

Mobile Learning Media “Jarak, Waktu Dan Kecepatan” As A Medium To Introduce Problem-Solving To Children

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Abstract: Mobile Learning Media (MLM) developed in interactive games is aimed at elevating the users' knowledge or improving their skills. In this study, MLM “Jarak, Waktu dan Kecepatan” (Distance, Time, and Speed) was used as a result of mobile learning development that has been tested for its properness and validity by several experts. This android-based mobile learning media was used in the learning process to introduce and teach problem-solving for children at the primary school ages. Moreover, MLM was equipped with quizzes at different levels to introduce problem-solving for primary students. The results indicated that the components in Mobile learning media (MLM) “Jarak, Waktu dan Kecepatan” which introduced problem-solving for primary school students involved the curriculum, material and evaluation sections, all of which were equipped with animations useful for students in problem-solving. However, the effect of this media on the problem-solving skill of the 5th graders at primary schools is still low, indicated by the percentage of students' skills with was only 17.3%.

Keywords: children, elementary school, mathematics, mobile learning media, problem-solving

1 INTRODUCTION

Science and technology which rapidly develop have a positive contribution to humans' lives. In the document of National Council Teachers of Mathematics [1], individuals who understand mathematics would have a greater chance and option to build their future. It affirms the importance of mathematics in learning and its role in determining students' futures as well. On the other hand, problem-solving is a general task for students at every education level. Problem-solving is the main purpose of mathematics learning at schools, considering that mathematics skills are essential in daily life and the workplace [2]. Furthermore, the National Council Teachers of Mathematics (2012) stated that problem-solving skill is the primary goal of mathematics learning. The achievement of mathematics learning outcomes in Indonesia, particularly in the aspect of knowledge and implementation is still low. The report of TIMMS in 2015 showed that primary school students (especially grade IV) in Indonesia ranked 45 out of 48 participating countries [3]. It causes teachers and academics to further improve the quality of mathematics learning in primary schools. During mathematics learning at primary schools, the materials include numbers, data management, geometry and measurement.

solving [4]. The aforementioned skills are supported by cognitive systems that manage the focus and information processing. In addition, language and visual-spatial skills are also important in interpreting and manipulating information effectively. Every difficulty in each of these parts can cause difficulties in the problem-solving process [5]. Moreover, align with world development, the use of ICT in schools is increasingly significant. The reason underlying the use of ICT in schools is ICT has a positive impact on student learning outcomes [6]. Hardman's (2019) findings showed that ICT positively affected mathematics learning outcomes in primary schools as it provides real experiences for students not as static as textbooks. In this case ICT functions as a medium in learning. Mobile learning is a form of learning media that has been widely developed to become a trend as an education application for new technologies [7]. Mobile learning is described as a learning process using media in the form of mobile devices so that students involved in learning, and they are not physically limited [8]. Moreover, mobile learning is defined as learning in several contexts, through social and content interaction, using personal electronic devices [9]. Mobile Learning Media (MLM) “Jarak, Waktu dan Kecepatan” is the result of research and development that has been tested for its validity and feasibility [10]. The specifications of this learning media are Android-based, covering materials about distance, time, and speed in grade 5 of primary school, comprising curriculum guidelines, i.e. basic competences and learning objectives, a gradual description of the material from simple to complex and from conceptual to procedural and there is a problem-solving section as the core. Furthermore, the objectives of this study are to answer the following questions:

1. What are the components of Mobile Learning Media (MLM) “Jarak, Waktu dan Kecepatan” that can be used to introduce problem-solving for primary school students?
2. How does Mobile Learning Media (MLM) “Jarak, Waktu dan Kecepatan” affect the problem-solving skills of primary school students?

2 METHODS

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They are taught through the stages of conceptual understanding to skills practice. Conceptual understanding and procedural knowledge are essential to skills in problem-

Mixed methods by combining quantitative and qualitative methods were employed in this study, both of which played the equal role. The quantitative method focused on analyzing students' problem-solving skills after learning using Mobile Learning Media (MLM) "Jarak, Waktu dan Kecepatan", and the data were analyzed under the Rasch model [11]. Meanwhile, the qualitative method focused on investigating the components of Mobile Learning Media (MLM) "Jarak, Waktu dan Kecepatan" related to the process of introducing problem-solving to students. The process of analyzing the qualitative data employed an interactive model following Miles, Huberman, & Saldana (2014), including data collection, data display, data condensation and conclusion: drawing / verifying. The participants of this study were 232 students in the fifth grade of primary schools in Kendal, Central Java, Indonesia to retrieve the data on problem-solving skills using a test. Ten of the participants were interviewed to obtain data on the learning process and learning experience.

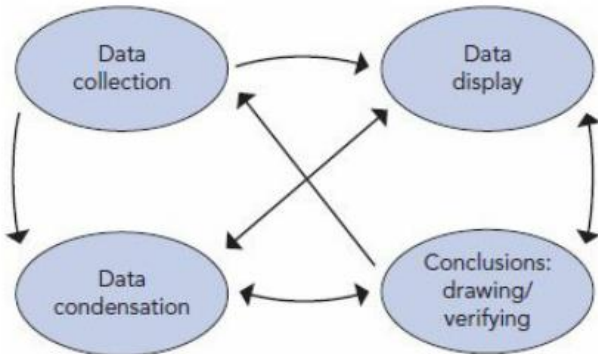


Fig 1. Components of Data Analysis: Interactive Model [12]

3 RESULTS AND DISCUSSION

3.1 Components of Mobile Learning Media (MLM) "Jarak, Waktu dan Kecepatan"

In general, the components of this media are displayed in the main menu, including the curriculum, figures, materials, exercises and independent assignments. In the beginning, it presents the written curriculum about learning objectives number 4, which is, students can solve the problems of speed correctly through a demonstration of the animated situation based on the problems to solve. Learning objectives are skills that students must be able to demonstrate after learning [13]. Learning objectives are formulated at the beginning and measured as the expected learning outcomes of the students [14]. Considering learning objectives, the material in Mobile Learning Media (MLM) "Jarak, Waktu dan Kecepatan" refers to the learning objective number 4 about problem-solving abilities. Material about speed is presented in the following animation: two brothers, Andi and Cita, want to go to their friend's house, Boni. Andi goes by bicycle, while Cita is on foot. In this animation, they go at the same time from home, but they have different average speeds. The problem of this animation is who will arrive first at Boni's house. The problem-solving refers to Polya's (1981) linear (hierarchical) model, i.e. (1) Understanding the problem, (2) Planning, (3)

Performing the plan, (4) Confirmation of the answer. Furthermore, in the evaluation section, there are several parts. The first one is process evaluation in the form of exercises for routine questions and the problem-solving part featuring animation and a final evaluation part. Learning evaluation is important in learning, as it helps to measure the learning success [13].

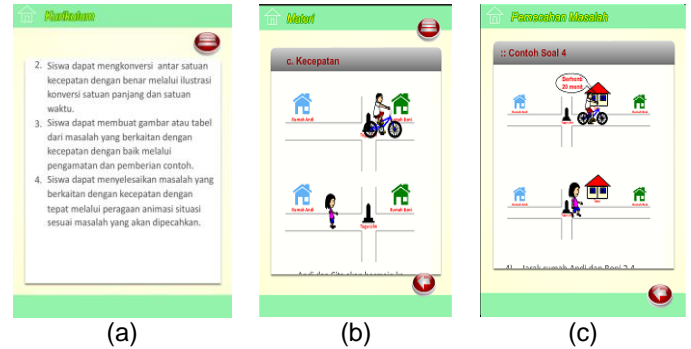


Fig 2. Parts showing problem-solving in Mobile Learning Media (MLM) "Jarak, Waktu dan Kecepatan" (a) curriculum, (b) material, (c) evaluation

3.2 Problem-solving skills of primary school students

Tests of the learning results were given to 232 fifth graders of primary school students after they learned by using Mobile Learning Media (MLM) "Jarak, Waktu dan Kecepatan" in learning. The tests were routine and non-routine questions about distance, time and speed material that have been tested for validity and reliability. Subsequently, the test results were analyzed using Rasch model with the output as shown in Tables 1 and 2.

Table 1. Summary of 232 measured people

SUMMARY OF 232 MEASURED (EXTREME AND NON-EXTREME) Person

	TOTAL SCORE	COUNT	MEASURE	MODEL S. E.	INFIT MNSQ	ZSTD	OUTFIT MNSQ	ZSTD
MEAN	3.8	10.0	-.65	.76				
SEM	.1	.0	.06	.01				
P. SD	1.7	.0	.95	.19				
S. SD	1.7	.0	.95	.19				
MAX.	8.0	10.0	1.52	1.86				
MIN.	.0	10.0	-3.66	.67				
REAL RMSE	.81	TRUE SD	.50	SEPARATION	.62	Person	RELIABILITY	.28
MODEL RMSE	.78	TRUE SD	.54	SEPARATION	.69	Person	RELIABILITY	.32
S. E. OF Person MEAN = .06								

Person RAW SCORE-TO-MEASURE CORRELATION = .98
 CRONBACH ALPHA (KR-20) Person RAW SCORE "TEST" RELIABILITY = .30 SEM = 1.45

Table 2. Summary of 10 measured items

SUMMARY OF 10 MEASURED (NON-EXTREME) Item

	TOTAL SCORE	COUNT	MEASURE	MODEL S.E.	MNSQ	INFINIT ZSTD	MNSQ	OUTFIT ZSTD
MEAN	87.6	232.0	.00	.15	1.00	-.08	.99	-.14
SEM	9.8	.0	.22	.00	.04	.61	.06	.61
P.SD	29.3	.0	.67	.01	.11	1.82	.17	1.84
S.SD	30.8	.0	.71	.01	.11	1.92	.18	1.94
MAX.	133.0	232.0	1.17	.18	1.19	3.50	1.22	3.01
MIN.	40.0	232.0	-.98	.14	.84	-2.61	.65	-2.74
REAL RMSE	.16	TRUE SD	.65	SEPARATION	4.15	Item	RELIABILITY	.95
MODEL RMSE	.15	TRUE SD	.65	SEPARATION	4.26	Item	RELIABILITY	.95
S.E. OF Item MEAN	= .22							

Item RAW SCORE-TO-MEASURE CORRELATION = -1.00
 Global statistics: please see Table 44.
 UMEAN=.0000 USCALE=1.0000

The analysis results using Rasch model are as follows:

1. The mean of person logit value was -0.65 (table 1) less than the logit value of 0, meaning that the student's skills were below the difficulty level of the questions or the students' tendency to face difficulties when doing the tests.
2. The value of item reliability was 0.95 (excellent category) (table 2). However, the person reliability was 0.28 (bad category) (table 1). It means that the consistency of students' was bad, but the quality of the test items was excellent.
3. The mean of person logit value = -0.65, and the standard deviation of person logit = 0.95, therefore, the participants can be categorized into high, medium, and low problem-solving skills as shown in table 3.

Table 3. Categorization of students' skills in problem-solving

Limit of person logit value	Category	Total	Percentage
More than 0.3	High	40	17.3%
Between -0.65 s.d. 0.3	Medium	95	40.9%
Less than -0.65	Low	97	41.8%

4. The value of the separation item was 4.15, so $H = \{(4 \times 4.15) + 1\} : 3 = 5.87$. The result of 5.87 was rounded up to 6, meaning that the test questions could be grouped into 6. Moreover, out of the 10 test questions, there were 3 questions as the most difficult for students. They were questions number 8, 9 and 10 (table 4). These three questions were in the form of story problems

Table 4. Three questions with the difficult category of the test

Indicators	Number	Questions
3.3.5 Determine the travel time if speed and distance are known (C3)	8	Pak Partono rode a motorcycle from his house to office with an average speed of 40 km / hour. The travel distance was 20 km. How much time did Pak Partono need to travel from his house to work?
3.3.6 Determine the average speed if distance and travel time are known (C4)	9	Vio went to school on foot at 6:15 and arrived at 6:35. If the distance from Vio's house to school was 1800 meters, how fast was Vio's walking

speed?

3.3.7 Solve the problem of distance, travel time, and speed (C5) 10

The distance between city A and B was 270 km. Andi drove from city A to B, leaving at 07.00 with an average speed of 40 km / hour. Bondan took a car from city B to city A leaving at 07.00 with an average speed of 50 km / hour. If Andi and Bondan went through the same road, at what time do they cross?

Data analysis using the Rasch model indicated that the level of students' skills in problem-solving tended to be in the sufficient and low categories. Although before test the students had learned by using Mobile Learning Media (MLM) "Jarak, Waktu dan Kecepatan", the results were not satisfactory. In solving the problems, the students revealed difficulties in planning how to manage problem-solving, using inadequate strategies and not trying to do calculations [2]. Furthermore, it was revealed from the students' test results. Various shortcomings of the primary school students in terms of problem-solving are greatly influenced by other things, e.g. mathematical concepts, symbols, algorithms, formulas to problem-solving schemes [15]. The interview results depicted the students' experiences in using a tablet or smartphone in daily life and its comparison to using this media in learning. Regarding the experiences in daily life, the students used a tablet or smartphone to play games, open social media, or search for learning materials assigned by the teacher. Thus, students have no difficulty in operating this media on tablets or smartphones. They like animation in MLM and can read the texts in MLM easily. The results of several studies pointed out a positive response of students to the use of technology in learning [16]. However, the use of different devices such as tablets or smartphones provides a different learning experience for students from both visual and sound aspects [17]. Whereas in this study, students used mobile devices with different specifications, so that the good learning experience through MLM may be reduced. In terms of the learning process when the students used this media, it was not well controlled. Although the learning media has been prepared by the researchers, the teacher's ability to deliver the material varies greatly depended on the teacher's experience. This indirectly affected the student learning outcomes. Moreover, the other several factors that influenced the teacher's readiness in using mobile learning were the possibilities, benefits, preferences, and external influences [18].

4 CONCLUSION

Based on the results, it can be concluded:

1. The components in Mobile learning media (MLM) "Jarak, Waktu dan Kecepatan" that can be used to introduce problem-solving for primary school students are presented in the curriculum, material and evaluation sections, all of which are equipped with animations that lead to students' understanding of problem-solving.

2. The effect of Mobile Learning Media (MLM) “Jarak, Waktu dan Kecepatan” on the problem-solving abilities of 5th graders of primary school is still low, indicated by the students’ skills with the high category are only 17.3%.

5 SUGGESTION

From the discussion about the shortcomings in this study, it is suggested that when Mobile Learning Media (MLM) “Jarak, Waktu dan Kecepatan” will be used in an experimental study, the same electronic devices for students are needed, either tablets or smartphones. Moreover, it requires the common-shared perception of the teachers who will use this media.

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