. Hasil pretest dan posttest dianalisis menggunakan uji normalitas, uji Paired Sample T-Test, dan uji N-gain. Hasil penelitian menunjukkan peningkatan signifikan kemampuan berpikir kritis siswa setelah penerapan model 3CM, dengan rata-rata nilai meningkat dari 55,16 menjadi 87,30 dan nilai N-gain sebesar 0,72 (kategori tinggi). Seluruh indikator berpikir kritis mengalami peningkatan, dengan indikator "Situation" mengalami peningkatan tertinggi. Temuan ini menunjukkan bahwa model pembelajaran 3CM efektif dalam meningkatkan kemampuan berpikir kritis siswa dan dapat dijadikan referensi dalam pengembangan strategi pembelajaran inovatif serta evaluasi kurikulum di jenjang SMA.

Keyword: Efektivitas, Cool-Critical- Creative-Meaningful, Kemampuan Berpikir Kritis, Sekolah Menengah Atas

Abstract

This study aims to examine the effectiveness of the Cool Critical Creative Meaningful (3CM) learning model on the critical thinking skills of Grade X-A students at SMA Muhammadiyah 1 Sleman. The model is expected to promote meaningful learning and enhance students' higher-order thinking skills. This research employs a quantitative approach using a Pre-Experimental Design with a One-Group Pretest-Posttest type. The sample consisted of 28 students from class X-A. The instrument used was a critical thinking test developed based on the indicators of Focus, Reason, Inferences, Situation, Clarity, and Overview, and had been tested for validity and reliability. Pretest and posttest results were analyzed using normality tests, Paired Sample T-Test, and N-gain analysis. The findings show a significant improvement in students' critical thinking skills following the implementation of the 3CM model, with the average score increasing from 55.16 to 87.30 and an N-gain score of 0.72 (high category). All critical thinking indicators showed improvement, with the "Situation" indicator showing the highest increase. These results indicate that the 3CM learning model is effective in enhancing students' critical thinking skills and can serve as a reference in the development of innovative learning strategies and curriculum evaluation at the senior high school level.

Keyword: Effectiveness, Cool-Critical-Creative-Meaningful, Critical Thinking Skills, Senior High School

INTRODUCTION

Critical thinking is a crucial skill that students in the 21st century need to develop (Kania et al., 2023). In the midst of the overwhelming flow of information and the complexity of global issues, students are expected not only to memorize concepts but also to analyze, evaluate, and devise logical solutions (Gema et al., 2024). In the context of high school learning, especially in grade X, the need for critical thinking skills becomes increasingly important as it relates to students' readiness to face academic and real-

DOI : 10.26486/jm.v9i1.4522
W : http://ejurnal.mercubuana-yogya.ac.id/index.php/mercumatika
E : mercumatika@mercubuana-yogya.ac.id

life challenges. However, the reality in the field shows that the learning process is often teacher-centered and provides limited opportunities for students to explore their thoughts in depth. As a result, students tend to be passive and focus only on the outcomes, rather than the thinking process. Therefore, there is a need for an innovative learning model that can facilitate the optimal development of critical thinking skills.

The Cool-Critical-Creative-Meaningful (3CM) learning model emerges as a promising alternative to address these issues. This model combines an enjoyable approach that encourages critical thinking, stimulates creativity, and provides meaningful learning experiences (Wahyudi et al., 2019). In its application, 3CM is designed to create a learning environment that is engaging yet challenging, so students are not only emotionally involved but also intellectually stimulated (Iqbal et al., 2024). Enjoyable learning is believed to enhance students' intrinsic motivation to understand the material. The critical and creative thinking aspects of 3CM are key components in shaping adaptive and solution-oriented students (Larasanti & Prihatnani, 2021). With this holistic approach, the 3CM model has the potential to foster higher-order thinking skills in students.

High school-level subjects, particularly in grade X, often require students to think more deeply and comprehensively (Siswanto et al., 2024). Many topics cannot be understood merely at a textual level but require analysis, comparison, and interpretation. For instance, in subjects like mathematics, students need to develop logical, rational, and systematic thinking. Critical thinking skills are highly relevant in understanding and solving problems from a broad perspective (Sari & Juandi, 2023). Therefore, a learning model that combines enjoyable and challenging approaches becomes a pressing need. The 3CM model offers an opportunity to address this need with a more contextual and interactive approach.

Previous studies have shown that active and meaningful learning can enhance students' critical thinking skills. For example, a study by Rizti & Prihatnani (2021) indicates that the 3CM model significantly improves learning outcomes as well as higher-order thinking skills. This approach allows students to construct their understanding through experience and idea exploration. Additionally, students are trained to work in teams, express opinions, and critically evaluate arguments. The creative component of this model also encourages students to generate new ideas and alternative solutions to given problems (Fitriana et al., 2025). Thus, learning becomes not just a process of receiving information but also an active process of constructing knowledge.

At the grade X level, students are at a stage of cognitive development that is more mature and ready to tackle higher-order thinking challenges (Miyashita & Wark, 2024). However, if the learning is not appropriately designed, this potential will not develop optimally. Initial observations at school indicate that many students still struggle to connect the concepts they learn with real-life situations. They are also not accustomed to evaluating information or formulating arguments based on data and logic (Patandung, 2023). This highlights the need for learning that emphasizes higher-order cognitive activities, as offered by the 3CM model. Therefore, it is important to conduct research to assess the effectiveness of this model contextually in grade X.

The 3CM learning model has a systematic and flexible learning structure, making it adaptable to various subjects and student characteristics. The meaningful learning aspect in this model provides students with opportunities to learn through real-life experiences that are close to their own lives (Daryanes et al., 2023). This approach aligns with the principles of contextual and student-centered learning, which are characteristics of the Merdeka Curriculum. In this context, the teacher is not only a provider of information but also a facilitator who actively guides students in the thinking process (Aswanti & Isnaeni, 2023). By using this model, teachers can create an inclusive and intellectually challenging learning environment. This is expected to help shape the Pancasila student profile with critical and creative thinking skills.

In addition to focusing on individual skill development, the 3CM model also strengthens collaboration and communication among students. The learning activities designed in small groups encourage students to exchange ideas and critically evaluate each other's views. This process is crucial in the formation of critical thinking because students not only learn from the material but also from constructive social interactions. Learning becomes more lively and dynamic as students are actively involved in every stage of the learning process. Thus, the success of the 3CM model is reflected not only in academic scores but also in the social and cognitive skills that are developed. This is why it is essential to research the effectiveness of this learning model.

Based on the above, this study aims to examine the effectiveness of the 3CM learning model in enhancing the critical thinking skills of grade X students. This research is important as it will contribute to the development of innovative teaching strategies at the high school level. With the right approach, it is hoped that students will be able to learn in a more meaningful and critical manner. The findings of this study are expected to serve as a reference for teachers in selecting appropriate learning models to improve

the quality of education. Moreover, the results of this research can also be used as materials for evaluation and curriculum development in the future. Therefore, this research holds significant urgency in improving the quality of 21st-century education.

METHOD

This study is a quantitative research with an experimental method, using a Pre-Experimental Design with a One-Group Pretest-Posttest Design model. This design was chosen because it allows for testing before and after treatment, making the results more accurate as they can be compared between the conditions before and after the treatment using the 3CM learning model. The population of this study consists of all students in class X-A of SMA Muhammadiyah 1 Sleman for the 2024/2025 academic year, totaling 28 students. The sampling technique used is saturated sampling, where the entire population is selected as the sample because the number of subjects is fewer than 100, in accordance with Arikunto (2017) opinion, making this a population study. The data collection methods used include tests, documentation, and observation. The test instrument consists of 6 items that refer to critical thinking indicators according to Ennis (1993): Focus, Reason, Inferences, Situation, Clarity, and Overview. This instrument was piloted in class XI-A of SMA Muhammadiyah 1 Sleman and was then tested for validity and reliability. Once the instrument was validated and found reliable, it was used for the study. Data analysis was conducted through Normality Test, Paired Sample T-Test, and N-gain Test to assess the improvement in student learning outcomes, with reference to Hake (1999).

RESULTS AND DISCUSSION

Results

Prior to conducting the research, the researcher administered an instrument test, which included validity and reliability tests. These tests were conducted in class XI-A of SMA Muhammadiyah 1 Sleman. The results of these tests are presented in the following table.

Table 1. Results of Validity and Reliability Tests

No	r_{count}	Category	Cronbach's Alpha	Category
1	0.363	Valid	0.412	Reliable
2	0.456	Valid		
3	0.493	Valid		
4	0.429	Valid		
5	0.555	Valid		
6	0.699	Valid		

Based on the results, all items in the test obtained $r_{count} > r_{table}$ (0.374) and a Cronbach's Alpha value of 0.412 > 0.05, indicating that all items of the instrument are valid and reliable. Therefore, the instrument can be used for the research. Before conducting the lesson using the 3CM model, students first completed a pretest to assess their initial critical thinking ability. Subsequently, learning was conducted using the 3CM model. Afterward, a posttest was administered to measure the students' critical thinking ability. The pretest and posttest scores for each indicator of student thinking are as follows.

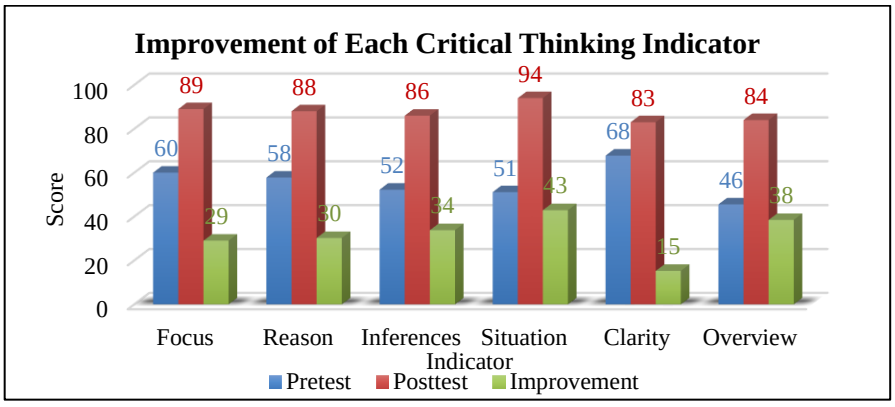

Figure 1. Improvement of Each Indicator

The figure above shows the improvement in scores for each of the critical thinking indicators of students after the learning intervention. The six indicators measured are Focus, Reason, Inferences, Situation, Clarity, and Overview. There was an increase in scores from pretest to posttest on all indicators, as indicated by the difference between the blue bars (pretest) and the red bars (posttest). The indicator with the highest improvement was Situation, with a pretest score of 51 and a posttest score of 94, increasing by 43 points. Other indicators, such as Focus, Reason, and Inferences, also showed significant improvements of 29, 30, and 34 points, respectively. Meanwhile, the Clarity indicator experienced the smallest increase, with only a 15-point improvement. Overall, this graph shows that the learning model applied was effective in enhancing students' critical thinking skills across all the tested indicators. The description of the pretest and posttest results for students can be seen in the table below.

Table 2. Description of Students' Pretest and Posttest Results

Test	N	Minimum	Maximum	Sum	Mean
Pretest	28	33.33	83.33	1544.44	55.16
Posttest	28	72.22	100.00	2444.41	87.30

Based on the descriptive statistical results, it is known that the number of participants who took the pretest and posttest was 28 students. In the pretest, the lowest score obtained by a student was 33.33, and the highest score was 83.33, with a total score of 1544.44 and a mean of 55.16. Meanwhile, in the posttest, the lowest score increased to 72.22 and the highest score reached 100, with a total score of 2444.41 and a mean of 87.30. This data indicates a significant improvement in student learning outcomes after the learning intervention. The data was then subjected to a normality test, with the results shown below.

Table 3. Normality Test Results

	Kolmogorov-Smirnova			Shapiro-Wilk		
Test	Statistic	df	Sig.	Statistic	df	Sig.
Pretest	.120	28	.200*	.964	28	.426
Posttest	.155	28	.084	.937	28	.090

*. This is a lower bound of the true significance.
a. Lilliefors Significance Correction

Based on the table above, it is known that the significant value of the pretest obtained using the Shapiro-Wilk test was 0.426, and for the posttest, the result was 0.090. The decision was made by comparing the distribution data at a significance level of 5%. The hypothesis for the normality test was that H0 is accepted, and Ha is rejected. Therefore, based on this data, it can be concluded that the significant values of 0.426 and 0.090 > 0.05 indicate that the residual values follow a normal distribution. The data was then subjected to a Paired Sample T-Test using SPSS-25, with the results shown below.

Table 4. Paired Sample T-Test Results

Test	Paired Differences					t	df	Sig. (2-tailed)
	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference Lower	Upper			
Pretest - Posttest	-3214.17	1499.61	283.39	-3795.66	-2632.69	-11.342	27	.000

Based on the table above, the sig. (2-tailed) value obtained is 0.000, which is smaller than 0.05 (0.000 < 0.05). This indicates that there is a significant difference between the pretest and posttest results after applying the 3CM model in class X at SMA Muhammadiyah 1 Sleman. After conducting the normality test and paired sample t-test, the next step is the N-gain test on the pretest and posttest results obtained by the students. The N-gain test is used to measure the effectiveness of the improvement in students' critical thinking skills. The N-gain calculation results are as follows.

$$\langle g \rangle = \frac{S_{post} - S_{pre}}{SMI - S_{pre}} = \frac{87.30 - 55.16}{100 - 55.16} = \frac{32.14}{44.48} = 0{,}72$$

Based on the calculation above, it can be seen that the N-gain value is 0.72, which falls under the high category.

Discussion

The instrument test was conducted in class XI-A of SMA Muhammadiyah 1 Sleman and showed that all items had an r-count value greater than the r-table (0.374), with a Cronbach's Alpha value of 0.412, which is greater than the minimum threshold of 0.05. This indicates that the instrument is valid and reliable, and is suitable for use in the study. This step is crucial to ensure the accuracy of measurements on students' critical thinking skills. These results are in line with the research of Wahyuni et al. (2024), which emphasizes the importance of validity and reliability tests in the development of educational research instruments.

After the instrument was declared valid and reliable, a pretest was conducted to assess students' initial critical thinking abilities before being given the treatment, which involved learning using the 3CM model. The 3CM model is an instructional approach that combines concepts, context, and metacognition to enhance higher-order thinking skills. After implementing this model, a posttest was administered to measure changes in students' critical thinking abilities. The measurement results showed significant improvements in all indicators of critical thinking. This finding is supported by the research of Aprioda et al. (2024) and Nurajijjah et al. (2024), which shows that 3CM-based learning significantly improves students' critical thinking skills.

In the graph showing the improvement in critical thinking indicators, it can be seen that all aspects showed improvement, with the "Situation" indicator demonstrating the highest increase of 43 points. Other indicators, such as Focus, Reason, and Inferences, also showed notable improvements of 29, 30, and 34 points, respectively. The smallest improvement occurred in the Clarity indicator, which only increased by 15 points, but it still indicated an impact from the learning intervention. The uniform improvement across most indicators suggests that the 3CM model effectively facilitates various aspects of students' critical thinking. This finding aligns with the research of Drigas & Mitsea (2020) and Varveris et al. (2023), which states that instructional approaches involving metacognition and real-world contexts effectively stimulate all dimensions of critical thinking.

Descriptive results show that the average score of students increased from 55.16 in the pretest to 87.30 in the posttest. This increase is also reflected in the minimum score, which rose from 33.33 to 72.22, and the maximum score, which increased from 83.33 to 100. This significant improvement demonstrates the effectiveness of learning using the 3CM model in enhancing students' critical thinking abilities. This is consistent with the findings of Pauzi (2024) and Siswanto & Andriyani (2024), who stated that conceptual and contextual model-based learning can develop students' critical thinking skills. These results also show that the intervention had an impact not only on students with high abilities but also on students with lower abilities.

The normality test showed that both the pretest and posttest data were normally distributed, with Shapiro-Wilk significance values of 0.426 for the pretest and 0.090 for the posttest, both of which are greater than 0.05. This indicates that the data meet the normality assumption required for further statistical analysis. The Paired Sample T-Test showed a significance value of 0.000 (< 0.05), meaning there was a significant difference between the pretest and posttest scores. This finding provides strong evidence that the 3CM learning model has a statistically significant impact on improving students' critical thinking abilities. This result is supported by the research of Abidah et al. (2023) and Wahyudi et al. (2023), which also found a significant effect of the 3CM model on improving students' cognitive learning outcomes.

Finally, the N-gain test was used to determine the effectiveness of the learning improvement, with a result of 0.72, which falls into the high category. This indicates that the 3CM learning model is highly effective in improving students' critical thinking abilities. This improvement is evident not only in the average score but also in all the critical thinking indicators that were tested. Overall, this study demonstrates that the instructional approach integrating context, concept, and metacognition yields optimal results. This study aligns with the findings of xxx, which states that innovative learning involving active student engagement significantly contributes to the development of critical thinking skills.

CONCLUSION

The findings of the study on the use of the 3CM learning model to enhance critical thinking skills among grade X students at SMA Muhammadiyah 1 Sleman demonstrate that the 3CM model is effective in improving students' critical thinking abilities. This is evidenced by the increase in the average score from 55.16 in the pretest to 87.30 in the posttest, as well as the statistically significant results of the Paired Sample T-Test. This improvement occurred across all critical thinking indicators, with the highest increase in the Situation indicator and the lowest in Clarity, along with an N-Gain value of 0.72, indicating high effectiveness. Based on these findings, it is recommended that future research expand the sample and settings to test the generalizability of the 3CM model in other contexts and educational levels. Additionally, the development of 3CM-based learning media, such as electronic workshetss or interactive modules, is highly recommended to assess their contribution to improving students' critical thinking skills.

REFERENCES

Abidah, H. S., Prihatnani, E., & Info, A. (2023). The experiment of 3CM learning model on the creative thinking ability of Junior High School students in Salatiga Indonesia. *Scholaria: Jurnal Pendidikan Dan Kebudayaan*, *13*(3), 250–262.

Aprioda, A., Utami, C., & Husna, N. (2024). Pengaruh model pembelajaran 3CM (Cool-Critical-Creative-Meaningfull) terhadap kemampuan berpikir kritis siswa kelas VIII. *JPMI (Jurnal Pembelajaran Matematika Inovatif)*, *7*(3), 459–468. https://doi.org/10.22460/jpmi.v7i3.22222

Arikunto, S. (2017). *Prosedur Penelitian Suatu Pendekatan Praktik*. Jakarta: Rineka Cipta.

Aswanti, N. H., & Isnaeni, W. (2023). Analysis of critical thinking skills, cognitive learning outcomes, and student activities in learning the human excretory system using an interactive flipbook. *Research and Evaluation in Education*, *9*(1), 37–48. https://doi.org/10.21831/reid.v9i1.53126

Daryanes, F., Darmadi, D., Fikri, K., Sayuti, I., Rusandi, M. A., & Situmorang, D. D. B. (2023). The development of articulate storyline interactive learning media based on case methods to train student's problem-solving ability. *Heliyon*, *9*(4), e15082. https://doi.org/10.1016/j.heliyon.2023.e15082

Drigas, A., & Mitsea, E. (2020). A metacognition based 8 pillars mindfulness model and training strategies. *International Journal of Recent Contributions from Engineering, Science & IT (IJES)*, *8*(4), 4. https://doi.org/10.3991/ijes.v8i4.17419

Ennis, R. H. (1993). Critical Thinking Assessment. *Theory Into Practice*, *32*(3), 179–186.

Fitriana, E., Siswanto, D. H., & Hanama, A. (2025). The Impact of Thematic Worksheet-Assisted Meaningful Learning Implementation on Students' Mathematical Concept Understanding and Metacognitive Skills. *Jurnal Praktik Baik Pembelajaran Sekolah Dan Pesantren*, *4*(02), 54–67. https://doi.org/10.56741/pbpsp.v4i02.788

Gema, I. S., Shinta, W., Pratiwi, I., Uli, W. N., & Basrowi. (2024). Strengthening digital literacy in Indonesia: Collaboration, innovation, and sustainability education. *Social Sciences and Humanities Open*, *10*(May), 101100. https://doi.org/10.1016/j.ssaho.2024.101100

Hake, R. R. (1999). Analyzing Change/Gain Scores. *Dept. of Physics, Indiana University*, *16*(7), 1073–1080.

Iqbal, M., Basri, B., Zaiturrahmi, Z., & Silahuddin, S. (2024). Development of 3CM T-Merdeka media to enhance creative thinking skills. *Proceedings of the International Conference on Educational Technology and Social Science*, *ICoETS 2023*, 76–87. https://doi.org/10.2991/978-2-38476-200-2_14

Kania, N., Fitriani, C., & Bonyah, E. (2023). Analysis of students' critical thinking skills based on prior knowledge mathematics. *International Journal of Contemporary Studies in Education (IJ-CSE)*, *2*(1), 49–58. https://doi.org/10.30880/ijcse.v2i1.248

Larasanti, R., & Prihatnani, E. (2021). Pembelajaran daring dengan model kolaboratif 3CM dan tutor sebaya untuk meningkatkan hasil belajar dan kreativitas. *Jurnal Pendidikan Dan Kebudayaan*, *11*(3), 271–282.

Miyashita, H., & Wark, N. (2024). Using online discussion forums in blended learning design to advance

higher order thinking. *Asian Journal of Distance Education*, *19*(1), 82–98.

Nurajijjah, N. A., Fatimah, T., & Pratiwi, I. M. (2024). Pengaruh model pembelajaran 3CM dalam meningkatkan keterampilan berpikir kreatif siswa. *TADRUSUUN*, *3*(2), 294–304.

Patandung, Y. (2023). Adolescence students' critical thinking skills in the context of christian education. *International Journal of Asian Education*, *4*(3), 150–156. https://doi.org/10.46966/ijae.v4i3.349

Pauzi. (2024). Critical thinking in learning perspectives on educational philosophy. *El-Ghiroh: Jurnal Studi Keislaman*, *22*(1), 1–17. https://doi.org/10.37092/el-ghiroh.v22i1.699

Rizti, T. M., & Prihatnani, E. (2021). Efektivitas model pembelajaran 3CM (Cool-Critical-Creative-Meaningfull) terhadap Kemampuan berpikir kritis siswa SMP. *Mosharafa: Jurnal Pendidikan Matematika*, *10*(2), 213–224. https://doi.org/10.31980/mosharafa.v10i2.945

Sari, R. N., & Juandi, D. (2023). Improving student's critical thinking skills in mathematics education: A systematic literature review. *Jurnal Cendekia: Jurnal Pendidikan Matematika*, *7*(1), 845–861. https://doi.org/10.31004/cendekia.v7i1.2091

Siswanto, D. H., Alghiffari, E. K., & Pujiastuti, N. I. (2024). Implementation of the CTL model as a strategy to increase interest in learning mathematics. *Indonesian Journal of Educational Science and Technology (Nurture)*, *3*(2), 61–74. https://doi.org/10.55927/nurture.v3i2.9168

Siswanto, D. H., & Andriyani. (2024). Examining students' critical thinking skills in addressing contextual matrix problem withn the tourism travel planing context. *Al Khawarizmi: Jurnal Pendidikan Dan Pembelajaran Matematika*, *8*(2), 88–98. https://doi.org/10.22373/jppm.v8i2.23094

Varveris, D., Saltas, V., & Tsiantos, V. (2023). Exploring the Role of Metacognition in Measuring Students' Critical Thinking and Knowledge in Mathematics: A Comparative Study of Regression and Neural Networks. *Knowledge*, *3*(3), 333–348. https://doi.org/10.3390/knowledge3030023

Wahyudi, W., Kusuma, D., Prihatnani, E., Nova Hasti Yunianta, T., & Amin, N. F. (2023). Development of blended learning activities based on 3CM (Cool-Critical-Creative-Meaningful) to support creativity and good character students. *Journal of Nonformal Education*, *9*(1), 10–22. https://doi.org/10.15294/jne.v9i1.42095

Wahyudi, Waluya, S. B., Suyitno, H., & Isnarto. (2019). Development of 3CM (Cool-Critical-Creative-Meaningful) learning model to increase creative thinking skill. *Journal of Physics: Conference Series*, *1321*(2), 0–9. https://doi.org/10.1088/1742-6596/1321/2/022063

Wahyuni, N., Alam, S. R., Alghiffari, E. K., & Siswanto, D. H. (2024). Harnessing TikTok for learning: Examining its impact on students' mathematical numeracy skills. *Journal of Professional Teacher Education*, *02*(02), 48–56. https://doi.org/10.12928/jprotect.v2i2.945