

## THE APPLICATION OF MATHCITYMAP AT SDN KAWERON II TO IMPROVE STUDENTS' PROBLEM SOLVING ABILITIES

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### Abstract

Quality education is one of the rights that every citizen must obtain. The quality of education can be seen through the learning process provided by teachers to students at school. However, when the COVID-19 pandemic hit, the learning process became very hampered, especially in mathematics learning. This cannot be separated from the assumption that mathematics is a subject that is difficult for students to understand. The presence of the MathCityMap application is one of the innovations in the field of mathematics learning because it can make learning mathematics more fun for students. This paper aims to analyze the MathCityMap experiment at SDN Kaweron II with the aim of improving students' problem-solving abilities. The research results show that using MathCityMap is quite effective in improving students' problem-solving abilities because learning is packaged in a fun way and attracts students' interest in studying mathematics outside the classroom. Using MathCityMap also becomes a challenge for students to want to solve every problem given by the teacher. Therefore, apart from problem-solving skills, this learning also improves students' critical thinking and teamwork skills.

**Keywords:** MathCityMap, Problem Solving, Students

### Abstrak

Pendidikan yang berkualitas merupakan salah satu hak yang harus didapatkan oleh setiap warga negara. Kualitas pendidikan dapat dilihat melalui proses pembelajaran yang diberikan oleh guru kepada siswa di sekolah. Namun, ketika pandemi COVID-19 melanda, proses pembelajaran menjadi sangat terhambat, terutama dalam pembelajaran matematika. Hal ini tidak lepas dari anggapan bahwa matematika merupakan mata pelajaran yang sulit dipahami oleh siswa. Hadirnya aplikasi MathCityMap merupakan salah satu inovasi di bidang pembelajaran matematika karena dapat membuat pembelajaran matematika lebih menyenangkan bagi siswa. Tulisan ini bertujuan untuk menganalisis eksperimen MathCityMap di SDN Kaweron II dengan tujuan meningkatkan kemampuan pemecahan masalah siswa. Hasil penelitian menunjukkan bahwa penggunaan MathCityMap cukup efektif dalam meningkatkan kemampuan pemecahan masalah siswa karena pembelajaran dikemas dengan cara yang menyenangkan dan menarik minat siswa untuk belajar matematika di luar kelas. Menggunakan MathCityMap juga menjadi tantangan bagi siswa untuk ingin menyelesaikan setiap masalah yang diberikan oleh guru. Oleh karena itu, selain keterampilan pemecahan masalah, pembelajaran ini juga meningkatkan kemampuan berpikir kritis dan kerja tim siswa.

**Keywords:** MathCityMap, Pemecahan Masalah, Siswa

## INTRODUCTION

Education is one of the rights that every citizen must obtain, especially quality education. Quality education is education that has an impact on improving student learning outcomes, both in cognitive competence and non-cognitive competence. Cognitive competence can be measured through numeracy competence and literacy competence, while non-cognitive competence can be measured through the behavioral characteristics of

students. This second competency is the basic capital that students must have in various aspects of living a social life. Apart from that, individuals can also improve the quality of natural resources through education (Asmawi, 2005). Quality education certainly cannot be separated from the learning process carried out by educators and students.

In recent times, the learning process has experienced obstacles, namely the Covid-19 pandemic, which has caused school activities to be carried out online (on the network) considering the social restrictions or physical distancing implemented by the government. This causes a decrease in students' learning motivation and mastery of learning concepts. Therefore, these obstacles become challenges for educators in the learning process. Arianti (2019) stated that a conducive environment could encourage learning that is more comfortable, enjoyable, and meaningful for students. However, the Covid-19 pandemic has certainly created an uncomfortable environment, so learning, including mathematics, is not optimal.

Mathematics is one of the subjects that is always taught at the education level from early childhood to higher education, especially at the elementary school (SD), junior high school (SMP), and senior high school (SMA) levels. Often, students consider mathematics to be a subject that is quite difficult to understand (Takdir, 2017). Even though it is often considered a difficult subject, mathematics needs to be given to every student because it can be a provision or basis for problem-solving, the ability to think critically, systematically, logically, analytically, and creatively, and the ability to work together in a team (Maharani & Bernard, 2018). The provision of mathematics subjects is also aimed at increasing students' curiosity and interest regarding certain problems, which must be given a solution by thinking concretely and presenting them to the surrounding environment (Saleh et al., 2018). Apart from that, having mathematics subjects can also help students master mathematical concepts so that they can then be applied to everyday life.

Mathematics, as a learning that is closely related to reasoning, is indeed a subject that really helps students in solving problems. As mentioned by Rizal (2009, in Yuwono, 2016), the presence of mathematics is a method for solving problems that are often found in everyday life. However, it is often found that teachers cannot teach mathematics by paying attention to its benefits for everyday life. This is what makes mathematics more difficult to understand and creates a difficult impression for students (Widjajanti, 2008).

Therefore, a teacher is required to have a teaching method that can make mathematics memorable and well-received by students so that it has benefits for everyday life.

MathCityMap is a learning media in mathematics that can relate mathematics to everyday life (Ludwig & Jablonski, 2019). This is because, in MathCityMap, mathematics learning uses formative tools such as maps and the surrounding environment to stimulate student responses. Learning using MathCityMap is carried out outside the classroom, and then students are given a map to find mathematical problems that have been prepared by the teacher. When students have succeeded in finding the problem in question, the next step is that students are asked to find a way out of the problem based on the teacher's guidance and direction. Based on this method, mathematics will certainly be interesting for students because it is packaged in a fun way. Therefore, this research will examine the application of MathCityMap at SDN Kaweron II in improving students' problem-solving abilities.

## **METHOD**

This research is a descriptive, experimental study that describes mathematics learning using the MathCityMap method with the research location at SDN Kaweron II. This research includes several stages, namely the preparation, implementation, and data analysis stages of the data obtained. Meanwhile, the time of this research was in the second semester of the 2021/2022 academic year, with the research subjects being students at SDN Kaweron II class VI, totaling 20 students who were then divided into 4 groups (each group consisting of 5 students) to apply the MathCityMap method.

Several data collection techniques were used in this research, namely observation, documentation, interviews, and written tests for students. Meanwhile, data analysis in this research is data triangulation using the results of observation, documentation, and written tests. Next, the research results will be analyzed and explained descriptively using words so that the author can find out the results of increasing the abilities of the students being tested. The author analyzes the differences between learning outcomes without using MathCityMap and learning outcomes using MathCityMap. Then, the final stage is conducting interviews with students regarding learning activities using the MathCityMap method with the aim of the author being able to dig deeper into the data for the analysis process.

## RESULTS AND DISCUSSION

Teachers are important actors in implementing the learning process in the classroom with the aim of delivering material to students or students. Therefore, being a teacher means having to be creative enough to create fun and quality learning so that students can understand the material according to learning objectives, especially in mathematics subjects. One learning media that can create a fun learning process is the use of the MathCityMap or MCM application. MathCityMap is an Android/iOS application based on GPS. MathCityMap provides the location/finding of mathematical problems in the Math Trail, which will be used as a stopping point for a mathematical problem that students will solve (Ismaya et al., 2018).

The first step in using MathCityMap is to download the application via the Play Store on each cellphone. Next, register to create an account on the MathCityMap application. Registering or creating an account in the application aims to help teachers use features such as creating tasks and trails which will be shared with students and visitors in general. There are several features or menus on the initial display of the application, such as Search for Trails, Add Trails, My Trails, and Manage Trails.

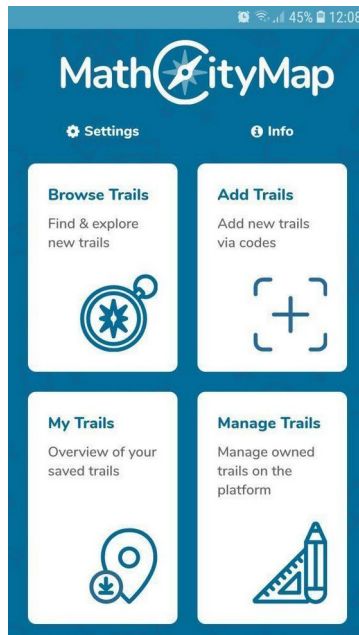


Figure 1: MathCityMap Application Display

Once the account has been created, the next step that must be taken by the teacher is to create a Task and Trail by looking for the right location for the MathCityMap project area with the criteria of an attractive, unique, comfortable, and safe location for students so

that learning can give a pleasant impression but stay safe. After the teacher finds and determines the Task points, these points will be made into a Trail so that students can later access and work on them by entering the code or link taken from the Trail.

Learning activities using MathCityMap are carried out in groups, where each group contains 5 students. The formation of this group is used to train cooperation and coordination between students to get maximum grades. Next, students will be directed to download a map of the location where they will go on an adventure and complete a series of tasks at several stopping points. Each Trail will have several problems that students must solve. In this activity, the teacher attempts to stimulate critical thinking skills and problem-solving abilities in students in groups.

Each group is required to solve each problem at each point in the task using tools determined by the teacher. Each task also contains instructions for solving existing problems, which will make it easier for students to complete them. However, proper cooperation and coordination are required to find a solution to the problem. After each task has been completed by a group of students, the final results of completing the task will be entered into the MathCityMap application. If there are groups of students who have difficulty or cannot access MathCityMap using cell phones, students can use the LKPD, which can be obtained by downloading a PDF file from the MathCityMap application.

Learning activities using the MathCityMap application are also one of the teachers' efforts to take advantage of technological advances, especially cell phones, which are currently closely related to students' lives. As explained by Ardiansyah & Nana (2020), cell phones are currently recommended as a learning medium outside the classroom to support students' abilities. MathCityMap is an application that can only be operated on smartphones with the Android platform and used using internet access. The MathCityMap application can help students solve problems while learning mathematics using the surrounding environment. Therefore, with the MathCityMap application, students can do math tracks with fun and even without the guidance of a teacher or adult.

### **Implementation of the Mathematics Pathway on MathCityMap at SDN Kaweron II**

There are several location points used by teachers to implement mathematics pathways through the MathCityMap application at SDN Kaweron II, namely the field and the park. In the field area, students will be given a number of gallons of mineral water and asked

to estimate the amount of water that can be stored in one gallon. In this question, students use the concept of room volume by measuring the length, width, and height of the room and gallon so that students can calculate the volume of water that the gallon can hold. The instructions given in this question are that there is information regarding the length of the block 270 cm, width 270 cm, and height 250 cm, where the volume of the block with the formula  $p \times l \times h$  is  $270 \text{ cm} \times 270 \text{ cm} \times 250 \text{ cm} = 18,225,000 \text{ cm}^3$ . By learning outside of class like this, it is hoped that students will be able to solve problems regarding determining the volume of blocks and cylinders.

The second task is in the park which has a circular area. Students are given questions regarding the costs of planting grass in the circle area. In this question, students will use the concept of area of a circle to work on the problem. Students are required to measure the diameter of the circular area to then determine the radius, and continue to calculate the costs required when the area must be planted with grass.

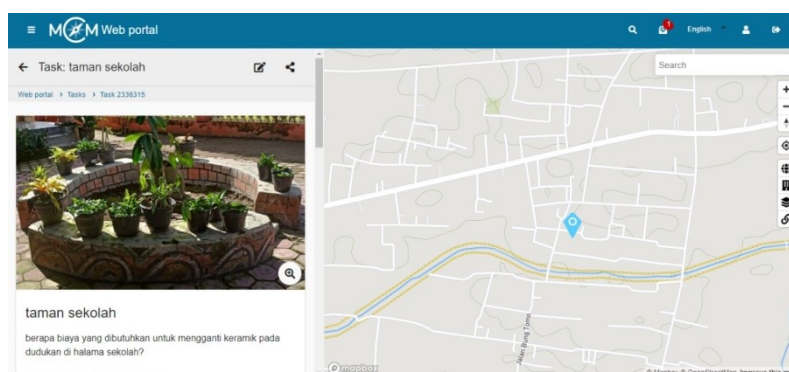


Figure 2: Display of the MathCityMap Application with Tasks in the School Garden

### Effectiveness of the MathCityMap Application

Experiments carried out by the teacher show that students have a high curiosity if the question is in a hidden location, so students will use the GPS feature in the MathCityMap application. Through this problem, students realize that the GPS feature can help them find the location point they are looking for based on the coordinates of the task position and the coordinates of the current position. Students can also learn to use other features in the application to help solve the questions given. Several features in the MathCityMap application can be used by students when they do not have ideas for solving a given problem. When students enter answers to the questions given, the system in the

MathCityMap application will immediately provide feedback in the form of a true or false statement regarding the answer.

Based on data findings at the research location, the majority of students agreed that the various features provided by the MathCityMap application were very helpful in the learning process and gaining knowledge, especially in mathematics subjects. Apart from that, the feedback feature regarding correct or incorrect answers can help students evaluate their answers if they are found to be wrong. The MathCityMap application also provides an opportunity feature when students give an incorrect answer to repeat their problem-solving process if time is still available.

### **Student Learning Process Using MathCityMap**

Students are divided into 4 groups, with each group consisting of 5 people. Each group will work together to complete all the tasks given. Based on the findings of the research data, generally, one group will be given different tasks for each member. For example, one student has the task of operating a mobile device, then two to three students measure objects, and the rest are tasked with calculating the results. Usually, in each task, there will be a rotation in the division of tasks for each group. Even so, students have many different ways of working with one another. The results of the data findings show that each group has its own way of solving problems in the MathCityMap application without using instructions. Each group realizes that the questions that must be solved are not a form of competition, so they do not compete to solve them quickly but try to work together to solve the problem correctly. The students also realized that the purpose of holding this activity was to study mathematics outside the classroom, not to test the individual abilities of each student.



Figure 3: Students Discuss to Solve Problems

### Math Activities in the MathCityMap Application

Based on the results of the analysis show that students tend to be enthusiastic about solving every problem given and feel challenged to work together to find answers. It was also seen that students were very happy with trail math activities, especially on favorite routes. Students' favorite routes are routes with varied tasks (both in level of difficulty, category, and topic), routes that are comfortable and not tiring, and are located in interesting and popular places. The level of task difficulty is related to the level of student interest in the task. The results of the regression analysis show that the relationship between the level of difficulty ( $x$ ) and interest ( $y$ ) is shown by the formula:  $y = -6.28 + 7.18x - 1.19x^2$ . The level of difficulty contributes to the level of interest by 84.4%. Through these findings, it can be concluded that questions that are too difficult will make students feel frustrated, while questions that are too easy will make students feel bored quickly. On the other hand, data findings in the field also show that when participants encounter questions or problems that are more difficult, they will feel challenged to find a solution. Students also have a high curiosity to find solutions to existing problems. Therefore, assignments that tend to be interesting and challenging actually become a special attraction for students. It is through this method that mathematics will be considered a fun subject for them.

Overall, the experiment using the MathCityMap application, which was carried out at SDN Kaweron II, was considered to have gone well and can be called a mathematical activity



(Fuller et al., 2010). This is caused by students who tend to be more easily involved in mathematics activities outside of class. Based on observations in the field, it was found that they easily understand new ideas and gain new experiences because they have to solve problems that are interesting and challenging, encourage discussion, and support discovery. Apart from having fun, students also gain knowledge about mathematical material. Therefore, students can explore mathematics more and not think mathematics is a boring and difficult subject. The experimental results show that the objectives and rules in MathCityMap are proven to be understandable by students. The majority of students were actively involved in these activities and, expressed positive feelings (97%), and did not experience difficulties in working on the mathematics route, including using applications (98%).

Table 1: Students' Sense of Enjoyment and Interest

Indicator	Criteria		
	Strongly Agree	Agree	Neutral
Students are like the activities	120	115	5
Interesting activity	143	90	7

Based on the table above, it can be seen that of the 240 students, 120 said they strongly agreed, 115 said they agreed, and 5 were neutral regarding the opinion that the students liked the activity. Meanwhile, 143 stated that they strongly agreed, 90 stated that they agreed, and 7 stated that they were neutral regarding the opinion that the activity was interesting. Through this questionnaire, the author conducted further data mining on students and found that around 30% of students felt happy and more interested in mathematics when learning was done outside the classroom. Meanwhile, 23% of students said that learning using technology or smartphones tended to be more fun. On the other hand, 18% of students said that mathematics felt more fun when it could be applied to the surrounding environment and daily activities. Apart from that, 16% of students admitted that they preferred working together in a group to solve problems in aspects of mathematical activities. Then, there were 13% of students gave another reason for enjoying learning mathematics using MathCityMap, namely because it was a daily routine, a break, and a new activity.

Table 2: Application of Mathematical Concepts

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Indicator	Percentage
Applying Mathematical Concepts in Real Life	63,6%
Doing Math Activities Outdoors	32,4%
Utilizing Advanced Technology Devices	15,6%
Using Non-Standard Measuring Instruments	12,0%
Tim Work	10,8%
Carrying out activities in different environments and public places (for example, how to maintain order, politeness, caution and security)	6,0%
Etc.	3,6%

They also reported that through this activity, they experienced applying mathematical concepts in real life (63.6%); doing math activities outdoors (32.4%); utilizing advanced technological devices (15.6%); using non-standard measuring instruments (12.0%); cooperate (10.8%); carrying out activities in different environments and public places (for example how to maintain order, politeness, caution and security) (6.0%); and others (3.6%). This new experience made them enthusiastic about participating in this activity until the end.

### **Increasing Students' Problem Solving Abilities through MathCityMap**

The experimental results of the mathematics learning process using media in the form of the MathCityMap application were proven to be able to improve students' problem-solving or problem-solving abilities. This can be seen from the desire and ability of students to find solutions to the problems they find through group collaboration. The existence of technological developments has a rapid influence on student behavior and abilities (Khoir & Subuatningsih, 2024). Therefore, apart from improving problem-solving skills, students are also trained to improve cooperation and coordination skills with teammates or a group of them. Good and unified cooperation will produce more precise problem-solving and can train students to think more critically.



Figure 4: Students Observe the Problem

Students tend to prefer and enjoy learning activities outside the classroom because they are directly related to the surrounding environment and daily activities. In addition, the use of technology in the form of smartphones also attracts students to this activity (Rahman et al., 2017). Students' ability to solve problems is also measured through questionnaires distributed before (pre) and after (post) the activity. In general, the results indicate that there is a change in students' problem-solving abilities after experiencing mathematics learning in this project. The results of the Mann-Whitney U test show that the p-value for all dimensions is less than 0.001. This shows that the problem-solving abilities of students in the two conditions are significantly different. The mean scores before and after implementation were as follows: 3.73 versus 4.36 for Internal Criteria ( $p = 0.000$ ); 3.61 versus 4.45 for Challenge ( $p = 0.000$ ); 3.40 versus 4.40 for Curiosity ( $p = 0.000$ ); 3.91 versus 4.43 for Independent Mastery ( $p = 0.000$ ); 3.40 versus 4.34 for Independent Assessment ( $p = 0.000$ ).

## CONCLUSION

MathCityMap learning media is a medium that has been used and developed by various countries not only to design mathematics pathways but also for several other subjects. The MathCityMap application includes the preparation, implementation, and evaluation process, in which a GPS feature is used to track the specified test location. The implementation of MathCityMap learning media at SDN Kaweron II is said to be in accordance with the expected concepts, techniques, implementation, and objectives. Overall, students also follow a series of activity flows and the flow of using the MathCityMap application. Research findings show that the application of MathCityMap at SDN Kaweron II has been proven to improve students' problem-solving abilities, especially cooperation in solving problems through one group.

**REFERENCES**

- Ardiansyah, A. A., & Nana, N. (2020). Peran Mobile Learning sebagai Inovasi dalam Meningkatkan Hasil Belajar Siswa pada Pembelajaran di Sekolah. *Indonesian Journal Of Educational Research and Review*, 3(1), 47. <https://doi.org/10.23887/ijerr.v3i1.24245>
- Arianti, A. (2019). Urgensi Lingkungan Belajar Yang Kondusif Dalam Mendorong Siswa Belajar Aktif. *Didaktika*, 11(1), 41. <https://doi.org/10.30863/didaktika.v11i1.161>
- Fuller, R. A., McDonald-Madden, E., Wilson, K. A., Carwardine, J., Grantham, H. S., Watson, J. E. M., Klein, C. J., Green, D. C., & Possingham, H. P. (2010). Replacing underperforming protected areas achieves better conservation outcomes. *Nature*, 466(7304), 365–367. <https://doi.org/10.1038/nature09180>
- Ismaya, B. F., Cahyono, A. N., & Mariani, S. (2018). Kemampuan Penalaran Matematika dengan Math Trail Project berbantuan MathCityMap. *Seminar Nasional Pendidikan Matematika Ahmad Dahlan*, January.
- Khoir, A. K., Suciptaningsih, O. A. (2024). Penguatan Pendidikan Karakter Disiplin dan Tanggung Jawab Berbasis Pembelajaran Digital Melalui Gerakan Literasi Sekolah. *Pendas: Jurnal Ilmiah Pendidikan Dasar*, 9(2). 4372-4385.
- Ludwig, M., & Jablonski, S. (2019). Doing Math Modelling Outdoors- A Special Math Class Activity designed with MathCityMap. <https://doi.org/10.4995/head19.2019.9583>
- Maharani, S., & Bernard, M. (2018). Analisis Hubungan Resiliensi Matematik Terhadap Kemampuan Pemecahan Masalah Siswa Pada Materi Lingkaran. *JPMI (Jurnal Pembelajaran Matematika Inovati)*, 1(5), 819.
- Saleh, M., Prahmana, R. C. I., Isa, M., & Murni. (2018). Improving the reasoning ability of elementary school student through the Indonesian realistic mathematics education. *Journal on Mathematics Education*, 9(1), 41–53. <https://doi.org/10.22342/jme.9.1.5049.41-54>
- Takdir, M. (2017). *Kepomath Go “ Penerapan Konsep Gamifikasi Dalam Pembelajaran Matematika Dalam Meningkatkan*.
- Widjajanti, Djamilah Bondan. 2008. *Mengembangkan Kemampuan Komunikasi Matematis Mahasiswa Calon Guru Matematika Melalui Perkuliahan Berbasis Masalah*. Makalah

Disajikan pada Seminar Nasional Mahasiswa S3 Matematika di Universitas Gadjah Mada Yogyakarta, 31 Mei 2008.

Yuwono, A. (2016). Problem Solving dalam Pembelajaran Matematika. UNION: Jurnal Pendidikan Matematika, 4(1). 143-156.