Math City Map: Student Numeration Using Android-Based Technology Media

Lis Pita Ilindia[1], Indah Widyaningrum[1], Chika Rahayu[1*]

[1] STKIP Muhammadiyah Pagaralam, Indonesia
Correspondence: ✉ chikarahayu80@gmail.com

Article Info	Abstract
	Students' low numeracy skills impact students' learning outcomes and progress in mathematics. To improve these abilities, we can use operating system-based application learning media. The Math City Map application is a system that works on iOS/Android devices that helps students become actively involved and master the material being studied. This research aimed to see students' numeracy abilities after applying the Math City Map to statistics material. This research is research whose data uses quantitative, systematic, planned, and structured analysis. The design used in the study is an experimental Design with One Group Pre-test-Post-test Design. Tests, questionnaires, and documentation are data collection methods to assess students' numeracy skills. The results of the student test data stated that 82% of students could use numbers and symbols, 69% could analyze information, and 48% could use the analysis results to make decisions and formulate conclusions. By obtaining this percentage of students' numeracy abilities, it can be stated that using the Math City Map (MCM) application can train students to use symbols, numbers, tables, and diagrams to be more careful and thorough in analyzing information and determining answers to solve mathematical problems.

INTRODUCTION

The reduction in students' academic knowledge and skills, especially in mathematics learning, results from low numeracy abilities. Therefore, various topics and initiatives containing educational design are needed, called curricula. The Curriculum aims to improve the quality of education in Indonesia [1]. The Curriculum in Indonesia has been modified, changes starting with a simple curriculum, namely the 1947 Curriculum, the 1952 Curriculum, the 1964 Curriculum, the 1968 Curriculum, the 1975 Curriculum, the 1984 Curriculum, the 1994 Curriculum and the 1999 Curriculum Supplement, Competency Based Curriculum (KBK) in 2004, Education Unit Level Curriculum (KTSP) in 2006, Curriculum in 2013, then finally in February 2022 the Ministry of Education and Culture launched the newest Curriculum, namely the Independent Curriculum as one of the Merdeka Belajar programs which concentrates on the key and character development of each Pancasila student to improve the quality of learning. To improve this quality, several abilities are needed, one of which is numeracy ability. Students' numeracy skills include their capacity to design, solve, and interpret mathematical problems and analyze, justify, and

communicate their thinking effectively, which is called numeracy ability [2]. Numeracy ability is the ability to master and implement mathematics to convey concepts to people in various problem scenarios and can help when solving a problem [3]. The way to find out how much numeracy ability there is is by looking at the scores achieved by Indonesia in several science events, such as the PISA scores.

Based on information from Puspendik 2019, the 2018 PISA results still place Indonesia in the bottom 10 of 79 countries participating in the PISA event. The average academic achievement of Indonesian students is 80 points below the OECD average. The reading proficiency score is 72 out of 77, the mathematics proficiency score is 72 out of 78, and the science proficiency score is 70 out of 78. This proves the weak level of numeracy skills of Indonesian students. Several factors cause the weak numeracy abilities of students, namely (1) Indonesian students are still unfamiliar with using reasoning, which requires critical thinking creative skills from material content and to solve the challenges of literacy and scientific processes [4] (2) students are still trying hard to understand texts, create representations and use problem-solving techniques [5]. So, many factors can influence Indonesia's total score on the PISA test. Students' skills in investigating problems, expressing opinions and reasons, and solving problems are numeracy skills [2]. When improving students' numeracy skills, a teacher must make efforts to select and perfect the steps in achieving the learning they want to achieve [6]. To achieve numeracy skills, teachers can use learning media.

Tools used as intermediaries between teachers and students to make learning more productive are called learning media [7]. Apart from that, teachers can use it to make it easier for students to understand the content they want to provide and prevent differences in views between teachers and students, which can quickly make them bored. Children feel more interested and happy in learning activities through learning media [8]. So it can create more quality in the learning process. A teacher who can determine liaison appropriately and effectively ensures that the message can be received appropriately [9]. In selecting learning media, there are several things that educators must avoid, namely:

a) Unfamiliar with the media used
b) The media chosen cannot correctly represent what they want to convey
c) The media he chooses does not motivate students to learn

The methods or media used by a teacher are usually the same. Teaching and learning activities should focus more on children's ability to understand the material and follow real life [10]. So, the learning media used as a connecting tool must be acceptable to students. This means that the media does not make it difficult for students to use it. The best connector that can be utilized today is technology. Technology is well-known and close to teachers and students. The technology that can be used is media-based Android, which almost every student is familiar with, and even has an Android cellphone. The Android application that can be applied is the Math Trail application. The Math Trail is a journey to discover mathematics, and the Math City Map is a functional form of the Math Trail that guides students to engage directly in realistic problems [11]. Math City Map (MCM) shares places or discoveries of mathematics problems with paths that will be used as problem points that they will solve. They can provide active learning activities, improve problem-solving abilities, increase positive attitudes about mathematics, and make students' thinking more critical [12]. In this study, researchers chose Trail in the school

environment. Using the school environment as a trial location is the same as using it as a tool for education. Appropriate learning materials influence success, both deliberately produced and already available and must be selected by teachers for each field of study [13]. This means that the results from this field of study can be structured to motivate and improve student achievement [14]. The advantage is that it makes it easier to run and solve the questions provided in the Math City Map application. Additionally, utilizing the environment can provide a holistic and authentic picture so students are more interested in learning [15].

In facilitating outdoor mathematics teaching, the teacher provides an overview of a positive attitude towards mathematics and helps gain a broader view of the relationships that may be established with the surrounding environment so that mathematics becomes alive and genuinely exists, involving students cognitively, emotionally, and physically. That is why they are associated with active learning [16]. Math trail activities assisted by Math City increase students' mathematical skills in solving everyday problems [17]. When students can solve math problems using the Math City Map, this means that this application improves students' abilities. Several studies related to Math City Map state that the Problem-Based Learning learning model using Math City Map on block material effectively increases learning outcomes in class VIII of SMP Negeri 1 Pagaralam for the 2021/2022 academic year [18]. Therefore, researchers are interested in digging deeper because researchers believe that when students can achieve and improve their learning outcomes, these students have high numeracy abilities. So, this research aims to share directions that include the application of the Math City Map to students' mathematical skills, which we know as students' numeracy abilities in studying statistical material in the context of the school environment. It is hoped that the knowledge gained will help us learn and find solutions for advancing education and the learning system in Indonesia.

METHODS

This research was conducted for two weeks, from February 25 to March 7, 2023. The research methodology used is experimentation with quantitative techniques, and the research program used is a group Pre-test-Post-test Design. Because it uses a One Group Pre-test-Post-test Design, this research was conducted in one class, namely class VIII.I, with 31 students consisting of 18 girls and 13 boys. The variables considered in this research are students' numeracy abilities after implementing the Math City Map application on statistics material in the context of the school environment in class VIII of SMP Negeri 2 Pagaralam for the 2022/2023 academic year. The instruments used in this research were tests and questionnaires on students' numeracy abilities and questionnaires about learning styles. The results of the tests and questionnaires given to students will be analyzed using descriptive quantitative data analysis techniques.

RESULTS AND DISCUSSION

The findings of this research will be shared in stages. Learning must be put into practice before data analysis—implementing learning as an experimental class in class VIII.I use the Math City Map application in statistics material, namely single data material mean, median, and mode. They were learning in class VIII.I worked for two weeks, which included four meetings. The

student learning process is separated into three stages: introduction, main activities, and closing. The researcher presented himself to the students at the beginning of the research and explained the purpose of this research. Then, The researcher divided the students into six groups, each consisting of 5-6 students. Then, the students downloaded and added the trail in the application with the shared code, as seen in Figure 1.

Figure 1. Student Downloads Application and Adds Trail

After all groups have downloaded and are ready to carry out the task, they start running the trail and going to the location directed by the map on the application. After arriving at the first location, they start looking for the needed information. After finishing from the first location, they continue to the following location, following the map provided in the application.

After visiting all the locations and running the application, each group displayed their work in front of the class. At first, they felt embarrassed to present the results of their work. Because maybe presenting in front of the class is something new for them. However, even though they were initially shy, each group was brave enough to present the results of their group work. After each group presented their LKPD (Students Worksheet) results, Researchers distributed questionnaires containing students' opinions about the Math City Map (MCM) application after implementing the Math City Map (MCM) application. After using the Math City Map (MCM) application learning media, the researcher gave post-test questions at the next meeting. Researchers distributed post-test questions in the form of written tests to students in essays with six questions on statistical material. The next stage is to examine the data that has been collected and the student test scores obtained, which are grouped using the value ranges provided.

Table 1 shows a recapitulation of students' final test results and categories of students' numeracy skills in Table 2.

Table 1. Final Results of Student Numeracy Skills Test Percentage

	Maximum score per indicator		
	1	2	3
Amount	304	773	269
Average student achievement per indicator	9.80	24.9	8.67
Percentage of student achievement per indicator	82%	69%	48%

Table 2. Categories of Student Numeracy Skills

Category	Value Range	Number of Students VIII.I
High	$71 \leq x \leq 100$	19
Currently	$41 \leq x \leq 70$	5
Low	≤ 40	7

Based on the recapitulation table of student test results, it can be seen that students' numeracy abilities after taking part in learning using the Math City Map (MCM) application, namely 82% of students in the experimental class were able to write numbers and symbols related to everyday life according to the first indicator of numeracy ability. With the criteria that children have learned to recognize numbers and mathematical symbols in elementary school, 69% of students have been able to analyze information according to the second indicator of numeracy ability with medium criteria because when learning using the Math City Map (MCM) application they have been trained to can analyze information using the hint feature provided by researchers and 48% of students have been able to solve problems and make decisions according to the third indicator of numeracy ability with moderate criteria. However, some students make mistakes when operating calculations when solving problems, so the third indicator is imperfect.

Figure 2. Numeracy Ability of Indicators One, Two, and Three

Figure 2 is one of the results of students' answers during the post-test, which explains the reason or one of the factors that caused the first indicator to be 82%. It can be seen that the student can use numbers and mathematical symbols, but it can be seen that the student does not write down the formula for the average itself, so the first indicator for his numeracy ability is less than perfect. However, for the second indicator, namely analyzing information, the student is competent because it can be observed from the answer that he can capture what is known and what is asked for in the question. Then, the student can evaluate the findings of the analysis to estimate the outcome and choose the best course of action. This can be seen from the students'

problem-solving and conclusions. So, we can say that this student also has the third indicator of numeracy ability.

Figure 3. First and Third Indicator Numeracy Ability

However, it differs from Figure 3, which shows that the student responded that he could correctly write numbers and mathematical symbols. However, when analyzing the information, the student was only partially able, namely when the student did not record the child's name or the number of lato-lato obtained and only recorded the number of children concerned. Because some students are only partially capable of analyzing information, the second indicator of numeracy ability is 69%.

Figure 4. Reasons for the imperfection of the second indicator

Meanwhile, the third indicator of numeracy ability was 48%. This was because some students forgot to write conclusions, as shown in Figure 4 above.

Figure 5. Causes of Less Perfect Third Indicator

Apart from that, it could also be because there are students who are still mistaken in calculations or can be said to be mistaken in carrying out calculation operations which were initially correct but at the end of the calculation operation experienced an error so that the answer was wrong as seen in Figure 5.

After following the learning process and taking the test individually, students filled out the questionnaires that were distributed, and the application of the Math City Map (MCM) application to students' numeracy skills in statistical material in the context of the school environment in class VIII SMP Negeri 2 Pagaralam was successfully implemented, according to the results of data analysis obtained through the questionnaire. Questionnaire data 1 showed that 62% strongly agreed, and 38% agreed they were happy with learning using the Math City Map (MCM) application. Moreover, 59% said they strongly agreed, and 49% agreed with the Math City Map application learning media because it allowed them to respect other people's opinions and taught them the importance of working together to achieve the same goal. Apart from that, by using the Math City Map (MCM) application, students feel that one of the sciences that are directly related to daily life is mathematics according to questionnaire data number 5, where 31% of students strongly agree, 62% agree, and 7% disagree with this statement. Using the Math City Map (MCM) application media, students also feel that the Math City Map (MCM) application helps them understand the material being studied. This is proven by questionnaire data number 16, where 41% of students strongly agree and 59% agree. The Math City Map (MCM) application helps them understand the material well. It trains them to use symbols, numbers, tables, and diagrams to be more careful and precise in analyzing information and determining answers to everyday problems according to questionnaire data numbers 18 to 20. This is supported by previous research, which showed that Math City Map outdoor mathematics instruction impacted problem-solving abilities [19]. This means it is necessary to plan learning activities to help students achieve their learning goals [20]. While the Math City Map application impacts students' problem-solving abilities, it also impacts their numeracy skills and ability to meet learning objectives.

CONCLUSION

Based on research findings regarding the use of the Math City Map application to assess the numeracy or counting abilities of class VIII students at SMP Negeri 2 Pagaralam on statistical material in the context of the school environment, it was found that the application of the Math City Map application can be implemented well and can train students' thinking power to be more critical in solving problems taken from the surrounding environment so that the application of the Math City Map application can improve students' numeracy skills and provide new experiences to students as if providing freshness for students. This is supported by their test scores, which have increased after taking part in learning using the Math City Map application, and is also supported by the results of the percentage of student responses when filling out the distributed questionnaire. Math City Map application can increase student participation in class activities. On the other hand, it is recommended that an educator use the Math City Map application as a substitute in learning to help students with numeracy or counting skills.
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