Al-Ishlah: Jurnal Pendidikan
Vol.14, 2 (June, 2022), pp. 1755-1764
ISSN: 2087-9490 EISSN: 2597-940X, DOI: 10.35445/alishlah.v14i1.1423

Improving Students' Creative Problem-Solving Skills in Online-Onsite Based Mathematics Learning

Tetty Natalia Sipayung, Imelda, Tatag Yuli Eko Siswono, Masriyah

[1] Universitas Katolik Santo Thomas, Indonesia; tetty_sipayung@ust.ac.id
[2] Universitas Katolik Santo Thomas, Indonesia; imelda@ust.ac.id
[3] Universitas Negeri Surabaya,Indonesia; tatagsiswono@unesa.ac.id
[4] Universitas Negeri Surabaya, Indonesia; masriyah@unesa.ac.id

ARTICLE INFO

Keywords:

Creative;
Problem Solving;
Mathematics;
Online-Onsite

Article history:

Received 2021-12-27
Revised 2022-02-28
Accepted 2022-05-18

ABSTRACT

Learning during the COVID-19 period is a concern in the world of education. This is because the learning system has changed from the previous one and it has not been used by both students and teachers. In response to this, it is necessary to conduct action research using the Kemmis and McTaggart models on online-onsite mathematics learning, namely boldly through online platforms and the request of students. The subjects of this study were seventh grade junior high school students who found 27 people. While the object of this research is to increase students' creative problem-solving skills and increase teacher activity and student behavior. Through the instruments used in online-onsite based learning, the results show that there is an increase in the percentage of classical learning completeness in creative problem-solving abilities of students who pass the minimum KKM in the 1st cycle from the percentage of initial ability results but have not shown achievement. While the results of observations of student behavior and teacher activities meet the criteria achieved. Therefore, it is continued to cycle II by correcting the weakness in cycle I. The results of implementation of cycle II show that all performance indicators have been achieved. Through these results, of course, it is a consideration that in improving problem solving skills, it is recommended to do online-onsite based learning, especially in mathematics.

Corresponding Author:
Tetty Natalia Sipayung
Universitas Katolik Santo Thomas, Indonesia; tetty_sipayung@ust.ac.id

1. INTRODUCTION

As knowledge develops, the role of observers and educators is certainly involved in it. It does not rule out the emergence of new problems in this regard. But even so, ideas or alternative solutions are always sought to minimize the problems that arise, especially in the field of mathematics education. Some of the general responses of most students about mathematics are that mathematics is seen as a boring and irrelevant subject, a subject that is too abstract, and the assessment is narrow (Clarke & Roche, 2018). These things are a big challenge for teachers in designing their learning in mathematics classes. Feelings of tension, worry, or fear are also part of math anxiety problems that can affect performance in solving mathematics problems (Stankov & Lee, 2017). The process of mathematical thinking, finding, and solving mathematical problems is central to the process of identifying mathematical patterns, creating mathematical insights, and also in applying mathematics in real-world contexts (Wilkinson, 2018). A problem always contains a conflict or difficulty but must be overcome and processed as a solution (Dostál, 2015).

Creative problem solving promotes individual and social success in an increasingly complex world (Rubenstein et al., 2020). With regard to creativity, it is necessary to make efforts of all leaders and educators in schools to create space (both physical and virtual spaces) in increasing teacher resources and encouraging students to show their creativity and imagination (Kuo et al., 2017). Creative thinking strategies can be used by students to develop their creative capacity in classroom learning (Chien et al., 2020).

Creative thinking refers to the ability to generate new thinking ideas or alternative solutions in solving problems (Hadar & Tirosh, 2019). Creative thinking is a thought process that is applied when needed and can lead to innovation (Kim, 2017). Creative thinking skills are thought processes in creating new ideas that are spread and varied or different (Hidayat et al., 2018). Tatag states the criteria for creative thinking include fluency, flexibility, and novelty (Aini et al., 2020).

Learning outcomes in a learning training can be in the form of competency development and or innovation not only for those who are trained but also for trainers (Mäkiö-Marusik et al., 2019). The importance of creative problem-solving skills is one of the factors causing the inclusion of these skills in the program for the assessment of Indonesian students (PISA) (Dindar, 2018). Creative problem-solving is part of general problem solving. General problem-solving requires problem-solving skills (Rubenstein et al., 2020).

In the conditions of the COVID-19 pandemic, the world of education, especially students and teachers, is forced to apply online learning. One of them is a middle school in the city of Medan. However, sometimes in these schools, onsite learning is also conducted for students who have difficulty in implementing online learning. This is known based on interviews with school principals and a mathematics teacher. In addition, the information was obtained through observations at school. There are some students who come to study with the mathematics teacher to discuss material that has not been understood by the students.

The effectiveness of teaching and mixed learning (onsite-online) is better and more effective than traditional learning. It is concluded based on retention and achievement, interaction and satisfaction in teaching and learning (Nielsen, 2008). Combining onsite online learning leads to performance improvement and gains as the main exercise of students in learning (Rowley et al., 2002). When compared, the demographics of online students differ from those of online students (Antilla, 2004). A study revealed that based on the level of satisfaction, it was found that face-to-face education and training was better than online application, while based on the results of increased retention scores it was concluded that the knowledge of the online group was better than the face-to-face group (Olivet et al., 2016).

However, there are also those who conclude through their research that students who study face-to-face or traditional learning have better retention rates than online and mixed learning (Paden, 2006).

In addition, there is also research literature that finds the hybrid lean model to be more effective and popular among course participants (Townsend, 2013). Other research also reveals that blended learning based on the right selection and division can lead to more useful learning outcomes (Jobst, 2016).

Based on the explanation above, classroom action research was carried out which aims to improve students' creative problem-solving abilities in online-onsite-based mathematics learning. Through this research, it is hoped that creative thinking, especially in solving mathematical problems, will continue to be improved and trained, especially in the face of the 4.0 revolution era. In every learning at school, teachers are expected to equip students with 21st-century skills so that students can be successful in living their lives (Aini et al., 2020). The COVID-19 pandemic situation has also led students and teachers to think creatively, especially in solving problems.

2. METHODS

This research is Action Research conducted at a middle school in Medan city on the odd semester of mathematics learning at the 2021/2022 academic year. This study uses a mixed approach, namely quantitative and qualitative. The subjects of this study were all students of class VII SMP, amounting to 27 people. While the object of this research is the improvement of students' creative problem-solving abilities and the results of observations of student activities and teachers' activities in online-onsite-based mathematics learning. The research instrument is a prerequisite ability test, creative problem-solving ability test, behavioral observation sheet or student learning motivation, and teacher activity observation sheet.

The design of this research cycle uses the Kemmis and McTaggart model which includes the stages of planning, acting, observing, and reflecting (replanning). The implementation flow process is described in the following figure:

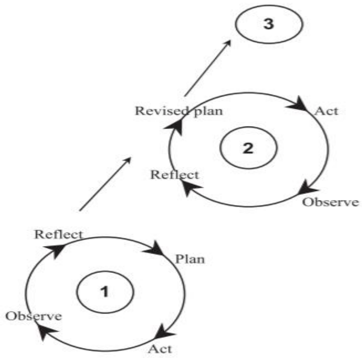

Figure 1. Cycle model of Kemmis and McTaggart (Altrichter et al., 2002)

In this study, the indicators of success were determined, namely (1) the results of observing teacher activities at least 61 (at least good); (2) observation of student behavior (student learning motivation) of at least 61 (at least good); (3) the test results of students' creative problem-solving abilities classically at least 75% of the total students reach the KKM (≥ 70).

In the percentage of students' creative problem-solving ability completeness is calculated using the following formula:

$$\% C = \frac{ES}{TS} x\ 100\% \quad (1)$$

Information:

$\%C$ = Completeness Percentage

ES = Earning Score

TS = Total Score

While classical completeness in this study is calculated by the formula:

$$CC = \frac{X}{Z}\ x\ 100\% \quad (2)$$

Information:

CC = Classical Completeness

X = Many students get scores ≥ 70

Z = Many students take the test

A student who is said to be complete if the value of his creative problem-solving ability reaches a minimum KKM score of 70. So, the creative problem-solving ability of students in one class is said to be complete if there are 75% of students reach the KKM score. In concluding observations of teacher activities, the formula is used:

$$TG = \frac{TS}{MS} x\ 100 \quad (3)$$

Information:
TG = Teacher Grades
TS = Teacher Scores
MS = Maximum Scores

Meanwhile, to calculate the results of observations of the development of student behavior or student learning motivation using the formula:

$$SS = \frac{SC}{MS} x\ 100 \quad (4)$$

Information:
SS = Students Scores
SC = Students Scores
MS = Maximum Scores

3. FINDINGS AND DISCUSSION

The Giving Students' Initial Ability

Before the start of the cycle in the application of action research, students are given an initial test, namely a prerequisite material ability test based on creative problem-solving. The results of the initial ability test are presented in the following table:

Table 1. Initial ability test score

Value Category	Score
Highest	79.2
Lowest	41.7
Average	58.8
Total of students who passed the KKM	8 people
Total of students who didn't pass the KKM	19 people

The table above shows that the average initial ability is 41.7 with the number of students who meet the criteria for completion are 8 people (30%) and those who do not meet are 19 people (70%) which is shown in the following diagram:

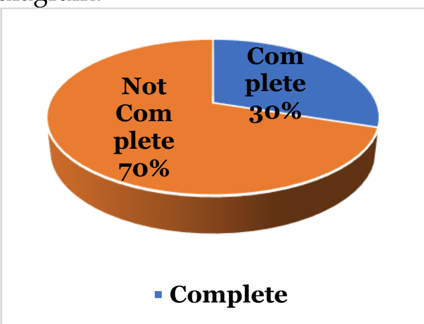

Figure 2. Percentage of completion ofinitial ability

Application of Cycle I

The application of the first cycle consists of four stages. The stages of activities are as follows:

Planning

At the action planning stage, the things to do are (1) develop a learning implementation plan which contains the steps of activities in online-onsite mathematics learning; (2) prepare to learn tools for each meeting such as: lesson plans and worksheets; (3) prepare research instruments, namely tests of creative problem-solving abilities, teacher activity observation sheets, and student behavior observation sheets; (4) prepare assessment guidelines.

Acting

At this stage, the implementation of online-onsite mathematics learning is carried out. The learning carried out is adjusted to the lesson plan. The purpose of implementing learning is to strive for creative problem-solving abilities and student learning motivation to increase. After the implementation of the first cycle of learning is complete, the students are given a creative problem-solving ability test, the results are presented in the following table:

Table 2. Score test of creative problem-solving ability at cycle I

Value Category	Score
Highest	87.5
Lowest	50
Average	75
Total of students who passed the KKM	20 people
Total of students who didn't pass the KKM	7 people

The table above shows that the average creative problem-solving ability of students is 75 with the number of students who meet the completion criteria as many as 20 people (74%) while the number of students who do not meet the completion criteria is 7 people (26%).

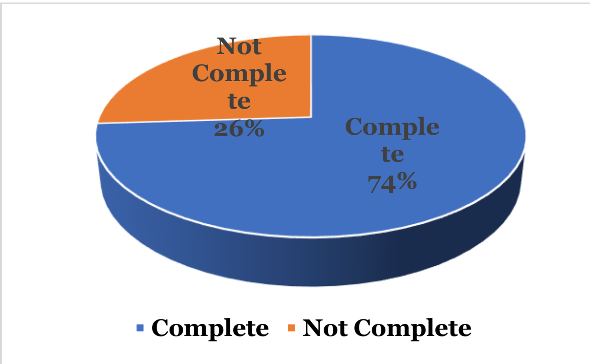

Figure 3. Percentage of creative problem solving ability at cycle I

In the picture above, it is clear that the percentage of students in one class who meet the criteria for completion has not been achieved at least 75%. In other words, the expected classical completeness has not been achieved.

Observing

The aspects observed at this stage are student behavior in the form of student learning motivation and teacher activities during the learning process. Observations were made by researchers. The results of the observations were recorded by the researchers for consideration of actions in cycle II. The average value of the observations of teacher activities during the three meetings is 87 (good) and the value of observing student behavior (learning motivation) is 67.3 (good). So, at this stage, it has met the criteria in accordance with those required in the performance indicators of research success.

Reflecting

Based on the performance indicators of the successful implementation of the first cycle of learning, the average percentage of teacher activity and student behavior has met the criteria, namely at least 61. However, the results of the problem-solving ability test have not been met, classical completeness is still below 75%. Therefore, it is necessary to take corrective actions in cycle II so that the weaknesses in cycle I do not recur in cycle II.

Application of Cycle II

The application of cycle II includes four stages. The stages of the activities are as follows:

Planning

At this stage, any errors in the implementation of the cycles I was corrected. The planning carried out in the second cycle is the same as the activities carried out in the first cycle planning, such as: Preparing learning tools and research instruments (assessment).

Acting

At this stage, the implementation of online-onsite-based mathematics learning is carried out according to the lesson plan. The purpose of implementing learning is to strive for creative problem-solving abilities and student learning motivation to increase or meet the minimum achievement performance indicators. After the implementation of the second cycle of learning is complete, students are given a creative problem-solving ability test, the results are presented in the following table:

Table 3. Score test of creative problem-solving ability at cycle I

Value Category	Score
Highest	87.5
Lowest	50
Average	75
Total of students who passed the KKM	21 people
Total of students who didn't pass the KKM	6 people

The table above shows the average creative problem-solving ability of students is 75 with the number of students who meet the criteria for completion as many as 21 people (78%) while the number of students who do not meet the criteria for completion is 6 people (22%).

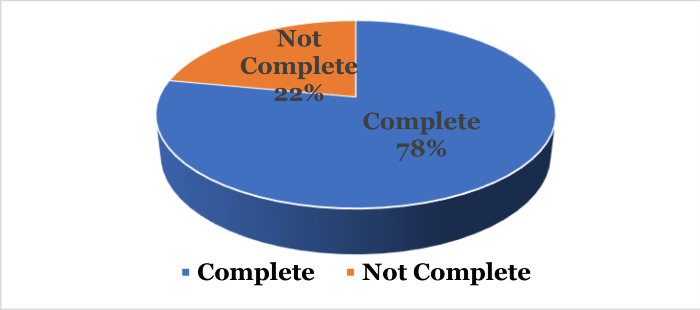

Figure 4. Percentage of creative problem solving ability at cycle II

The picture above illustrates the percentage of students in one class who meet the criteria for completion, which is 78%. In other words, classical completeness is achieved.

Observing

The aspects observed at this stage are student behavior in the form of student learning motivation and teacher activities during the learning process. Observations were carried out by researchers and the results were recorded by researchers for consideration of actions in cycle II. The average value of the observations of teacher activities during the three meetings was 83 (good) and the average value of observation of student behavior (learning motivation) was 67.3 (good). So, at this stage, it has met the criteria in accordance with those required in the indicators of research success.

Reflecting

Based on the performance indicators of the success of the implementation of the second cycle of learning, the average value of teacher activity is 83 (good) and student behavior is 67.3 (good), and the results of the problem-solving ability test meet classical completeness, which is 78%. With these conditions, the expected success performance indicators have been achieved. Therefore, it is not necessary to proceed to cycle III. Based on the overall percentage of students who meet the criteria for completion on the initial ability test is 30%, the percentage of classical completeness at the end of the first cycle is 74%, then increased by 3% in the second cycle, which is 78%. So, online-onsite-based mathematics learning can improve students' creative problem-solving abilities.

In connection with efforts to improve creative thinking skills or creative problem solving, it can also be done through problem-based learning (Wijayati et al., 2019), strategies for increasing metacognition (Song & Park, 2017), with the RME approach (Soraya et al., 2018), with an RME-based student worksheet (Hidayati, Balu Suparman, 2018), with an e-learning-based RME approach (Azmi et al., 2018), with a brainstorming strategy (AlMutairi, 2015), with an open-ended-based Student Activity Sheet (Romli et al., 2018). Through this research, improving the ability to solve creative problems can be done in online-onsite-based learning.

4. CONCLUSION

Based on the results of the study, it is concluded that online-onsite mathematics learning can improve students' creative problem-solving abilities. This can be seen after the learning in cycles I and II are carried out. All performance indicators of the success of this research were achieved after the end of the implementation of the second cycle stage. To further strengthen the validity of this research, further research is needed. The next research plan will be qualitative research to analyze the creative problem-solving abilities of students who are taught by applying online-onsite learning methods.

Acknowledgement

The author expresses his gratitude for the support and funding of the national competitive research grant for the Cooperation between universities research scheme provided by the Director of Research and Community Service at the Ministry of Education, Culture, Research, and Technology based on letter number 9/E1/KPT/2021 and contract agreement 165 /LL1/PG/2021 between the Institute for Higher Education Services Region 1 and the Institute for Research and Community Service at Universitas Katolik Santo Thomas so that the research carried out this year went well and we can write down the results of our research through this educational journal article.

REFERENCES

Aini, A. N., Mukhlis, M., Annizar, A. M., Jakaria, M. H. D., & Septiadi, D. D. (2020). Creative Thinking Level of Visual-Spatial Students on Geometry HOTS Problems. Journal of Physics: Conference Series, 1465(1). https://doi.org/10.1088/1742-6596/1465/1/012054.

AlMutairi, A. N. M. (2015). The Effect of Using Brainstorming Strategy in Developing Creative Problem Solving Skills Among Male Students in Kuwait: A Filed Study on Saud Al-Kharji School in Kuwait City. Journal of Education and Practice, 6(3), 136–146.

Altrichter, H., Kemmis, S., Mctaggart, R., & Zuber-Skerritt, O. (2002). The Concept of Action Research. The Learning Organization, 9(3), 125–131. https://doi.org/10.1108/09696470210428840.

Antilla, J. L. (2004). A Comparison of Academic Achievement and Course Activity Factors Among Online and Onsite Learners in Higher Education. In Dissertation. http://dx.doi.org/10.1016/j.jaci.2012.05.050.

Azmi, A. L., Wardono, & Cahyono, A. N. (2018). Mathematics Literacy on Creative Problem Solving with Realistic Mathematics Education Approach Assisted by E-Learning Schoology. Unnes Journal of Mathematics Education, 7(1), 188–194. https://doi.org/10.15294/ujme.v7i1.24472.

Chien, Y. C., Liu, M. C., & Wu, T. T. (2020). Discussion-Record-Based Prediction Model for Creativity Education Using Clustering Methods. Thinking Skills and Creativity, 36(October 2019), 100650. https://doi.org/10.1016/j.tsc.2020.100650.

Clarke, D., & Roche, A. (2018). Using Contextualized Tasks to Engage Students in Meaningful and Worthwhile Mathematics Learning. Journal of Mathematical Behavior, 51(November 2016), 95–108. https://doi.org/10.1016/j.jmathb.2017.11.006.

Dindar, M. (2018). An Empirical Study on Gender, Video Game Play, Academic Success and Complex Problem Solving Skills. Computers and Education, 125, 39–52. https://doi.org/10.1016/j.compedu.2018.05.018.

Dostál, J. (2015). Theory of Problem Solving. Procedia - Social and Behavioral Sciences, 174, 2798–2805. https://doi.org/10.1016/j.sbspro.2015.01.970.

Hadar, L. L., & Tirosh, M. (2019). Creative Thinking in Mathematics Curriculum: An Analytic Framework. Thinking Skills and Creativity, 33(September 2018), 100585. https://doi.org/10.1016/j.tsc.2019.100585.

Hidayat, T., Susilaningsih, E., & Kurniawan, C. (2018). The Effectiveness of Enrichment Test Instruments Design to Measure Students' Creative Thinking Skills and Problem-Solving. Thinking Skills and Creativity, 29, 161–169. https://doi.org/10.1016/j.tsc.2018.02.011.

Hidayati, Balu Suparman, S. (2018). Development of Student Worksheets Based on RME to Improve Creative Thinking of Grade VII Middle School Students in Indonesia. International Summit on Science Technology and Humanity, Iseth, 162–172.

Jobst, V. J. . (2016). Diving Into the Blended Learning Pool: One University's Experience. Journal of Higher Education Theory & Practice, 16(4), 89–104. http://ezproxybib.pucp.edu.pe:2048/login?url=http://search.ebscohost.com/login.aspx?direct=true&db=eue&AN=120149392&lang=es&site=eds-live&scope=site.

Kim, K. H. (2017). The Torrance Tests of Creative Thinking - Figural or Verbal: Which One Should We Use? Creativity. Theories – Research - Applications, 4(2), 302–321. https://doi.org/10.1515/ctra-

2017-0015.
Kuo, H. C., Burnard, P., McLellan, R., Cheng, Y. Y., & Wu, J. J. (2017). The Development of Indicators For Creativity Education and A Questionnaire to Evaluate Its Delivery and Practice. Thinking Skills and Creativity, 24, 186–198. https://doi.org/10.1016/j.tsc.2017.02.005.
Mäkiö-Marusik, E., Colombo, A. W., Mäkiö, J., & Pechmann, A. (2019). Concept and Case Study For Teaching and Learning Industrial Digitalization. Procedia Manufacturing, 31, 97–102. https://doi.org/10.1016/j.promfg.2019.03.016.
Nielsen, S. M. (2008). Half Bricks and Half Clicks: Is Blended Onsite and Online Teaching and Learning The Best of Both Worlds ? Proceedings of the Seventh Annual College of Education Research Conference: Urban and International Education Section, 105–110. https://bit.ly/3bJ06Yy.
Olivet, J., Zerger, S., Greene, R. N., Kenney, R. R., & Herman, D. B. (2016). Online Versus Face-to-Face Training of Critical Time Intervention: A Matching Cluster Randomized Trial. American Journal of Distance Education, 30(4), 237–249. https://doi.org/10.1080/08923647.2016.1232107.
Paden, R. R. (2006). A Comparison of Student Achievement and Retention in An Introductory Math Course Delivered in Onine, Face-To-Face, and Blended Modalities. In A Dissertation, Capella University.
Romli, S., Abdurrahman, A., & Riyadi, B. (2018). Designing Students' Worksheet Based on Open-Ended Approach to Foster Students' Creative Thinking Skills. Journal of Physics: Conference Series, 948(1). https://doi.org/10.1088/1742-6596/948/1/012050.
Rowley, K., Bunker, E., & Cole, D. (2002). Designing The Right Blend Combining Online and Onsite Training For Optimal Results. Performance Improvement, 41(4), 26–36. https://doi.org/10.1002/pfi.4140410406.
Rubenstein, L. D. V., Callan, G. L., Speirs Neumeister, K., & Ridgley, L. M. (2020). Finding The Problem: How Students Approach Problem Identification. Thinking Skills and Creativity, 35(August 2019). https://doi.org/10.1016/j.tsc.2020.100635.
Rubenstein, L. D. V., Callan, G. L., Speirs Neumeister, K., Ridgley, L. M., & Hernández Finch, M. (2020). How Problem Identification Strategies Influence Creativity Outcomes. Contemporary Educational Psychology, 60(January), 101840. https://doi.org/10.1016/j.cedpsych.2020.101840.
Song, J., & Park, J. (2017). The Effects of Strategy of enhanced Metacognition on the Improvement of Creative Problem Solving Skills. 1–12.
Soraya, F., Yurniwati, Y., Cahyana, U., & Syarif Sumantri, M. (2018). The Application of Realistic Mathematics Education (RME) Approach to Increase The Creative Thinking Ability of Fraction Subject Matter For Fourth-Graders of SDN Rawajati 06 Pagi. American Journal of Educational Research, 6(7), 1016–1020. https://doi.org/10.12691/education-6-7-19.
Stankov, L., & Lee, J. (2017). Self-Beliefs: Strong Correlates of Mathematics Achievement and Intelligence. Intelligence, 61, 11–16. https://doi.org/10.1016/j.intell.2016.12.001.
Townsend, J. S. & J. R. P. (2013). Energy as A Unifying Concept in Science Teaching: Results From A Hybrid (Online/Onsite) Course For Middle School Science Teachers. ASTE Annual Conference Charleston, 1, 105–112.
Wijayati, N., Sumarni, W., & Supanti, S. (2019). Improving Student Creative Thinking Skills Through Project Based Learning. KnE Social Sciences, 2019, 408–421. https://doi.org/10.18502/kss.v3i18.4732.
Wilkinson, L. C. (2018). Teaching The Language of Mathematics: What The Research Tells Us Teachers Need to Know and Do. Journal of Mathematical Behavior, 51(April), 167–174. https://doi.org/10.1016/j.jmathb.2018.05.001.