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Development of Ethno-PMRI based E-Worksheet with Mayang Rontek Dance Context on Plane Figures of Geometry Materials

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Abstract

The e-worksheet is an interactive tool that allows students to access questions and explore information electronically, supporting their understanding of the concepts being studied. This study aims to develop a valid and effective e-worksheet based on the Ethno-*Pendidikan Matematika Realistik Indonesia* (PMRI) approach, incorporating the context of the *Mayang Rontek* Dance, to assist students in learning geometry. The research followed the ASSURE model, which includes six stages: analyzing students' needs, defining objectives, selecting appropriate media and materials, engaging learners, and evaluating and revising the developed e-worksheet. The e-worksheet underwent validation by three experts using Aiken’s analysis technique. Limited trials were conducted with six junior high school students, followed by field trials with twenty-nine students. The results revealed that the e-worksheet was valid, with Aiken indices ranging from 0.59 to 0.89. Statistical analysis using the Wilcoxon test on pre-test and post-test scores successfully rejected the null hypothesis, indicating that the e-worksheet effectively improved students' test scores. Furthermore, the practicality test yielded a score of 84.97%, demonstrating the e-worksheet's high level of practicality. Thus, the developed e-worksheet has been validated as both effective and practical in enhancing students’ understanding of geometry. The integration of the Ethno-PMRI approach and GeoGebra is expected to further enrich students' comprehension of mathematical concepts and their connection to local culture.

Keywords: Ethnomathematics, E-Worksheet, Geometry, *Mayang Rontek* Dance, PMRI

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INTRODUCTION

Geometry is one of the most important branches of mathematics and has been linked to other branches of mathematics or non-mathematics (Sudirman et al., 2024). In mathematics learning, geometry is a natural forum for developing students’ thinking skills (Prahmana & D’Ambrosio, 2020). Learning it can awaken and inspire the improvement of students’ logical thinking skills, develop their spatial abilities, and enhance their capacity to unravel practical problems using geometric terms (Febrian & Astuti, 2018). Geometry contains a lot of materials, such as linear shapes like line and curvet, plane shapes with only two dimensions-breadth and length; and 3D shapes with length, depth, and breadth (Sharma, 2024).

However, students face many difficulties when learning geometry (Sudirman et al., 2024). For instance, they lack an understanding of the concepts and properties of geometry, previous material, and geometry ideas to solve math problems during experiments about plane figures (Sari et al., 2023). They might also face many problems in learning plane geometry, especially those related to angles on parallel lines (Mirna, 2018). In addition, Haryanti et al. (2019) showed that most students make mistakes in transforming plane geometry world problems into mathematics models. This is due to its nature and

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involves the ability to visualize geometry concepts (Nindiasari et al., 2024).

To address the aforementioned issues, the Realistic Mathematics Education (RME) approach, when incorporating the local context of Indonesia, is known as the *Pendidikan Matematika Realistik Indonesia* (PMRI) approach, which can enhance student engagement in the geometry learning process (Febrian & Astuti, 2018), because the PMRI approach promotes student-centered learning (Zulkardi et al., 2020). In line with Putri et al. (2015) argue that PMRI highlights that learning math lets students gain a new understanding by working through real-life problems informally and progressing through different stages to connect concepts and strategies. PMRI is the use of real-life phenomena to accelerate the learning of mathematics so that mathematics teaching can be undertaken better (Nuraida & Putri, 2019).

Since geometry is closely related to human life and daily problems, developing educational medi in the form of geometric instruments embedding local culture, called ethnomathematics, might be a solution for the development of local culture (Aisyah et al., 2022). Prahmana & D'Ambrosio (2020) and Murtafiah et al. (2024) explain that ethnomathematics is defined as an approach that applies the learning of mathematics to specific cultural groups, workers and professionals, children from particular social classes, and indigenous people. Rosa et al. (2016) state that the most important foundation of ethnomathematics is the recognition of the many ways of knowing and applying mathematics that relate to values, ideas, concepts, procedures, and practices in a variety of contextualized environments.

The use of PMRI and ethnomathematics in mathematics learning can enhance students' understanding in mathematics concept (Prahmana, 2022). In PMRI, context can assist students in creating a clear connection between mathematical concepts and settings, which is beneficial for the growth of their mathematical thinking (Nuraida & Putri, 2019; Zulkardi, 2002). The example of context that can use is local wisdom (Sari & Putri, 2021). Deda & Maifa (2021) stated that incorporating the context of local wisdom into the classroom will encourage critical thinking, creativity and activity, a positive learning environment, ease of comprehension of the subject matter, and ultimately, increased student engagement and performance. Thus, using PMRI and ethnomathematics has an important role in improving students' cognitive and affective abilities (Rawani et al., 2023).

In contrast, PMRI focuses on utilizing the real-world context surrounding students, the process of mathematization, and their cognitive development (Zulkardi, 2002; Zulkardi et al., 2020) Therefore, the integration of Ethnomathematics and PMRI, known as Ethno-PMRI, aims to foster a deep and accurate understanding of mathematical concepts through the mathematical process, aligning with students' cognitive levels (Prahmana, 2022). Additionally, it seeks to internalize the socio-cultural values present in students' experiences and local culture, ultimately shaping responsible and ethical users of mathematics in their daily lives.

Building on this, the implementation of PMRI and ethnomathematics in geometry learning is manifested through the use of e-worksheet (Deda & Maifa, 2021), providing students with an interactive and accessible medium to enhance their understanding while integrating socio-cultural values. E-worksheet is a student worksheet containing interactive features and questions that can be accessed electronically (Syafitri & Tressyalina, 2020). In line with Widyaningrum & Prihastari (2020) that explained a worksheet can help students add information about the concepts learned systematically. It is a medium for students to use as a guide for doing research activities or solving problems (Sutama et al., 2021). However, the teaching materials used by the teacher are still limited to modules and printed worksheets (Sari et al., 2021). Meanwhile, the educational process should focus on preparing a new generation capable of facing global challenges and mastering the skills of the 21st century. Thus, developing an e-worksheet is one solution to that problem.

Previous studies have used e-worksheets integrated with PMRI or ethnomathematics, but they have not combined e-worksheets with PMRI and ethnomathematics. Nuraida & Putri (2019) concluded that students' mathematical comprehension is improved when the PMRI approach is used to solve the integer division problem utilizing typical Archipelago cakes. Another study resulted that students' mathematical skills were enhanced by using a South Sumatra dance as a setting to learn about the formal forms of translation and reflection through instruction based on the PMRI approach (Rawani et al., 2023). In addition, Deda & Maifa (2021) stated that the development of Students Worksheet which utilizes local wisdom, has a potential effect on improving junior high school students' mathematics skills and learning outcomes. The novelty of this study lies in the use of GeoGebra within an E-worksheet that integrates PMRI and Ethnomathematics (ethno-PMRI). This study aims to develop a valid and effective e-worksheet for junior high school students, based on the ethno-PMRI approach, incorporating the context of the *Mayang Rontek* dance to enhance students' understanding of plane geometry concepts.

METHODS

This study employed a research and development approach utilizing the Analyze learners, State objectives, Select methods, media, and materials, Require learner participation, Evaluate and revise (ASSURE) model, which consists of six development stages (Kim & Downey, 2016). The ASSURE model offers a systematic process for selecting suitable technologies that not only align with content standards but also effectively address the diverse learning needs of students (Altin, 2021). The developed product, an e-worksheet, was rigorously tested in two phases: an initial small-group trial with 6 students, followed by a larger-scale evaluation involving 29 students. This multi-phase testing ensured a comprehensive assessment of the product's effectiveness and its potential for broader application in enhancing student learning outcomes. Figure 1 below is a research stage chart using the ASSURE model.

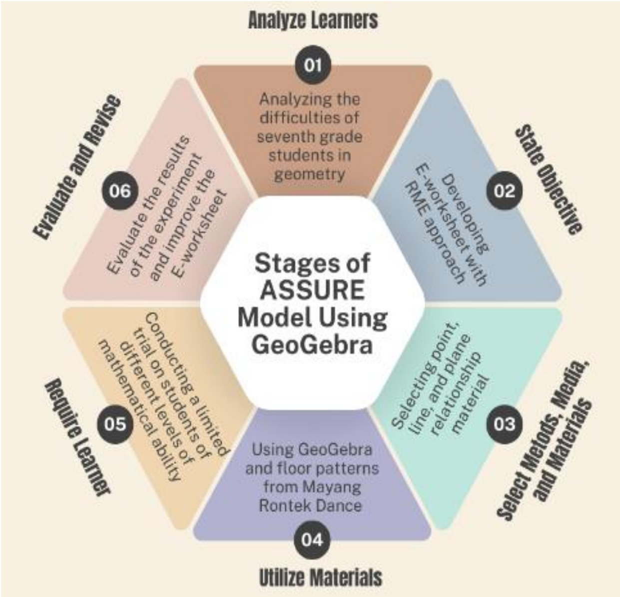


Figure 1. ASSURE model stages using GeoGebra

Figure 1 illustrates the stages of the ASSURE instructional model, specifically adapted for teaching geometry using GeoGebra and incorporating cultural elements. This model is presented as a cyclical process with six interconnected steps to guide effective learning design. The first stage, Analyze Learners, involves identifying and understanding the challenges faced by seventh-grade students in geometry. This step ensures that the instruction is tailored to their specific needs and difficulties. Next, in the State Objective phase, clear learning objectives are developed. These objectives are designed based on the principles of the PMRI approach, ensuring that the goals are practical and contextually relevant. In the Select Methods, Media, and Materials stage, the focus is on choosing appropriate instructional tools and strategies. Here, the use of GeoGebra software is highlighted, along with the integration of floor pattern designs inspired by the traditional *Mayang Rontek* Dance, bridging mathematics and cultural heritage.

The fourth stage, Utilize Materials, involves the application of these selected resources. This step emphasizes the active use of GeoGebra and the cultural patterns as teaching tools to help students explore and understand geometric concepts. During the Require Learner Participation stage, students are actively engaged in the learning process. They participate in activities that encourage problem-solving, critical thinking, and hands-on exploration, fostering a deeper understanding of the material. Finally, the process concludes with Evaluate and Revise, where the effectiveness of the instructional approach is assessed using evaluation worksheets. Based on the outcomes, necessary revisions are made to improve the learning experience and ensure the objectives are met.

In this study, data were collected using (1) validation sheets to test the validity of the e-worksheet, (2) pretest-posttest tests used to examine the effectiveness of the e-worksheet, and (3) student response questionnaires to test the practicality of the e-worksheet developed (Hasmawaty et al., 2020). Data collection consisted of the validity, practicality, and effectiveness of the e-worksheet. The product validity was based on the result of Aiken's V Index (see Equation 1 for Aiken formula) and was categorized based on Table 1 (Divayana et al., 2019). The practical test was based on the results of the students' response survey (Putra et al., 2023). Effective assessment was used to reveal the product's effectiveness covering the pretest and posttest (Hasmawaty et al., 2020). The questionnaire used the Likert's scaling method to validate the students' subjective feelings and actions (Joshi et al., 2015). In addition, (DeCastellarnau, 2018) argues that the use of a scale with more than two points gave better results in quality measuring.

$$V = \frac{\sum s}{n(c-1)} \qquad (1)$$

Description:

V : Aiken's index validity

S : $r - L_o$

n : Number of raters

c : Highest validity assessment score

L_o : Lowest validity assessment score

r : Score given by the raters

Table 1. Classification of Aiken's validity

Score	Classification
$0.80 < V \leq 1.00$	Very high
$0.60 < V \leq 0.80$	High
$0.40 < V \leq 0.60$	Satisfactory
$0.20 < V \leq 0.40$	Low
$0.00 < V \leq 0.20$	Very low

RESULTS AND DISCUSSION

Analyzing Learners

Researchers analyzed the difficulties faced by the students during the learning process of Geometry and the utilization of learning media. The instrument was developed to enhance students' understanding of Plane Figures in Geometry learning. Based on mathematics teacher interviews and researcher observation, researchers found that students in class VII B, consisting of 29 students had received materials related to straight lines and parallel lines, but the students were unable to fully comprehend straight and parallel lines. The students rarely used the available learning media in this school such as GeoGebra. They also rarely used contextual and local-based learning media.

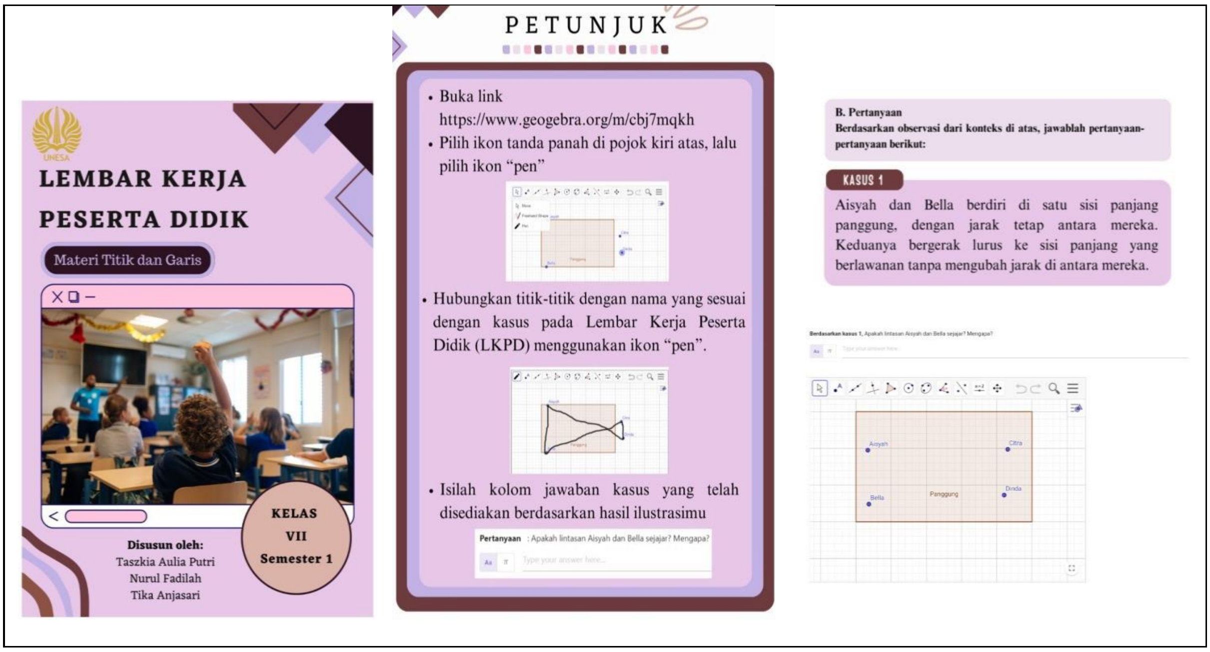
Stating Performance Objective

The researchers aimed to develop an ethno-PMRI based e-worksheet that uses the *Mayang Rontek* dance as a context to enhance students' understanding of geometry, specifically focusing on parallel and intersecting lines. The integration of *Mayang Rontek* as a learning context aligns with the characteristics and principles of PMRI, where learning is contextual, meaningful, and culturally relevant. The intricate movements and formations of the dance serve as a concrete example of geometric concepts, making the abstract notions of parallel and intersecting lines more tangible for students. By incorporating the dance's characteristic formations, such as dancers forming parallel lines in synchronized movements or intersecting lines in dramatic sequences, the e-worksheet aims to bridge the gap between students' everyday experiences and formal mathematical concepts. This progression aligns with the model off and model for approach in PMRI, where students first encounter informal and contextual models (in this case, the dance) before moving to more formalized representations of geometry.

Furthermore, the integration of the *Mayang Rontek* dance also highlights the principles of ethnomathematics, which emphasizes the connection between culture and mathematical thinking. In this case, the *Mayang Rontek* dance exemplifies how mathematical ideas such as symmetry, proportion, and geometric formations are embedded in cultural practices. The use of the dance as a context allows students to explore the intersection between cultural heritage and mathematical knowledge, fostering a deeper understanding of both. To further support this learning, GeoGebra was utilized as a tool for creating dynamic visualizations, helping students not only grasp geometric concepts but also improve their technological skills and knowledge. This innovative approach merges cultural expression with mathematical learning, providing a rich, interdisciplinary experience for students.

Selecting Method, Media, and Material

Researchers arranged the e-worksheet indicators based on the analysis result and the research objectives. Researchers used Canva to design the e-worksheet as interactive as students needed. Then, it was uploaded in GeoGebra Classroom and was used in a trial mode to confirm whether GeoGebra Classroom was ready to be used or not. Figure 2 show the examples of the GeoGebra integrated e-worksheet based on the ethno-PMRI.



English version:

E-Worksheet
Point and line material

For Grade VII
1st semester

Composed by
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Nurul Fadilah
Tika Anjasari

Instruction
1. Open the link https://www.geogebra.org/m/cbj7mqkh
2. Select the arrow icon in the top left corner then, select the "pen" icon.
3. Connect the dots with names that match the case on the e-worksheet using the "pen" icon.
4. Fill in the case answer column provided based on the results of your illustration.

B. Questions
Based on the observations from the context above, answer the following questions.

Case 1
Aisyah and Bella stand on one long side of the stage with a fixed distance between them. Both move straight to the opposite long side without changing the distance between them.
Based on case 1, are Aisyah and Bella's trajectories parallel? Why?

Figure 2. E-worksheet on GeoGebra

Figure 2 showed the e-worksheet on GeoGebra. It showed the cover of e-worksheet, the instruction of e-worksheet uses, and the students' exploration with GeoGebra asking about parallel line. Moreover, pre-test, post-test, and student questionnaire were administered online using the Google Form. Researchers arranged five questions of pre-test and post-test which were not similar but the difficulty of both tests was equivalent. The questionnaire also used Google Form as a tool for conducting a practicality test. The results were distributed in spreadsheet and ready to analyze.

Utilizing Materials

In the next stage, the validity of the e-worksheet was assessed by three experts for material and media validation. The quantitative data were obtained from a four-point Likert's scale from bad (1) to excellent (4). The qualitative data involved suggestions and criticisms related to the e-worksheet, which was being validated. The validation was referred to the Aiken's Validation and the results are portrayed in Table 2 and Table 3.

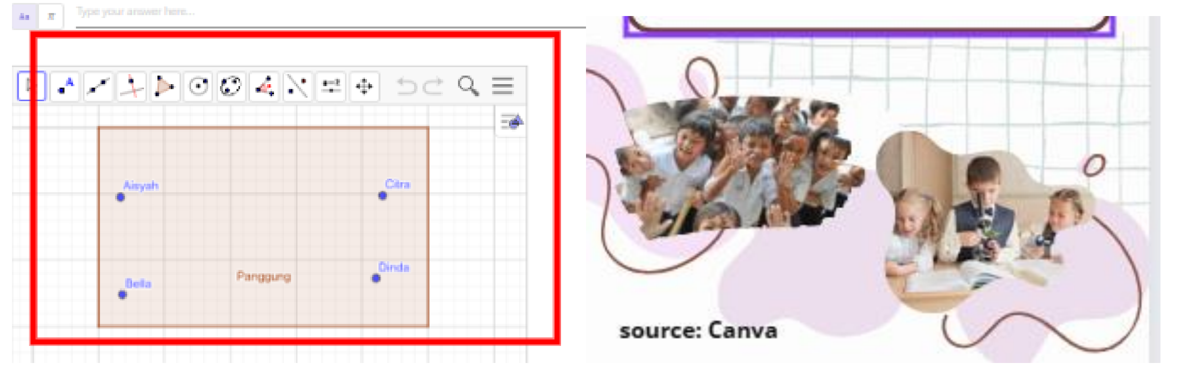
Table 2. Media expert validation

Item	Expert 1	Expert 2	Expert 3	$\sum S$	V	Information
1	3	2	3	8	0.89	very high
2	2	2	3	7	0.78	high
3	3	2	2	7	0.78	high
4	1	2	2	5	0.56	satisfied
5	2	2	2	6	0.67	high
6	2	3	2	7	0.78	high
7	2	2	3	7	0.78	high
8	2	2	2	6	0.67	high
9	1	3	2	6	0.67	high
10	2	2	2	6	0.67	high
11	2	3	3	8	0.89	very high

Table 3. Material expert validation

Item	Expert 1	Expert 2	Expert 3	$\sum S$	V	Information
1	2	2	2	6	0.67	high
2	2	2	2	6	0.67	high
3	2	3	2	7	0.78	high
4	1	2	3	6	0.67	high
5	2	3	3	8	0.89	very high
6	2	2	3	7	0.78	high
7	2	2	2	6	0.67	high
8	1	2	2	5	0.56	satisfied
9	2	3	2	7	0.78	high
10	1	2	2	5	0.56	satisfied
11	1	2	2	5	0.56	satisfied
12	3	3	2	8	0.89	very high

Table 2 focuses on media expert validation, with most items receiving high or very high ratings, while a few items were rated as satisfied. Table 3 shows the material expert validation, where similar results were obtained, with a combination of high and very high ratings, although a few items were rated as satisfied. The validators also provided feedback and comments regarding the developed e-worksheet. The input was used by researchers for evaluation and revision purposes. Figures 3 show the revised results of the e-worksheet following the critiques and suggestions from the validators.



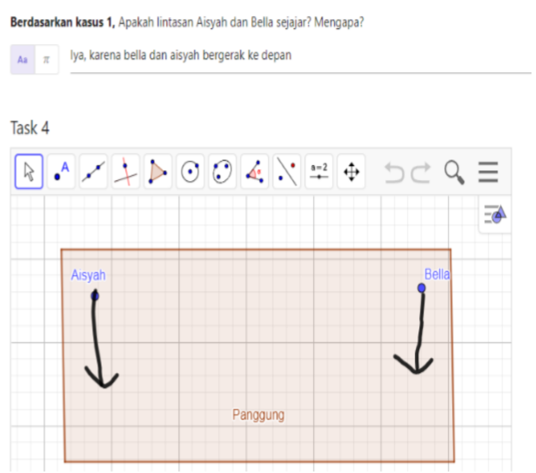
(a) (b)

Figure 3. E-worksheet revision to lock

Figure 3(a) illustrates a revision where the stage is locked within GeoGebra, preventing any changes to its position. This means that the stage remains fixed in place during use. On the other hand, Figure 3(b) shows a revision where a new resource has been added to the e-worksheet, enhancing its content and functionality. This update aims to provide additional support or information for users interacting with the e-worksheet.

Requiring Learner Participation

The developed and revised e-worksheet was tried out on 29 Junior High School students in grade VII. Students were asked to work on the e-worksheet using their respective tabs or smartphones. Previously, they would do the pre-test first, then did the e-worksheet, and finally worked on the post-test questions. Some of the students still appeared to have difficulties operating GeoGebra. There were examples of automatic logouts, requiring them to repeat their answers from the beginning. Students also required assistance in their work because the tool was still unfamiliar to them.



English version:

Based on case 1, are Aisyah and Bella's trajectories parallel? Why?

Student's Answer:
Yes, because Bella and Aisyah moved forward.

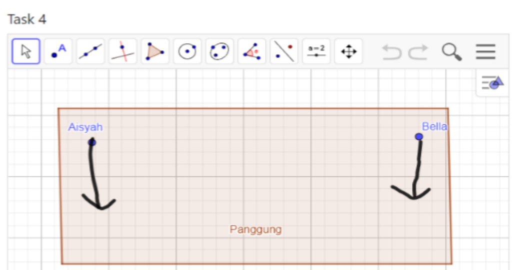
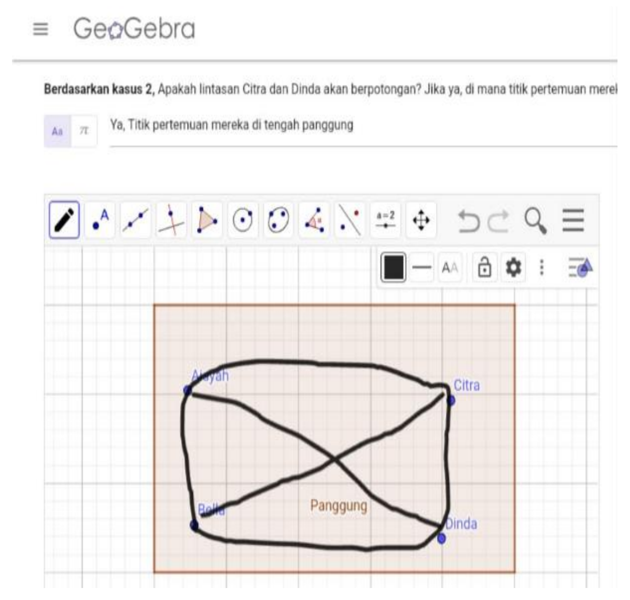


Figure 4. Question result case 1

The majority of students correctly answered question number 1 by stating that Aisyah's and Bella's paths were parallel, as seen in Figure 4. However, for their own reasons, students provided various arguments. For example, in Figure 4, some students argued that the paths were considered parallel because both were moving forward. On the other hand, some other students answered that their paths did not intersect. In other words, students already understood that paths are considered parallel when they did not have intersection points, and their directions and slopes were also the same. Students just found it challenging to describe it using precise mathematical sentences.



English version:

Based on case 2, will the trajectories of Citra and Dinda intersect? If yes, where is their meeting point?

Student's Answer:
Yes, their meeting point is at the center of the stage.

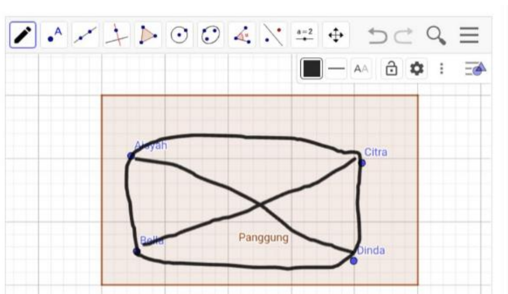
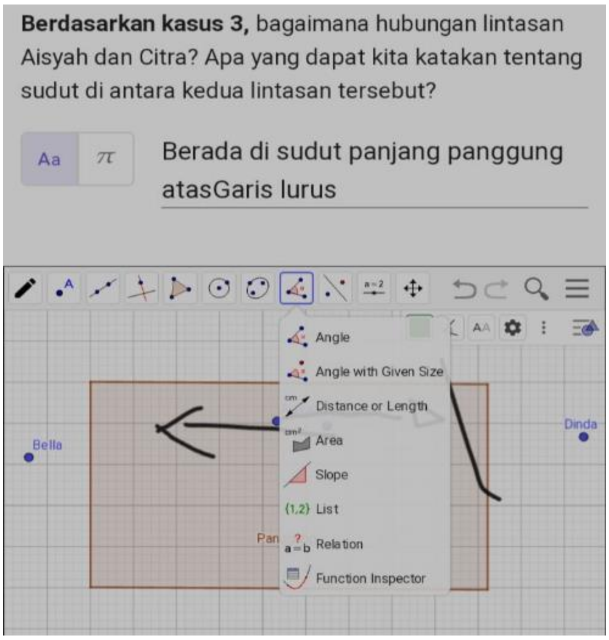


Figure 5. Question result of case 2

Figure 5 shows the answer of case 2 from one of them. She drew according to the concept of the problem given and made conclusions by filling in the short form provided. She stated that the results of her experiment would form a trajectory that would cause Citra's and Dinda's paths meet at a certain point. The meeting point was in the middle of stage. The results of the students' drawings, on average, already represented the given case's concept. However, the conclusions they drew were not entirely accurate yet. When interviewed, the subjects stated that one reason they did not understand was because the teacher did not explain in detail why those lines were called intersecting lines.



English version:

Based on case 3, what is the trajectory relationship by Aisyah and Citra? What can we say about the angle between the two paths?

Student's Answer:
It is at the corner of the stage length or straight line.

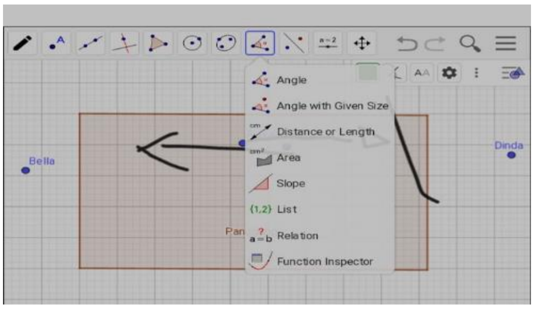
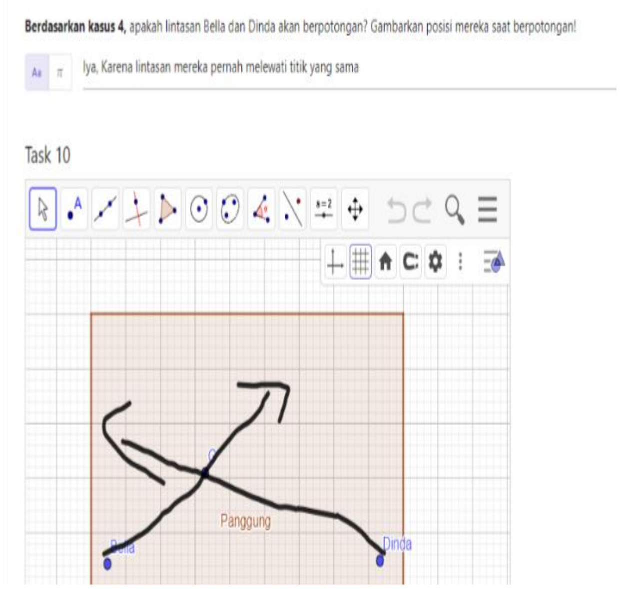


Figure 6. Question result of case 3

The students' answers for case 3 (see Figure 6) appear to be highly diverse depending on how students interpreted the problem in the sketch. One of them answered that the relationship of the trajectory with the angle for PMRI by Citra and Aisyah was located at the acute angle above the straight line. Another student drew two triangles, so the intended angle was in the form of a triangular angle. It was also evident that some of them still did not understand the angle for PMRI by the two trajectories in question.



English version:

Based on case 4, will Bella and Dinda's trajectories intersect? Draw their positions when they intersect!

Student's Answer:
Yes, they will because their trajectories once passed the same point.

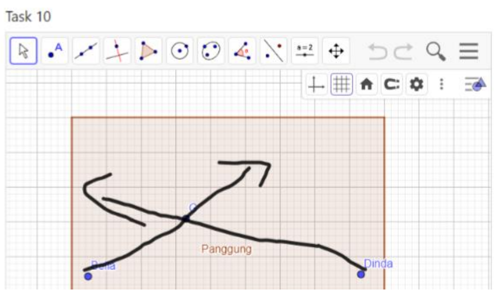
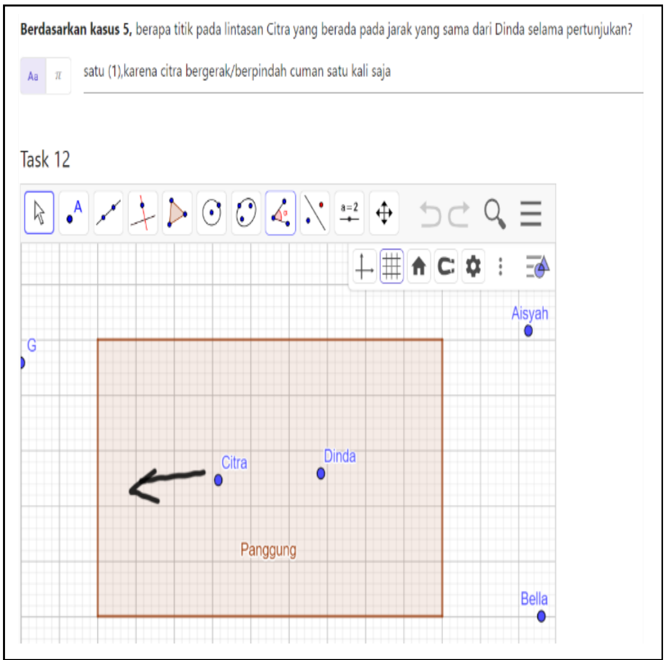


Figure 7. Question result number 4

Most students successfully completed question number 4 correctly. Figure 7 shows that the students answered that Bella's and Dinda's paths intersect is because their paths have passed through the same point. All students who answered correctly were also able to construct the image on GeoGebra accurately. However, the reasons given remained diverse. Some students said that the paths crossed each other, so they considered it as an intersection. Some students simply answered that the paths intersected without explaining their reasons.



English version:

Based on case 5, how many points on Citra's trajectory are at the same distance from Dinda during the show?

Student's Answer:
One, because Citra's moves or moves only once.

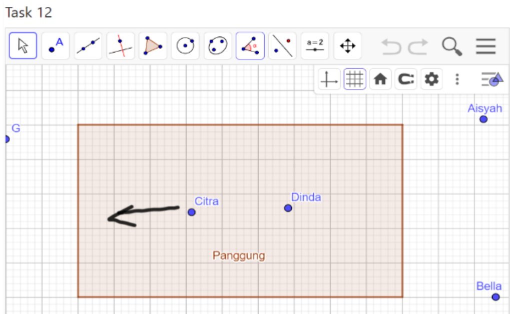


Figure 8. Question result number 5

In case 5, some students were able to sketch in accordance with the given problem. However, a few of them drew it in an inverted position, with the arrow pointing to the right. Meanwhile, regarding the conclusions they used to answer the short-answer questions above, almost all students did not answer correctly. They mistakenly believed that the distance referred to was by counting the squares between Citra and Dinda. However, the expected result by the researcher was zero, because they would not meet due to their increasingly distant positions. The students were required to answer five pretest questions before completing the e-worksheet and work on five post-test questions after completing the e-worksheet. The aim was to test the effectiveness of the e-worksheet with equivalent indicators. Researchers were expected that the score of their post-test was greater than the post-test, so the e-worksheet was categorized as effective. This test was analyzed using normality test and Wilcoxon.

Table 4. Normality test results

Type of tests	N	α	L_{count}	L_{table}	Analysis
Pre-test	29	0.05	0.44	0.15913	$L_{count} > L_{table}$
Post-test	29	0.05	0.69	0.15913	$L_{count} > L_{table}$

Based on the results of the normality test, it was found that L_{count} was greater than L_{table}. It was concluded the data were not normally distributed. Therefore, the Wilcoxon test was used to analyze the data that were not normally distributed and the result is shown in Table 5.

Table 5. Wilcoxon test results

Wilcoxon Test	
Ties	2
Total rangking (+)	1
Total ranking (-)	434
Average (+)	1
Average (-)	15.5
W_{count}	1
$W_{critical}$	126
Sample size	29
H_0	There is no difference before and after treatment
H_1	There is a difference before and after treatment
Significance level	0.05
Conclusion	Because $W_{count} < W_{critical}$, the result successfully rejected H_0. It was found that there was a difference between before and after treatment

From the Wilcoxon test, it was found that Table 5, there was a difference between before and after the implementation of the e-worksheet owing to the value of W_{count} was less than W_{critic}. This test showed an increase from the pre-test to the post-test due to the administration of the e-worksheet. Thus, the ethno-PMRI-based e-worksheet was declared effective because the e-worksheet improved students' understanding of the geometry materials. Its results identified the effectiveness use of e-worksheet.

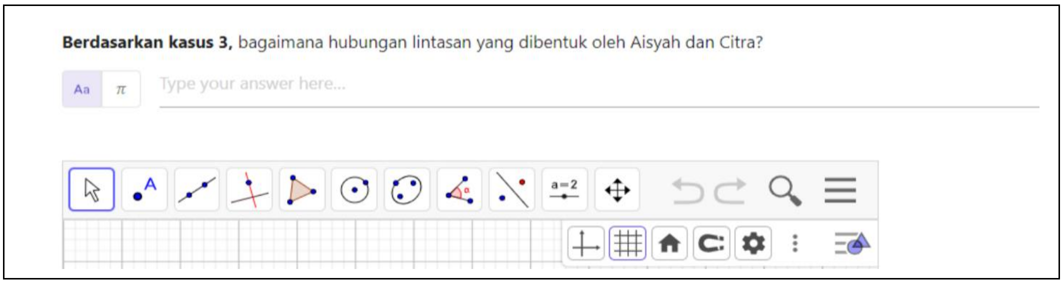
After testing for validity and effectiveness, the last test was to examine the practicality of the e-worksheet by a simple questionnaire. The e-worksheet assessment was conducted after students tried and used the e-worksheet. The response questionnaire was distributed to 29 students who had used the e-worksheet to test the practicality of the e-worksheet that had been developed. According to Table 6, the practicality testing result was 82.44%. It was obtained from four aspects encompassing content, representation, language, and motivation. It also meant that the e-worksheet developed on the criteria was very practical to be used to improve students' understanding on the topic of the relationship between two lines with the PMRI approach for junior high school students grade VII based on the assessment obtained from readability, students' views, and teachers' view.

Table 6. Practicality test results

No.	Assessed Aspect	Question Item	Score		Percentage	Description
			Result	Expectation		
1	Contents	4	1329	1612	82.44%	Very Practical
2	Presentation	2				
3	Language	2				
4	Motivation	2				
5	Usability	3				

Evaluating and Revising the E-worksheet

In the last stage of ASSURE, evaluation involved an analysis of student responses, teaching effectiveness, and the positive impact. The evaluation results became the basis for revision and improvement of the e-worksheet by integrating feedback from students and teachers to ensure that this material remained relevant and effective in the learning process. Revision occurred for question number three and five and the revised version were depicted in Figures 9 for question number three; and Figures 10 for question number five.



English version:

Based on case 3, what is the relationship between the paths formed by Aisyah and Citra?

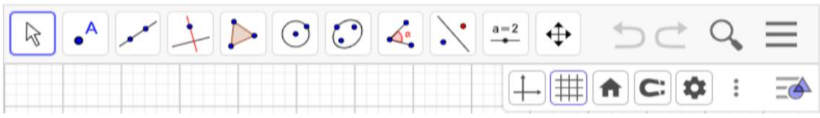
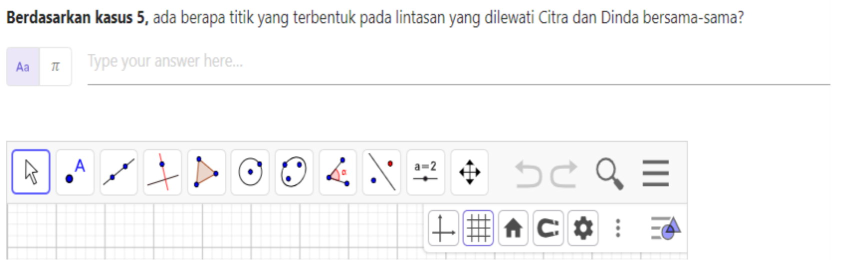


Figure 9. Question number 3 after revision

Based on Figure 9, the question number 3 after revision asking about the relationship between the paths formed by Aisyah and Citra? Meanwhile, before the revision, the researchers included a question about the size of the angle on the trajectory in the problem. As a result, many students admitted that they were confused because they did not understand the relationship between the situation given and the question asked (Figure 9). After reviewing it, the questions given should only be related to the relationship between points and lines, not on angle material. After the revision, the researchers decided to remove the question about angles and focus only on the line relationship formed by the trajectory of the two dancers. In addition, some students complained that they had difficulty in understanding the meaning of the question, so the researchers decided to improve the clarity of the sentence to be simpler to understand. Figure 10 show the question number 5 after revision.



English version:

Based on case 5, how many points are formed on the path that Citra and Dinda take together?

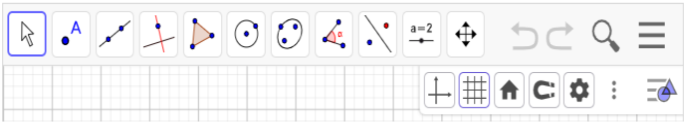


Figure 10. Question number 5 after revision

Regarding Figure 10 was the question number 5 after revision. After reviewing and re-reading, the researcher admitted that the quality of the questions and the readability of the questions used confusing and ambiguous language. After reviewing and correcting readability, the author agreed to remove the word "distance" and use simple language. Before revise the problem used contained the word distance which caused students to have difficulty in understanding the problem. The students had different perceptions in illustrating the problem on GeoGebra which caused each student to have many pictures or illustrations according to their respective understanding. The researchers also tested the readability again on junior high school students to correct whether the questions were easy to understand. In Figure 10, students stated that the questions, after being revised, were easier to understand and illustrate by students.

Based on interviews with mathematics teachers and researcher observations, it was found that students in class VII B, consisting of 29 students (Kang, 2021), had received material on straight lines and parallel lines. However, students have not thoroughly understood straight lines and parallel lines. This finding aligns with research by (Ulusoy & Çakıroğlu, 2021) which showed that although students could identify parallel lines in drawings, they had difficulty providing examples of parallel lines in daily life. This results, showed that PMRI and ethnomathematics help students to understand mathematics concept through contextual problems. The application of the PMRI and ethnomathematics approaches, particularly through the integration of the Mayang Rontek dance movement, has proven to be effective in helping students better grasp these mathematical concepts in a contextual and meaningful way. This result align with Prahmana (2022) stated that Ethno-PMRI facilitate students grasp mathematical ideas by reimagining them via real-world situations and applying mathematics to solve issues. PMRI focuses on the process of mathematizing lines surrounding *Mayang Rontek* dance movement (Fredriksen, 2021), meanwhile ethnomathematics encourages the study of straight line and parallel through the concepts, strategies, and tactics from *Mayang Rontek* dance movement (Rosa et al., 2016).

To assess the effectiveness of students' understanding before and after treatment, the Wilcoxon test was used, which functions to compare paired data, especially on data that is not normally distributed (Fiandini et al., 2024). The normality test results showed that the Lcount value was greater than the Ltable, which indicated that the data was not normally distributed, so the Wilcoxon test was chosen as the appropriate analysis method. This test is used to see significant differences between two data groups that are not normally distributed (Fiandini et al., 2024).

According to the practicality test results shown in Table 6, 82.44% was obtained in the "very practical" category (Yanto et al., 2024). This score is based on four aspects: content, representation, language, and motivation. This finding indicates that the Student Worksheet (LKPD) developed meets the practical criteria to improve students' understanding of the relationship between two lines with the Realistic Mathematics Education (PMRI) approach for grade VII junior high school students. This is supported by the readability assessment and the views of students and teachers. Readability itself is very important to determine whether a text is in accordance with the level of language ability of students so that they more easily understand the material presented (Maruti et al., 2024).

CONCLUSION

Based on the validity test results, the e-worksheet is declared valid with an average of Aiken's V value of 0.74, categorized as high validity. Based on the effectiveness and practicality tests conducted on 29 students, the e-worksheet helped them improve their understanding of the material with an increase in pre-test and post-test by the results of the Wilcoxon test, so the study successfully rejects H_0, where the e-worksheet is effective for improving students' understanding of geometry materials. In addition, the practicality test result is 84.97%, which means that the developed e-worksheet is classified as valid, practical, and effective in helping students understand plane figures material in Geometry. The revised e-worksheet can be used to measure Geometry skills in mathematics learning. By developing an e-worksheet based on the PMRI approach using GeoGebra and ethnomathematics, it is expected that students will not only understand geometry concepts in mathematics but also the link between mathematics and culture in everyday life. This study suggests the forthcoming research to use the local context for learning media development, such as local dances, traditional food, or other traditions close to students. The existence of local context allows students to understand the usefulness of mathematics directly in the culture around them. In addition, the PMRI approach can be used not only for individuals but in small groups or full-class situations as well.

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