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The development of numeracy problems using *light rail transit* context

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Abstract

The emergence of this research is due to the low numeracy skills of students in Indonesia. It is due to the soft critical thinking skills of students. One of the strategies that can be done is to develop PISA-type questions and activities. This study aims to produce PISA-type questions and activities using a valid and practical context using *Light Rail Transit*. This research is a design research type of development research which consists of a preliminary evaluation stage and a formative evaluation stage. This study involved students of eighth-grade junior high school students in Palembang City, totaling 34 students with various skills. The analysis of the results of this study was qualitatively based on data from the field received in the form of interviews, document reviews, observations, and tests to see student activities in solving questions and activities. The result of this research is the development of PISA-type questions and activities, namely four student activities and six evaluation questions using the *Light Rail Transit* context. In conclusion, PISA-type questions and activities in the context of *Light Rail Transit* can be used in classroom learning to improve students' numeracy skills.

Keywords: design research; *light rail transit;* numeracy skills; PISA; questions and activities

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Introduction

The Program for International Student Assessment (PISA) is one of the schemes used in several nations to evaluate students' literacy and math abilities. Every three years, the PISA assesses the performance of 15-year-olds in science, arithmetic, and reading. Indonesian students had an average math literacy score of 386 with a score of 69 out of 72 countries (OECD, 2016), but it dropped to 74th out of 79 countries with a score of 379 in 2018 (OECD, 2019b). The PISA results show that Indonesia still needs to gain basic mathematical literacy skills (Fitriyani & Mastur, 2017). Indonesia's participation in PISA is intended to gauge how far Indonesia's educational system has advanced relative to other nations. Three key PISA components cover the topic of competence. PISA questions are created based on the four topics that are offered in the curriculum.

The causes of low mathematical numeracy skills in Indonesia in the PISA study have been found in several studies conducted by other researchers (Fitra et al., 2018). Some of these studies mention students' low ability to interpret solutions in authentic contexts, weak computational skills, and need to be more accustomed to writing conclusions (Wati & Murtiyasa, 2016). Sugiman and Kusumah (2010) said that if students often encounter types of questions, he only uses the same method so that the problem does not become an obstacle for them. However, if students get a question that has yet to be, they do not even know the method of solving it, and the problem becomes an obstacle for students. In addition, educators are also part of the factors that cause students' common understanding in solving PISA math problems because teachers need to provide specially designed questions, especially in training students' reasoning. It leads to real-life contexts or questions tested in the PISA survey so that it can be estimated that students' reasoning does not develop optimally (Pamungkas, 2017). Therefore, students need to be given and familiarized with PISA model math problems developed and adapted to the PISA 2018 framework as a solution to help students improve their mathematical literacy skills.

Numerous reasons may contribute to Indonesian students' low PISA performance, particularly in mathematics. One of them is that students need higher numeracy abilities when solving PISA questions because they are not accustomed to working on problems like those in the PISA during the learning process (Nusantara et al., 2020a). In addition, textbooks do not emphasize students' real-world problem-solving skills as tested by PISA questions (Munayati et al., 2015). To acquaint students with the methods required to solve PISA questions, PISA-style questions should be utilized in classroom learning activities (Nusantara et al., 2020a). Creating PISA-style questions and using them in classroom learning activities is crucial. Shape and space, change and relationship, quantity, and uncertainty and data are the four topics (Nusantara et al., 2021; OECD, 2019a).

One of the most crucial PISA subjects for students is change and relationship because they are closely related to daily life. Explaining, modeling, and examining how change events develop is crucial (OECD, 2018, 2019a). However, this content score does not match the poor performance of Indonesian students on context-based assessments such as PISA (Wijaya et al., 2014). According to the unexpected PISA results released in late 2018, Indonesian students' competency in change and relationship materials is surprisingly lower than the OECD average, with 379 out of 489 (OECD, 2019b).

The students' dismal performance prevented them from determining the root problem. Reading, math, and character education are three crucial subjects that children must learn and are equivalent to internationally accepted, successful teaching strategies like PISA. Numeracy, often known as mathematical literacy, is a fundamental mathematical skill that allows students to experience mathematical processes (formulating, applying, and interpreting) in various situations and with problems from the real world (Stacey, 2010; Stacey & Turner, 2015).

Additionally, local surroundings can produce tests like PISA, a legitimate effort to familiarize Indonesian students with challenges like PISA (Kohar et al., 2019). With the help of PMRI, context-based learning in mathematics has been successfully applied in Indonesia and the Netherlands (Zulkardi et al., 2020; Zulkardi & Putri, 2010). Because abstract mathematical ideas can be transformed into a form of representation that is easy to understand through didactic phenomena, mathematical concepts have greater relevance for students (Nusantara et al., 2020b; Wijaya et al., 2014). The PMRI approach is more focused on student participation in the learning process so that they can develop their knowledge. It is also concentrated on students creating their knowledge through their activeness in class. Compared to traditional learning, learning that incorporates real-world challenges is thought to increase mathematical literacy (Umbara & Nuaraeni, 2019). According to Zulkardi and Putri (2006), when using the PMRI approach, the context provides students with a foundation for comprehending mathematics and a source for mathematical applications.

Using the *Light Rail Transit* context, specifically the line for buying *Light Rail Transit* Palembang tickets, is one of the contexts of settings connected to daily life. The initial purpose of the *Light Rail Transit* IT development was to assist venues in preparing for the 2018 Asian Games. The *Light Rail Transit* is a form of contemporary transportation that many people in Palembang have utilized and is well-known to the present millennial age. Because only a few researchers still study the *Light Rail Transit* context, researchers picked it. The following are the Palembang *Light Rail Transit* stations' names: DJKA, Jakabaring, Polresta, Ampera, Cinde, Dishub, Bumi Sriwijaya, Demang, Garuda Dempo, RSUD, Punti Kayu, Asrama Haji, and Bandara.

Researchers chose the Palembang *Light Rail Transit* context because there are still few researchers who researched the *Light Rail Transit*, one of which was a previous study using the *Light Rail Transit* context for class X SMA (Hardianti, 2019). Their findings demonstrated that the questions created had been deemed genuine and valuable. However, studies have yet to be conducted using the *Light Rail Transit* context, which contains content on change and relationships in Algebra. However, PISA forms or evaluation questions still need to be developed for *Light Rail Transit*. Nowadays, many people, including adults, parents, students, and others, use the *Light Rail Transit* as a mode of transportation because it provides quick access to destinations. Consequently, research goals generate reliable and valuable PISA types in the context of *Light Rail Transit*.

Methods

The preliminary evaluation and formative assessment stages are the two steps of this design research: development research (Bakker, 2018; Zulkardi & Putri, 2006). The researcher's initial task during the preliminary evaluation phase was to analyze the PISA framework using PISA items from 2000 to 2018 and create the 2022 PISA criteria, composed of content, context, and cognitive competence at the level of reasoning. The researchers then created assessment standards, grids, question cards, activity questions, and PISA evaluation questions. Examining the curriculum to the PISA questions produced is the second action. The first draft of activity questions and evaluation questions are then created using the analytic results and other tools, including question grids, question cards, assessment rubrics, a list of interview questions, and validation sheets. Numeracy abilities that appear in activity questions and assessment questions include employing different symbols or numbers related to fundamental mathematics to solve problems in daily life (N1); examining data shown in a variety of formats, including graphs, charts, tables, and diagrams (N2); creating a prediction and judgment, analyze the findings of the analysis (N3).

The Sriwijaya University Mathematics Education Lecturers, Ph.D. students, postgraduate students, and junior high school mathematics teachers carried out the expert review stage validation in this study. Additionally, the researchers validated three students with low, medium, and high abilities, not one-on-one research subjects. Before moving on to the small group stage, the expert review and one-to-one stages comments and ideas are used as modifications. Nine students with low, medium and high talents participated in the trial's small group phase to examine the usefulness of the questions produced. Each student contributes their solutions in small groups. A research team that served as observers was assigned to each group of students. After all, groups provided answers to the questions, and students were free to share their contributions. The role-model instructor conducted interviews with the students in order to learn more about how they saw the activity questions and evaluation questions. Before moving on to the field test stage, changes were made from the small group stage.

Thirty-four junior high school students, all 15 years old and with varied skill sets, participated in this field test stage, which served as the final trial stage. The first field test meeting used questions and activities as learning difficulties. In the field exam portion of the second meeting, each student is assessed on the questions individually. Trials on this study's subject were undertaken using genuine and valuable questions and activity questions. By examining student answer sheets and using indicators of the students' numeracy ability measured in the questions, the field test stage seeks to determine the potential impact of the questions created.

Then, when applying the PBL model, the model instructor gives pupils the necessary information at the start of the lesson before the activity starts. The PBL model's learning steps include introducing students to problems, setting them up to learn, supervising individual and group investigations, producing and presenting work, and assessing and analyzing problem-solving techniques. To pique their attention, the exemplary teacher turns a problem into an activity that students must accomplish in the orientation phase. Additionally, after being broken into groups of 4-5 students, they can ask questions regarding issues they need help understanding. Students work together to solve problems, and the teacher keeps an eye on each group to see if anyone needs clarification or is still needing help. The teacher asks a group representative to present the discussion outcomes in front of the class after each group resolves the problem and records its findings on the student activity sheet. Students are requested to comment on the presentations made by other groups as part of the last phase, which involves analyzing and evaluating the problem-solving procedure. The instructor will correct any mistakes in the talks' outcomes.

Techniques for gathering data include testing, interviews, observation, and document examination. Using comments and recommendations from expert reviews, FGD, and one-to-one document reviews, the validity of activity and assessment questions within the framework of *Light Rail Transit* was evaluated. At the small group stage, practicality is acquired through observation, interviews, and document analysis. It was evident from student responses, observations, and interviews conducted during the field test phase that the activity and evaluation questions may have impacted students' numeracy abilities. The gathered data were put through descriptive analysis.

Results

This study's questions and activities in the *Light Rail Transit* context resulted in four activities and six evaluation questions. This research focuses on change and relationship content. The *Light Rail Transit* context used is the Palembang *Light Rail Transit* tickets, Palembang *Light Rail Transit* travel routes, physical distancing on the Palembang *Light Rail Transit* train, Palembang *Light Rail Transit* facilities, Palembang *Light Rail Transit* ticket counters, Palembang *Light Rail Transit* tickets sold, Palembang *Light Rail Transit* station visits, Palembang *Light Rail Transit* travel time, Palembang *Light Rail Transit* ticket purchases.

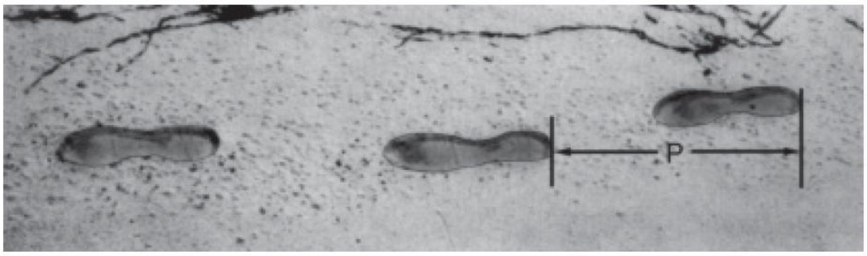
Preliminary

In order to choose the research topics, schedule, and flow of teaching and learning activities in the classroom, as well as to take care of permits as an administrative requirement in carrying out research in the schools concerned, the researchers first conducted observations in junior high schools in the city of Palembang. Develop PISA-style questions and activities using the *Light Rail Transit* context after analyzing numerous PISA questions and activities.

Direct visits by researchers were made to SMP Negeri 59 Palembang schools. Then they determined which students had contributed to data collecting, such as by implementing one-on-one and small group instruction under the teacher in charge of the class. Three students with low, medium and high abilities were chosen for the one-to-one stage. Nine students with low, medium, and high abilities were chosen for the small group stage at the same time. It means gauging the effectiveness of the questions and exercises the researchers created using data from various student abilities and the degree of difficulty for each student.

The study's focus was then narrowed down to teaching materials based on the curriculum followed at SMP Negeri 59 Palembang. The independent curriculum is the one being used. The first chapter of the Independent Curriculum covers the material for teaching integer arithmetic operations. At this point, assess the activities and questions that have been created. The 2012 PISA question depicted in Figure 1 is one of the PISA questions used as an illustration in the production of this study.

MATHEMATICS UNIT 2: WALKING



The picture shows the footprints of a man walking. The pacelength *P* is the distance between the rear of two consecutive footprints.

For men, the formula, $\frac{n}{P}=140$, gives an approximate relationship between *n* and *P* where,

n = number of steps per minute, and

P = pacelength in metres.

QUESTION 2.1

If the formula applies to Heiko's walking and Heiko takes 70 steps per minute, what is Heiko's pacelength? Show your work.

QUESTION 2.2

Bernard knows his pacelength is 0.80 metres. The formula applies to Bernard's walking.

Calculate Bernard's walking speed in metres per minute and in kilometres per hour. Show your working out.

Figure 1. Original 2009 PISA questions with Walking context

Figure 1 is a PISA problem with change and relationship content, which tells about walking, the distance between the actual two consecutive footprints. The formula applies to Helko's walking Helko takes 70 steps per minute, and the pace length is 0.80 meters. In this case, the problem is whether Bernard's walking speed is calculated in meters per minute and kilometers per hour. The researchers will develop PISA-type questions using *Light Rail Transit* context based on these questions.

Self-evaluation

In the self-evaluation stage, developed PISA-style questions and activities with change and relationship content and a *Light Rail Transit* setting must first be studied and assessed by the researchers. When creating questions and activities, factors including topic, construct, and language should be considered. Researchers will fix the questions and activities if mistakes like typos, poor word choice, or many sentences need to be finished. Students were subjected to two types of research tests: questions and activities. The researcher improved the questions and activities from the self-evaluation results and got Prototype 1, as shown in Figure 2 below.

Figure 2. Development of PISA prototype 1 type questions and activities

Personal improvements include rephrasing sentences to be more impactful, correcting typos, and revising the applicability table on activity questions. The prototype 1 changes made during the self-evaluation stage will be carried over to the expert review and one-to-one stages.

Expert review and one-to-one

Expert review and one-to-one validation were used to create legitimate questions and activities for content, construct, and language after creating questions and activities in Prototype 1 (Zulkardi et al., 2020). Regarding content, the PISA framework should be examined to determine whether questions and activities are appropriate in light of the topic being evaluated, indications of numeracy ability, and change and relationship content. The PISA framework's features of the level of issues, as well as questions, tables, and illustrations, are provided in a clear, understandable, and practical way to decide whether questions and activities are appropriate for class VIII students' ability level. Additionally, in terms of language, to determine the words in the questions and exercises using the appropriate language, the sentences employed are straightforward and unambiguous, do not lend themselves to numerous interpretations, and are communicative. The researchers also conducted a one-on-one review by the expert review and FGD to examine comments and suggestions on the created questions and see students' thoughts when working on the questions and activities on Prototype 1. The researchers improved the questions and activities for prototype 2 based on comments and ideas from prototype one and the outcomes of the expert review and one-to-one sessions.

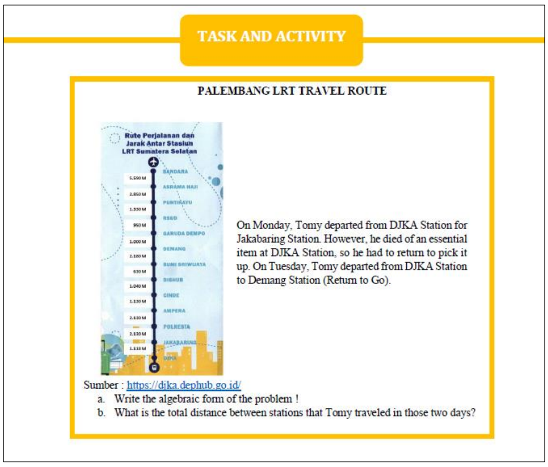
Table 1. Comments, suggestions and revision decisions

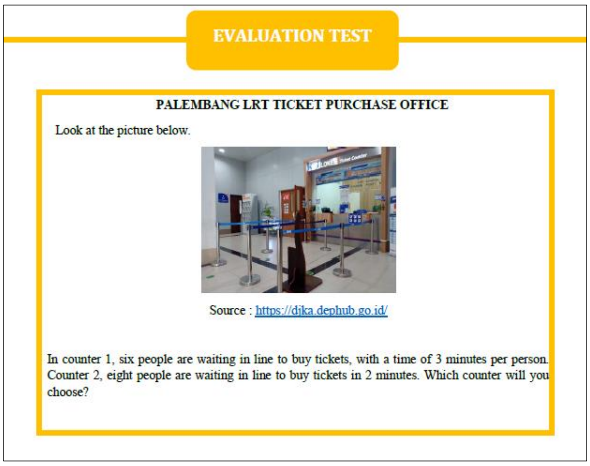
Validation	Comments and Suggestions	Revision Decision
Experts	1. Add symbol descriptions to the question 1 activity. 2. Correct the sentences on some questions according to the suggestions. 3. Add table information to question all activity. 4. Add sources of information and images as suggested. 5. Reconsider the level of the question. 6. All possible answers to the question 3 activity should be written in the scoring rubric.	1. Adding symbol descriptions in the question 1 activity. 2. Correct the sentences on some questions according to the suggestions. 3. Adding table information to question all activity. 4. Adding information sources and images as suggested. 5. Fixed the question level. 6. Write down all possible answers to the question 3 activity in the assessment rubric.
Students	1. Because students' and researchers' interpretations of the question are different, the language in question activity four must be corrected.	1. Because the meaning of the question varies between students and researchers, improve the language in question activity four.

Based on Table 1 above, all comments and suggestions from professionals and students regarding creating questions and activities are worthwhile. However, future iterations must be improved.

Small group

The following are the outcomes of the expert review stage repair of prototype 1 and the one-to-one created prototype 2 that will be used in the small group.





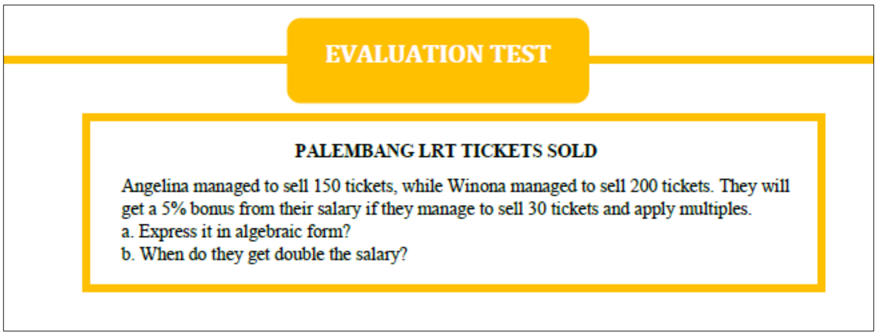
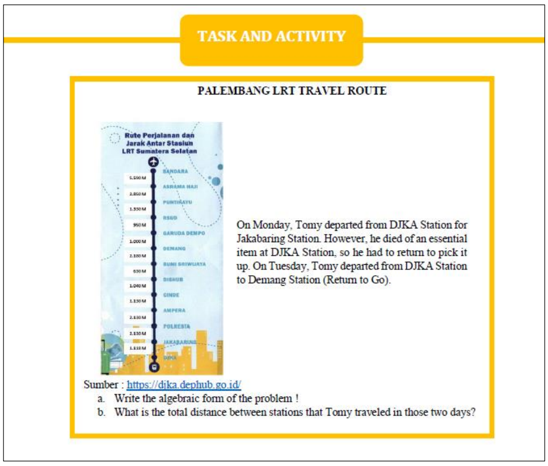
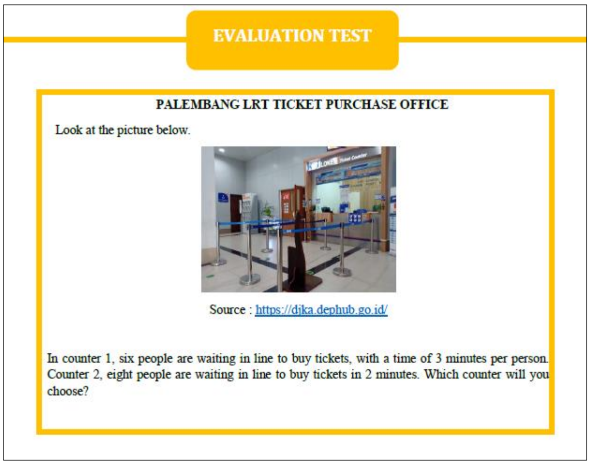


Figure 3. Development of PISA prototype 2 type questions and activities

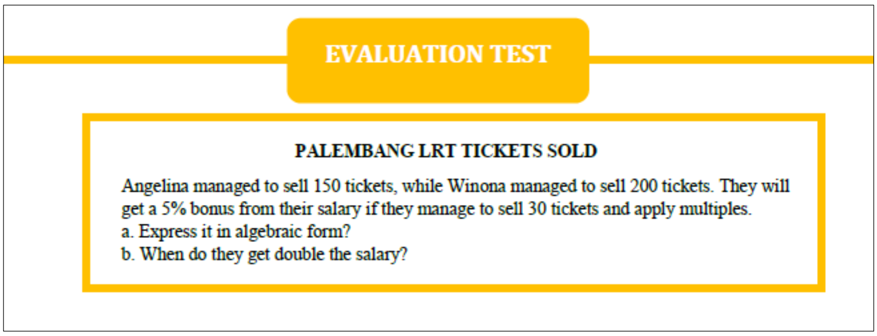
Based on figure 3 above, three small groups of three students, each with a range of skills, were used to test prototype two's activities and evaluation questions. Students work together for 60 minutes to answer activity and evaluation questions. Researchers have used a *Problem Based Learning* (PBL) model at the small group level with stages like student orienting to problems, arranging students to learn, guiding individual/group investigations, producing and presenting work, and assessing and evaluating problem-solving processes. Some students correctly understood the questions' meanings and provided answers, while others provided incorrect responses.



(a)



(b)



(c)

Figure 4. Development of PISA prototype 3 type questions and activities

Figures 4a, 4b, and 4c are the results of improvements after making observations at the small group stage and conducting interviews with several students. In Figure 4a, the researchers made improvements by moving the information sentence "On Monday, Tomy departed from DJKA Station for Jakabaring Station. However, he died of an essential item at DJKA Station, so he had to return to pick it up. On Tuesday, Tomy departed from DJKA Station to Demang Station (Return to Go)." after question part a. It was done because, in the small group process, the researchers observed that some students misinterpreted the question partly because they had thought too far after reading the sentence first. In Figure 4b, many students have answered correctly, but some students need help understanding your meaning, so students do not add your queue at the *Light Rail Transit* counter queue. In Figure 4c, Because the students' responses did not yield the best answer, the researchers added information to the problem. The researchers' interviews with students further supported this. The outcomes of small group interviews with students are listed below. (Note: R: Researcher; S: Student).

R: From your answer, why did you answer counter two? Which will be chosen?
S: After many times, ma'am, the result is counter 2, which has the least waiting time.
R: That is right. Try reading the information in the question. Are you sure there are 6 people at counter 1 and 8 at counter 2?
S: I thought you weren't counted in the queue, Ma'am, so I just counted Ma'am.
R: For question no. 2 is there a problem or not to determine the algebraic form?
S: At first, I was confused, ma'am. In determining which variable, after I read it, it turned out that the variable was the salary and the bonus they received, Ma'am.
R: Are you sure with your answer?
S: Yes ma'am.
R: Try to explain to ma'am how do you calculate it?
S: Leave me and share, ma'am.
R: The 5%?
S: Oh yes, ma'am, I forgot to change 5%. It should be made to 5/100 first
R: Yes, right

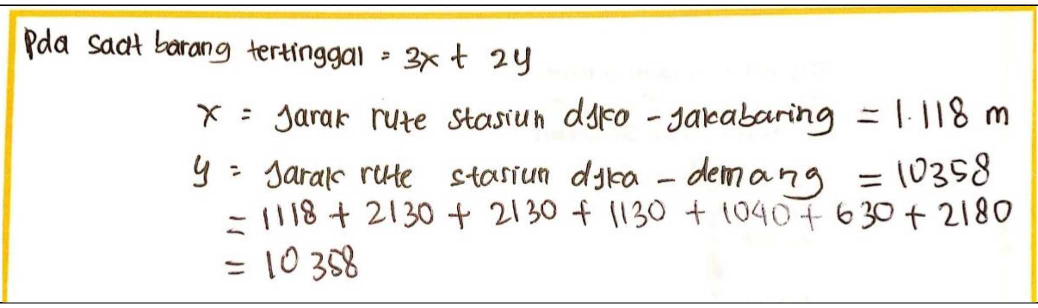
According to the interview findings, it is evident that students misunderstood the question's intent due to the question's double-meaning language. As a result, the researchers revised the questions' phrases in light of the interviews she conducted with these students.

Field test

A field test is the following step, which evaluates students' numeracy abilities. Thirty-four students from SMP N 59 Palembang participated in this field test activity. Students participating in the field test have high, medium, and low talents. In order to teach the ongoing field test, the researchers partnered with the classroom instructor Kristeria Febriani, S.Pd. The PBL approach, which is used in classroom activities, is applied to the learning in this study. Additionally, Prototype 3, which has been deemed legitimate and valuable, will be used in classroom instruction to conduct field tests.

Then, when applying the PBL model, the model instructor gives students the necessary information at the start of the lesson before the activity starts. The PBL model's learning steps include introducing students to problems, setting them up to learn, supervising individual and group investigations, producing and presenting work, and assessing and analyzing problem-solving techniques. The model teacher turns a problem into an activity that students must perform in the student orientation phase of the problem in order to get them interested in doing it. Additionally, after being broken into groups of 4-5 students, they can ask questions regarding issues they do not understand. Students work together to solve issues, and the teacher monitors each group to see if anyone needs clarification or needs help. The teacher asks a group representative to deliver the discussion outcomes in front of the class after each group resolves the challenge and records its findings on the student activity sheet. Students are requested to comment on the presentations made by other groups as part of the last phase, which involves analyzing and evaluating the problem-solving procedure. The teacher will correct any mistakes in the discussion outcomes if they occur.

Numeracy abilities that appear in activity questions and assessment questions include employing different symbols or numbers related to fundamental mathematics to solve problems in daily life (N1); examining data shown in a variety of formats, including graphs, charts, tables, and diagrams (N2); creating a prediction and judgment, analyze the findings of the analysis (N3). Students' descriptions of how to solve issues provide insight into their numeracy skills. It demonstrates how students' numeracy abilities are displayed when answering questions.

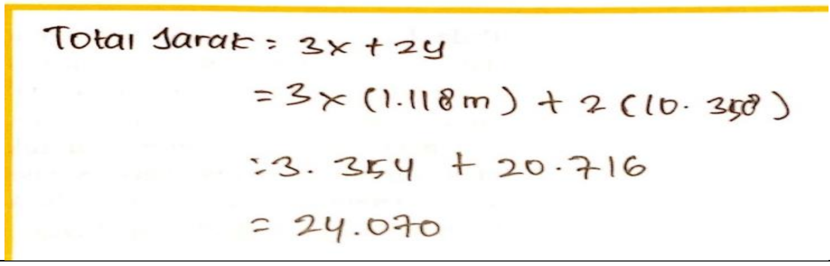

Pda saat barang tertinggal = 3x + 2y
x = Jarak rute Stasiun djka - jakabaring = 1.118 m
y = Jarak rute stasiun djka - demang = 10358
= 1118 + 2130 + 2130 + 1130 + 1040 + 630 + 2180
= 10 358

Translation:

a. When the item is left behind $= 3x + 2y$
x =DJKA-Jakabaring station route distance $1{,}118\ m$
y = DJKA-Demang station route distance $= 10{,}358\ m$
$= 1{,}118 + 2{,}130 + 2{,}130 + 1{,}130 + 1{,}040 + 630 + 2{,}180 = 10{,}358$

Figure 5. The results of student answers from the Palembang *Light Rail Transit* travel route task activity part

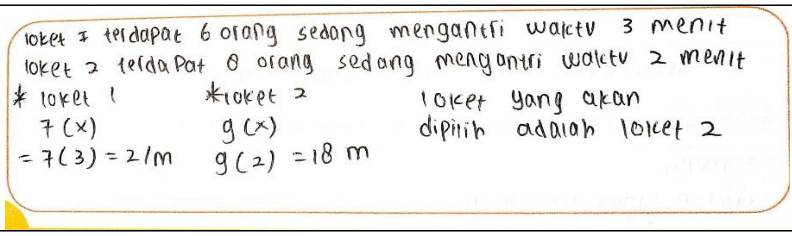
Figure 5 shows the results of students' answers during the field test. The answers show that students can solve problems with the information in the questions and activities. In Figure 5, the assignment activity for the Palembang *Light Rail Transit* route, students understand the problem nicely by giving the correct answer. From the results of these answers, all indicators of numeracy skills appear; namely, students can use numbers in solving problems, students can also read the information on travel routes and distances between *Light Rail Transit* stations, and students can make algebraic forms and conclude and make decisions in solving problems.


Total Jarak = 3x + 2y
= 3x (1.118 m) + 2 (10.358)
= 3.354 + 20.716
= 24.070

Translation:
total distance $= 3x + 2y$
$= 3(1{,}118) + 2(10{,}358)$
$= 3{,}354 + 20{,}716$
$= 24{,}070$

Figure 6. The results of student answers from the Palembang *Light Rail Transit* travel route task activity part

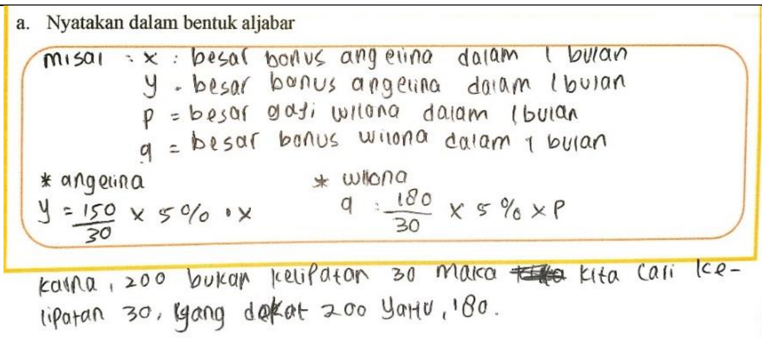
The Figure 6 shows the results of students' answers to the task of the Palembang *Light Rail Transit* travel route. It is also seen that students understand the problem well by giving the correct answer to find the total distance traveled and all indicators of numeracy ability appear.


loket I terdapat 6 orang sedang mengantri waktu 3 menit
loket 2 terdapat 8 orang sedang mengantri waktu 2 menit
* loket 1
7 (x)
= 7(3) = 21m
*loket 2
9 (x)
9 (2) = 18 m
loket yang akan dipilih adalah loket 2

Translation:
Counter 1 there are 6 people waiting in line for 3 minutes
Counter 2 there are 8 people waiting in line for 2 minutes
Counter 1
$7(x) = 7(3) = 21\ m$
Counter 2
$9(x) = 9(2) = 18\ m$
the counter to be selected is counter 2

Figure 7. The results of student's answers from the evaluation test Palembang *Light Rail Transit* ticket purchase office

Based on Figure 7, the N1 capability indicator appears; students can use numbers to solve problems. Students understand the problem very well because it provides a complete solution, namely calculating the time it takes to buy an *Light Rail Transit* ticket between counter 1 and counter 2, which is included in the N2 indicator. In addition, on the N3 indicator, students can conclude their answers and provide solid reasons for their answers.



Translation:

know : x = Angelina's salary is significant 1 month

y = Angelina's big bonus in 1 month

p = Winona's salary is significant 1 month

q = Winona's big bonus in 1 month Angelina

$$y = \frac{150}{30} \times 5\% \times x$$

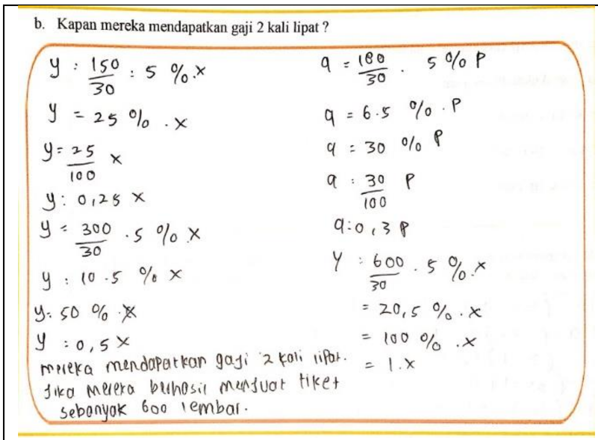
Winona

$$q = \frac{180}{30} \times 5\% \times p$$

Because 200 is not a multiple of 30, so we look for multiples of 30, which are close to 200, which is 180

Figure 8. The results of student answers from the evaluation test Palembang *Light Rail Transit* tickets sold

Figure 8 shows the results of students' answers during the field test. The answers show that students can solve problems with the evaluation test Palembang *Light Rail Transit* tickets sold, the Palembang *Light Rail Transit* route assignment activity, students understand the questions well by giving the correct answers. From the results of these answers, students can make algebraic forms. For example, the amount of salary and bonus received by Angelina and Winona can determine the value of multiples of 30 and conclude and make decisions in solving problems.



$y = \frac{150}{30} \times 5\% \times x$ $\quad$ $q = \frac{180}{30} \times 5\% \times p$

$y = 25\% \times x$ $\quad$ $q = 30\% \times p$

$y = \frac{25}{100} x$ $\quad$ $q = \frac{30}{100} \times p$

$y = 0.25x$ $\quad$ $q = 0.3p$

$y = \frac{300}{30} \times 5\% \times x$ $\quad$ $y = \frac{600}{30} \times 5\% \times x$

$y = 50\% \times x$ $\quad$ $y = 100\% \times x$

$y = \frac{50}{100} \times$ $\quad$ $y = \frac{100}{100} x$

$y = 0.5x$ $\quad$ $y = 1x$

They get double the salary if they manage to sell 600 tickets

Figure 9. The results of student answers from the evaluation test Palembang *Light Rail Transit* tickets sold

Based on Figure 9, the students gave a great answer. The bonus that Angelina received was selling 150 tickets. Then the students tried again, and Winona managed to sell 200 tickets. Because 200 is not a multiple of 30, students look for multiples close to 200, which is 180, then count 180 sheets to get double the salary of students trying to try to add tickets so that students get the correct answer.

Discussion

Prototyping stage

During the process of developing questions and when students answer questions and activities, this makes students able to read well because students can understand the information on the questions, and the sentences used in the questions do not cause double meaning. The images displayed are apparent, as well as questions and activities that are displayed in real contexts that are well known by students so that it is effortless for students to understand this is in line with the help of PMRI, context-based instruction in mathematics has been successfully implemented in Indonesia, and the Netherlands (Wijaya et al., 2014; Zulkardi & Putri, 2010), because an abstract mathematical notion can be turned into a form of easily understood representation through didactical phenomena, mathematical concepts have greater relevance for students (Wijaya et al., 2014).

The Questions and Activities Using *Light Rail Transit* Context were theoretically valid in terms of their contents, constructs, and language because of the activities that produced them. The initial prototype was also deemed valid qualitatively based on the opinions and recommendations of experts as well as students' comprehension of the issues (Zulkardi, 2002).

Developing this mathematical PISA-like has been validated qualitatively in terms of content, construct, and language. As can be seen in table 1, some comments and suggestions from students and experts were considered to improve the PISA items. Students' results at this point offer a choice of solutions. Researchers made improvements to the questions and activities in the context of *Light Rail Transit* based on student responses, observations, and interviews, so they were deemed realistic. It is in line with Nusantara et al. (2021) and Zulkardi (2002), who assert that PISA-style questions can be helpful if they satisfy the requirements, including professional opinions on issue formulation and students' capacity to solve problems using a variety of methodologies.

Learning process stage using student activity sheet

According to the data from this study, using the PBL approach to create activities and questions substantially impacts how children develop their numeracy skills. The PBL paradigm consists of five stages: introducing problems to students, setting up students for learning, directing individual or group investigations, creating and presenting work, and analyzing and evaluating the problem-solving process. Regarding the earlier explanation of the student orientation stage issue, students can readily process and comprehend the information provided therein despite the activity's lengthy duration. Additionally, through organizing students, students can discover the issues that need to be solved through these activities. Then, students can present problems based on the exercises and questions presented, and they can give illustrations of potential responses and steps that should be taken to finish these exercises and questions. Additionally, as part of the final closing phase, students study and evaluate the outcomes of the activities and solutions provided.

Students can quickly complete the tasks and questions using the PBL model's steps. Students' capacity to answer mathematical issues can be honed, grown, and developed by applying PBL-style activities, Zulfah et al. (2018). Students are more engaged in discussing issues and actions using the *Light Rail Transit* context during the PBL learning process in class. According to Hendriana et al. (2018), implementing the PBL model encourages students to be more engaged in their studies, creative, and self-assured. They also communicate more and collaborate more to find solutions to problems.

According to the findings of student interviews, it is more engaging to complete activities and questions within the context of a *Light Rail Transit* than it is to do similar tasks and questions since it requires more effort to think critically about them. According to Zulfah et al. (2018), presenting problems in the real world makes students enthusiastic about learning.

Overall, the *Light Rail Transit* environment promotes mathematical learning and thought and may unintentionally include students in active learning. It supports the claim made by Kohar et al. (2019) and Zulkardi et al. (2020) that employing contexts motivates students to think mathematically by increasing the likelihood that they will do so in particular circumstances. Context makes learning relevant and enables students to engage in collaborative learning (Putri & Zulkardi, 2020).

Students' numeracy skills

Numeration is also the ability of students to understand and apply mathematics learning in everyday life (OECD, 2016). Numeration is a student's ability to formulate, use, and interpret mathematics in various contexts. Includes mathematical reasoning and mathematical concepts, procedures, facts, and tools to describe, explain and predict phenomena (OECD, 2019a). However, numeracy is a fundamental ability for students to solve everyday problems. We can see the analysis of the numeracy abilities of students when working on questions appear, three numeracy indicators (Kemdikbud, 2017a) are:

During the development process (see Figure 5) for the first numeric indicator, namely different symbols or numbers related to fundamental mathematics to solve problems in daily life (N1), as seen from students' answers, students can answer questions correctly because they can read helpful information and can understand how to make mathematical models. It happens because students skilled at reasoning may incorporate the stage of comprehending, formulating, and effectively addressing problems (Kohar et al., 2019). Additionally, early comprehension of real-world issues is crucial for interpreting and solving PISA questions (Nusantara et al., 2020a, 2020b).

When answering questions, an indicator appears, namely: examining data shown in a variety of formats, including graphs, charts, tables, and diagrams (N2). As seen in the answers to Figure 8, students know what information will be on the problem to be solved and can formulate questions that exist in the problem or represent the problem. Here it is seen that students understand the meaning of the large bonus in 1 month and the salary in 1 month accepted by Angelina and Winona. It is in line with several academics who have backed it up by saying that events or conditions can serve as both a springboard for learning and a problem-solving strategy (Jannah et al., 2019; Wijaya et al., 2014).

The next indicator to create a prediction and judgment, analyze the findings of the analysis (N3). For student answers, it can be seen in Figure 9 that students can solve problems according to the information presented. Students understand multiples of 30 to look for bonuses that can be obtained. Then students can formulate or make conclusions and give reasons about what is offered. It can be seen that students understand the meaning of the questions. and students can conclude that each must sell 600 tickets. To answer this question, students need a deep understanding. It is in line with research according to the research findings (Ahyan et al., 2014; Jannah et al., 2019; Nusantara et al., 2021). Students may accurately perceive, develop, and solve an issue by using sound reasoning and argumentation.

When students work on rare PISA problems, they understand that they can make algebraic forms (see Figure 6). Awareness and answering PISA challenges require a fundamental understanding of global issues (Nusantara et al., 2020b). However, for some students, answering questions was not as crucial as just supplying evidence. It is in line with Nusantara et al. (2021), which found that students spent more time comprehending the problem statement than identifying critical details in the problem. It may interfere with students' ability to calculate. Students made errors when turning questions into a calculation procedure, according to Efriani et al. (2019), since they needed to understand the questions correctly.

Students also read the questions carefully, as seen from the answers of students who wrote important notes on the questions (see Figure 9). It shows that students have understood the problem well so they can provide conclusions about the solution to the problem. According to Zulkardi et al. (2020), there are specific processes when students comprehend and address issues: solving difficulties, looking at the photos and reading the questions, and reading and contrasting all the information.

Conclusion

This study produced a PBL exercise with four problems and six evaluation questions, all of which have a valid and helpful *Light Rail Transit* context. These criteria include the quantity of *Light Rail Transit* content and context in the form of Palembang *Light Rail Transit* tickets, Palembang *Light Rail Transit* travel routes, physical distancing on Palembang *Light Rail Transit* trains, Palembang *Light Rail Transit* facilities, Palembang *Light Rail Transit* ticket booths, Palembang *Light Rail Transit* ticket sales, Palembang *Light Rail Transit* station visits, Palembang *Light Rail Transit* travel time, and purchase of *Light Rail Transit* Palembang tickets. Students can combine other subjects with problem-solving by learning by creating exercises and questions in the *Light Rail Transit* context. At *Light Rail Transit*, children share their thoughts and discussions about life skills using calculations and mathematical reasoning. It improves students' numeracy skills while teaching them how to use and utilize the *Light Rail*

Transit. However, this study has drawbacks. Namely, the questions used have a relatively high difficulty level, and students need a long time to get answers.

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Conflicts of Interest

The authors claim that there are no conflicts of interest related to publishing this work. Additionally, the authors thoroughly examined moral issues like plagiarism, misconduct, data fabrication or falsification, repeated submissions, and redundancy.

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Author Contributions

Yessi Permata Sari: design PISA-type questions and conduct formative evaluation activities to collect data and write articles draft; **Zulkardi:** validate pieces made by the first author and analyze; **Ratu Ilma Indra Putri:** validate reports produced by the author first and analyze.

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