

Development Of Google Maps–Assisted E-Worksheets Based On Local Tourism Context To Support Students’ Mathematical Literacy In Matrix Topics

Nova Elvina¹, Ratu Ilma Indra Putri², Zulkardi³

¹ Sriwijaya University, ² Sriwijaya University, ³ Sriwijaya University

*Corresponding author, e-mail: nova.elvina38@guru.smk.belajar.id

Abstract

This study aims to develop Google Maps-assisted E-Worksheets (E-LKPD) with the context of Musi Banyuasin tourism in matrix material to support the mathematical literacy of grade XI students at SMK Negeri 1 Sekayu. This study is a development study using the Tessmer Model, which includes the stages of Self-evaluation, expert review, one-to-one, and small group. Data collection was conducted through observation, interviews, and walkthroughs. The E-LKPD was developed employing the Indonesian Realistic Mathematics Education (PMRI) method, which places a strong emphasis on student activities and real-world circumstances. The study's findings show that the created E-LKPD satisfies the requirements for validity and usefulness, making it appropriate for use as instructional materials to enhance students' mathematical literacy. The results show that the developed E-LKPD is valid and practical based on expert validation and small group trials.

Keywords: E-LKPD, Google Maps, Mathematical Literacy, Matrix, PMRI.

INTRODUCTION

Education is one of the foundations for creating people with potential and quality. ((Novitasari and Yonata 2021; Syaifuddin, Bharata, and Caswita 2017). Through education, people are taught to acquire expertise and skills so that they become skilled, creative, innovative, and productive individuals. The 21st-century paradigm places a strong emphasis on students' capacity for critical thought, real-world knowledge acquisition, information technology proficiency, communication, and teamwork (Novitasari & Yonata, 2021). The NCTM Curriculum standards state that the primary goals of mathematics education should be to boost students' confidence in their ability to think critically, raise their awareness of the power of mathematics, and foster their view that mathematics makes sense. that mathematics is one of the most important subjects for children, as it helps students solve problems in their daily lives (Khotimah and As'ad 2020).

Based on the results of the Programme for International Student Assessment (PISA) in mathematical literacy, it shows that Indonesian students' creative thinking skills are still below the OECD average. With an average score of 19 out of 60, Indonesian students' achievements are significantly lower than the OECD average of

33. Only 31% of Indonesian students have achieved a basic level of creative thinking (Level 3), compared to an OECD average of 78%. According to Anderha, difficulties in learning mathematics from early childhood to college are common because of its abstract nature and difficulty in understanding. This assumption makes mathematics a frightening subject, resulting in low student interest and boredom. The demands placed on students in mathematics go beyond mere calculation skills to include logical and critical reasoning skills in problem solving. Problem solving is not limited to routine problems, but rather extends to everyday problems (Retno Kusumawardani, Wardono, and Kartono 2018).

In the context of the Merdeka Curriculum, learning is directed so that students are able to apply mathematical concepts in everyday life through the strengthening of mathematical literacy. The ability to construct, apply, and understand mathematics in a variety of contexts to describe, forecast, and explain phenomena is another definition of mathematical literacy (OECD 2020). In order to solve mathematical issues, pupils must be able to effectively evaluate, reason, and communicate concepts. This is known as mathematical literacy (Muzaki and Masjudin 2019). Mathematical literacy is one of the higher-order skills (Masfufah and Afriansyah 2021). This is in line with the main areas of study in PISA, namely reading literacy, scientific literacy, and mathematical literacy. Mathematical literacy in the framework of the 2012 Programme for International Student Assessment (PISA). However, initial observations in the 11th grade of a vocational school in Musi Banyuasin Regency show that students' mathematical literacy is still low. Students have difficulty solving real-world problems, such as calculating distances, estimating time or costs, and interpreting visual data. This is because students tend to focus on the mechanical use of formulas without relating mathematical concepts to everyday situations.

One of the reasons for this difficulty is the conventional approach to learning. The PMRI approach is an effective approach to teaching mathematics in elementary schools. Without neglecting the requirements of the applicable curriculum, PMRI can also transform students' abstract views into real ones (Dipayana, Gusti, and Japa 2019). The PMRI approach's context is helpful for the development of concepts, mathematics for motivation and access, the creation of models, the provision of tools for thinking through procedures, notation, images, and rules, reality as a source and field of application, and particular abilities in specific circumstances (Zulkardi and Putri 2020). RME can significantly improve students' mathematical literacy by encouraging active engagement, deep understanding, and transferability of knowledge in various contexts (Hamidah et al., 2025). Because the PMR approach links mathematics to everyday life and starts learning with something real so that students can participate in a meaningful learning process, the RME approach has the potential to improve students' mathematical literacy (Sudi, Kadir, and Salim 2022). The PMR approach can support mathematical literacy by presenting learning based on the local context.

Musi Banyuasin Regency has tourism potential that is relevant as a context for mathematics learning. The use of local tourist attractions that are familiar to students,

supported by the use of technology-based E-LKPD, can increase learning motivation and conceptual understanding, as well as make learning more interactive and flexible. Well-designed LKPD plays an important role in encouraging student activity and helping to build knowledge understanding in the learning process. (Millatul Hanifah, Pima Sari Tambunan, and Nur Afinni Dwi Jayanti 2024). One tool that might lessen the workload for teachers during the learning process is student worksheets. As a result, they establish an effective rapport between students and teachers, enhancing both the caliber of the activities and the students' skills (Sintya Dewi, Rismayani, and Muslimah 2022). One technology that can be integrated with PMRI to strengthen the learning context is Google Maps.

Google Maps is an application that offers digital maps with various interactive features that help students understand mathematical concepts by providing realistic spatial visualizations (Elvina et al. 2024). This service has many features that make it easy for users to find information about locations, routes, and other geographic data (Nila Puspita Sari 2024). Google created the online mapping tool known as Google Maps. Satellite imagery, road maps, 360-degree panoramas, highways (Street View), real-time traffic conditions (Google Traffic), and travel route planning for walking, private automobiles, and public transportation are all displayed by this tool (Fadillah, Erita, and Suriani 2023). Google Maps has great potential for integration into learning (Yunita 2023). This technology is not only used in everyday life but also plays a role in education, helping students understand mathematical concepts in a spatial and geographical context (Goodchild 2007).

Although previous studies have developed literacy-based worksheets and technology-assisted learning materials, limited research integrates Google Maps with local tourism contexts in matrix learning. Therefore, this study addresses this gap by developing of E-LKPD based on mathematical literacy is necessary based on these issues. To improve numeracy literacy, previous studies have examined numeracy-based LKPD with a socio-cultural context, electronic problem-based learning-based LKPD, and minimum competency assessment-based LKPD. However, there has not been much development of E-LKPD that integrates the context of local tourism with the help of Google Maps. Therefore, this study focuses on the development of E-LKPD with the help of Google Maps in the context of Musi Banyuasin tourism. It is hoped that this will increase student engagement and support the mathematical literacy of grade XI students.

METHODS

The three phases of the development research design used in this study are preliminary, development, and assessment. The Tessmer approach, which comprises two primary stages—preliminary and formative evaluation—will be used in the development study series. Expert review, one-on-one, small group, and field test are the three phases of the formative evaluation process (Tessmer 1993). This study involved students in grade XI at SMK Negeri 1 Sekayu. The individual group in the one-to-one stage consisted of students with various abilities, and the small group consisted of grade XI students. This study addresses the design and evaluation of an

electronic student worksheet (E-LKPD) enhanced with Google Maps features, contextualized to tourism in Musi Banyuasin and focused on the mathematics topic of matrices. The research objectives are to develop the E-LKPD and to determine both its validity and its practicality for promoting students' mathematical literacy.

The development process follows Tessmer's formative evaluation model and comprises four sequential stages: (1) *Self-evaluation*: internal design and refinement of the E-LKPD. (2) *Expert review*: content and instructional validity assessment conducted by subject-matter and instructional-design experts. (3) *One-to-one*: usability testing with individual students to assess readability and ease of use. (4) *Small-group*: classroom-level trials to evaluate the practicality of the E-LKPD in actual instructional settings.

Data collection methods include observation, interviews, and walkthroughs. Observation is used to document the implementability of the E-LKPD during learning activities. Interviews elicit student responses and identify any difficulties encountered. Walkthroughs are conducted to evaluate the clarity of content, user interface/presentation, and the sequencing of learning activities within the E-LKPD.

Data analysis integrates qualitative and quantitative approaches. Qualitative analysis is applied to observations, interview transcripts, and expert feedback to inform iterative product revisions. Quantitative analysis processes validation and practicality ratings to classify the E-LKPD's level of validity and practicality for classroom use.

RESULTS AND DISCUSSION

Self Evaluation

The creation of Google Maps-assisted E-LKPD with the backdrop of Musi Banyuasin tourism in matrix material for grade XI pupils has proceeded as planned, according to the results of self-evaluation. The Merdeka curriculum, matrix material content, E-LKPD that promotes mathematical literacy, and student characteristics have all been considered in the planning and design process. The PMRI technique makes it possible to connect abstract matrix ideas to practical scenarios. The E-LKPD is intended to be applicable to students' everyday experiences.

Expert review and One to One

Activity 1 aims to train students' mathematical literacy skills by engaging them in a real-life context of planning a trip in Musi Banyuasin Regency using Google Maps as a technological support tool. In this activity, students are required to explore tourist destinations, identify distances between locations, and interpret spatial information provided by Google Maps. Through these tasks, students are guided to connect mathematical concepts, particularly matrices, with authentic situations that are familiar to their daily experiences. This context encourages students to formulate real-world problems into mathematical representations, apply appropriate mathematical concepts and procedures, and interpret the results in relation to practical decision-making. Based on students' responses on the worksheet, it can be observed that the use of Google Maps facilitates students' understanding of spatial relationships and supports their ability to reason mathematically within a meaningful context. The following discussion elaborates on students' mathematical literacy processes at each stage, namely formulating, employing, and interpreting, as reflected in their worksheet answers.

a. Formulating Problems Mathematically (Formulating)

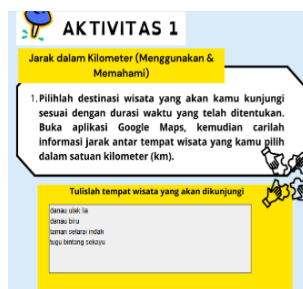


Figure 1. Student C's answers to Activity 1, Question 1

The first activity's solutions demonstrate that students can recognize travel-related contextual issues and use mathematics to find pertinent information. However, the selection of destinations is still dependent on proximity without a thorough examination of visit duration and return time since students have not fully taken into account the relationship between the number of destinations, distance traveled, and time limits.

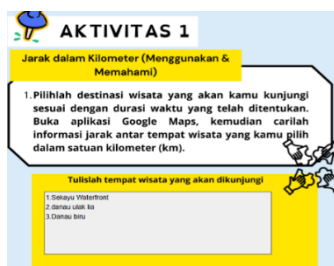


Figure 2. Student J's answers to Activity 1, Question 1

Students are able to recognize the context of travel and determine relevant objects mathematically, demonstrating an initial ability to formulate problems. However, the formulation is still simple because it does not yet fully consider the relationship between the number of destinations, distance traveled, and time constraints.

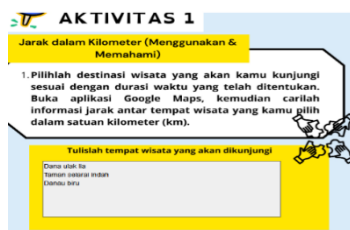


Figure 3. Student MTN's answers to Activity 1, Question 1

Students are able to identify data on the distances between tourist locations obtained through Google Maps and presented in tabular form. This shows that students understand the context of travel planning based on distance and are able to formulate real-life situations into mathematical problems. Thus, the mathematics literacy indicator at the formulate stage has been met.

b. Menggunakan Konsep dan Prosedur Matematika (*Employing*)

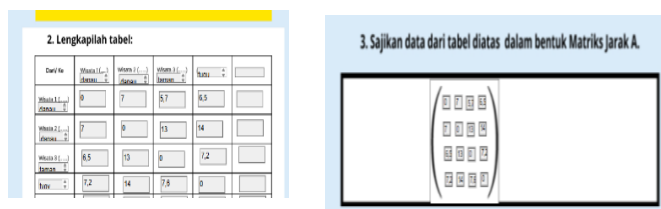


Figure 4. Student C's answers to questions 2 and 3 in activity 1

Using Google Maps, student C was able to methodically finish the table in question 2 that listed the distances in kilometers between tourist destinations. Additionally, the student demonstrated the ability to accurately change data representation from a table to a matrix by presenting the data in matrix form with zero values on the main diagonal and distances between positions in the other elements.

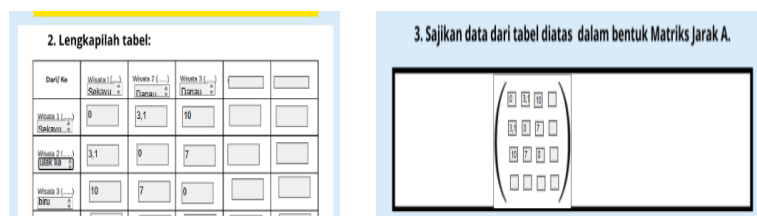


Figure 5. Student J's answers to questions 2 and 3 in activity 1

Students were able to gather information on the distances between tourist destinations using Google Maps and display it in a table in kilometers for the second question. Students successfully transformed the table data into a distance matrix in the third question by correctly arranging the elements, including putting zero values on the major diagonal, which shows the distance between two locations.

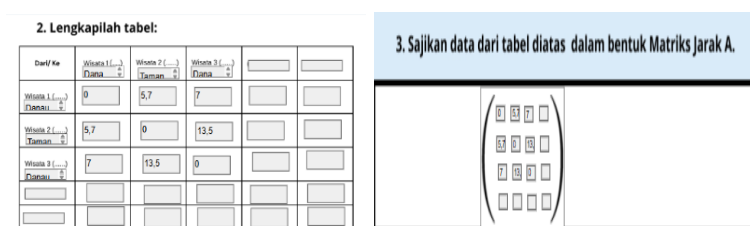


Figure 6. Student MTN's answers to questions 2 and 3 in activity 1

By using rows and columns, students may accurately depict data on the distances between tourist destinations in matrix form. After that, the matrix is used to accurately calculate the entire distance or trip time based on the chosen route. This illustrates the students' capacity to apply the idea of matrices and reason about the connections between places in the context of practical issues. Consequently, the utilize and reason stages of mathematical literacy indicators have been satisfied.

c. Menafsirkan dan Mengevaluasi Hasil (*Interpreting*)

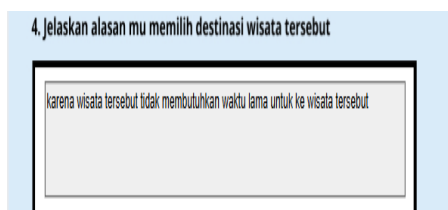


Figure 7. Student C's answer to question 4 in activity 1

The students' answers demonstrate their ability to interpret distance data and relate it to travel time constraints in order to determine route efficiency. However, their interpretations are still general and not supported by numerical data, as distance has not been linked to travel time estimates or quantitative route comparisons. Therefore, the students' mathematical evaluation and communication skills still need to be improved.

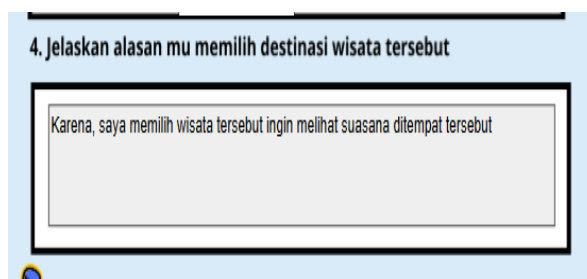


Figure 8. Student J's answer to question 4 in activity 1

The students' answers show that destination selection is based not only on distance, but also on preferences regarding travel conditions. This demonstrates the students' ability to interpret mathematical analysis results and relate them to decision-making in real-life contexts.

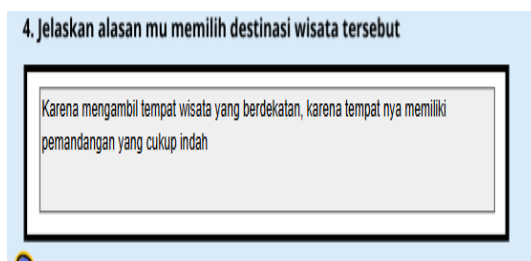


Figure 9. Student MTN's answer to question 4 in activity 1

When selecting tourist places, students took into account the distance between neighboring locations and scenic attractions. This demonstrates that pupils can

decipher mathematical computations and apply them to make decisions in practical situations. As a result, the interpretation stage's mathematical literacy indicator has been met.

Table 1. Ringkasan hasil analisis tahap expert riview dan one to one

Tahap	Comments/Suggestions	Decision
Expert Riview	<ol style="list-style-type: none"> 1. Learning objectives and outcomes need to be clarified and sequenced appropriately 2. The problem context is too long 3. Tourism data and visit times are unclear 4. Students need guidance on filling out the matrix 5. Prerequisite and diagnostic materials are not yet available 	<p>Added brief prerequisite material and initial diagnostic questions</p> <p>Provided initial tables and guidelines before forming the matrix</p> <p>Added a table of travel options and visit times</p> <p>Simplified the context in the form of tables/images and brief statements</p> <p>Revised learning objectives and outcomes to be more systematic</p>
One to One	<ol style="list-style-type: none"> 1. Some students are able to use E-LKPD and Google Maps well 2. Some students are still rushing and lack attention to detail 3. Difficulty reading time units and converting data 4. Errors in data entry and location selection 	<ol style="list-style-type: none"> 1. Show that the E-LKPD is interesting and can be used independently 2. Instructions need to be clearer and more gradual 3. Guidance and examples of unit usage need to be strengthened 4. Cognitive load is reduced with a more structured fill-in format

Small Group

After revisions were made based on the previous stage, the prototype was developed into prototype II, which was then tested on two groups consisting of four people each in a small group stage that was different from the research subjects, with the aim of observing the practicality of the E-LKPD that had been developed.

Researchers received practical observation data to describe how easy it is to use E-LKPD during the learning process after completing E-LKPD trials in small groups. The observation was carried out by focusing on a number of practical issues, such as student reactions when utilizing E-LKPD with Google Maps assistance on matrix material, simplicity of access, clarity of instructions, and seamless activity implementation. The usefulness of E-LKPD at the small group stage is evident in the table below, which was created by methodically presenting the observation results in tabular form.

Table 2. Small Group Observation Results

No	Practicality	Indicators Observed	Observation Results
1	Ease of access	Students can log in and access E-LKPD with their email accounts.	Some students had trouble logging in because they forgot their email passwords, but this was resolved with the help of their teachers.
2	Ease of use	Students can use E-LKPD without intensive assistance from teachers.	After successfully logging in, students are able to use E-LKPD independently.
3	Clarity of instructions	Activity instructions are easy for students to understand	Students understand the instructions and rarely ask for clarification
4	Appearance and structure	The flow of the E-LKPD is easy for students to follow	Students flip through the pages to read the context story and match it with the questions
5	Overall practicality	Ease and efficiency of use of E-LKPD	E-LKPD is considered practical with minor improvements needed in initial access and information layout.

It is clear from the data in the above table that students can use the created E-LKPD in small groups with relative ease. Students can generally follow the learning activities, comprehend the instructions, and use the E-LKPD in accordance with the available flow. There are still a few small challenges, though, such as students who have trouble entering into the E-LKPD due to forgetting their email passwords and students' tendency to revisit the story page in order to adapt to the questions being worked on. These challenges, however, do not impede the process of learning as a whole.

This shows that the E-LKPD is practical to use, although it still needs a few improvements to make it more convenient to use in the next stage.

CONCLUSION

In order to promote and improve the mathematical literacy of Grade XI students, this work concentrated on creating a Google Maps-assisted E-Student Worksheet (E-LKPD) for matrix themes based on the tourism context of Musi Banyuasin. Tessmer's formative evaluation methodology, which methodically included the phases of self-evaluation, expert review, one-to-one evaluation, and small group trials, was used during the development process. Every phase helped to continuously improve the E-LKPD's technical functionality, instructional design, contextual relevance, and content accuracy.

While feedback from the one-on-one and small group phases showed that the E-LKPD was useful and simple for students to use, the expert review results showed that

the E-LKPD satisfied the requirements of content validity, construct validity, and language clarity. In order to complete relevant assignments, students were able to use matrix ideas, understand real-world data from Google Maps, and actively engage with contextual difficulties. These results imply that the created E-LKPD not only satisfies the validity and practicality requirements but also has the ability to improve students' capacity to formulate, apply, and comprehend mathematics in real-life situations.

As a result, the Google Maps-assisted E-LKPD can be regarded as an inventive and contextual learning tool that successfully combines technology with real-world scenarios, fostering the growth of mathematical literacy and encouraging senior high school students to learn mathematics in a more meaningful way.

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