Learning Direct and Inverse Proportion Using Pen and Money for Slow-Leaners

KARTIKA DYAH WARDANI [1] AND RULLY CHARITAS INDRA PRAHMANA [2]

Abstract

Students who have slow mathematical cognitive abilities or slow learners usually have difficulties understanding an abstract mathematical concept. One alternative learning that can improve the mathematical understanding of slow learners is the Indonesian Realistic Mathematics Education (IRME) approach. Therefore, this research aimed to determine the learning process and the role of IRME to improve the cognitive mathematics ability of slow learners about the concept of direct and inverse proportion. This research used a single subject research method with the study subjects of the 7th-grade slow learners at one private junior high school. The research data were collected in audio and video recordings, photographs, and student worksheets. Data were analyzed by using in and between conditions with the A-B research design. The results showed that the IRME approach improves the mathematical understanding of slow learners in direct and inverse proportion concepts. Lastly, this research can contribute as alternative solutions to answer the gap in effective learning for slow learner students.

Keywords
Direct and inverse proportion, IRME, pen and money context, single-subject research, slow learner students

1. Faculty of Teacher Training and Education, Universitas Ahmad Dahlan, Yogyakarta, Indonesia; kartikadyahwardani@gmail.com
2. Faculty of Teacher Training and Education, Universitas Ahmad Dahlan, Yogyakarta, Indonesia; rully.indra@mpmat.uad.ac.id

Introduction

One of the lessons, which is usually difficult for students to understand, is mathematics with abstract materials (Rofiah & Rofiana, 2017; Vasudevan, 2017). This occurred because students think in specific terms, have a limited attention span, and have a negative attitude toward school, especially in a formal or traditional learning system (Martin & Martin, 1965; Muppudathi, 2014; Vasudevan, 2017; Warnemuende, 2008). At schools in Indonesia, teachers usually teach with one learning style, conventionally, and do not understand that each student is unique and has different characteristics, so learning must be a characteristic of every student being taught (Dina, Mawarsari, & Suprapto, 2015; Hadi & Kasum, 2015). Thus, to improve the cognitive ability of slow learner students, especially in mathematics lessons, teachers need to understand these students and provide learning with the characteristics and uniqueness of those who are easier to understand concrete and more interested in unconventional learning.

Previous research on slow learners was conducted by Rofiah and Rofiana (2017), with the findings showed that quiet learner students need additional time and assignments in learning mathematics. Furthermore, Hasibuan et al.'s (2020) research regarding identifying the learning process for slow learners in one of Jakarta schools found that the learning process is currently equated with students. In general, it is adjusted to the characteristics of the students. On the other hand, Wanabuliandari and Puwaningrum (2018) found that using local wisdom-based modules could improve students' understanding of slow learners in understanding mathematics material. Of the three studies, no research has answered the learning difficulties of slow learner students in understanding abstract mathematics material. Therefore, we need a learning design that can answer this gap that previous researchers have not found, and this research tries to answer this gap.

Based on the characteristics that are easy to consider concrete things and interest with unconventionally learning, so to improve the mathematics ability cognitive of slow learner students' needs a learning approach that can connect abstract mathematics with realistic and concrete things that are around students (Brennan, 2018; Chauhan, 2011; Fany, 2018; Walker, 1951). One approach that can be used is Indonesian Realistic Mathematics Education (PMRI) or in English (IRME), which uses a concrete context derived from the culture and daily lives of students (Jannah & Prahmana, 2019; Karaca & Özkaya, 2017; Risdiyanti, Prahmana, & Shahrill, 2019). IRME was adapted from Realistics Mathematics Education (RME) developed by Freudhental in the Netherlands (Gravemeijer, 2008. Prahmana et al., 2012); IRME has been adapted to the life and culture of the Indonesia people (Zulkardi, 2002; Zulkardi et al., 2020). Therefore, this IRME approach is suitable for improving the cognitive mathematics abilities of slow learner students in Indonesia.

At one of the private 7th-grade Junior High School-based students, one student had difficulty understanding mathematics in class, and the average midterm scores were low. At school, the learning model used is conventional learning. It makes students feel less interested in participating in learning and understanding the material presented by teachers. Students tend to be passive when the teacher presents the material in front of the class. One mathematics concept that is difficult for children to understand is direct and inverse

proportion. Students' misconceptions in understanding direct and inverse proportion usually because they have difficulties which uses direct proportion and which uses inverse proportion. This is also often caused by teachers not giving concrete examples that are close to students' daily lives, so that makes students difficult to imagine the concept and difficult to understand. In line with these problems, IRME can be an approach that can be used to improve slow learner students' cognitive abilities in understanding direct and inverse proportions.

One context that can be used to understand students' slow to the concept of direct and inverse proportion is pen and money. This context was chosen because it is close and easy to find around students, pen and money are also concrete objects, so it's in accordance with the characteristics of slow learner students who tend to easily understand something concrete. The research of Wanabuliandari and Puwaningrum (2018) proves that the use of the local wisdom context of the Gusjigang Kudus can improve the mathematics abilities of slow learner students. Furthermore, the research of Musyani and Nurhastuti (2019) shows that a realistic approach can improve children who have learning difficulties, including slow learner students. Therefore, this study aims to design learning based on the IRME approach using the context of pen and money to find out. The research question of this study is how the role and learning process and the role of IRME in improving slow learner students' mathematical cognitive abilities regarding the concept of direct and inverse proportion. So far, previous studies have only identified the mathematics learning process of slow learner students, the use of local wisdom-based modules for slow learner students, and discussion of the IRME approach in general in overcoming mathematics learning difficulties. No one has specifically developed a learning design using everyday contexts to improve the cognitive understanding of slow learner students and make it easier for students to learn abstract material. So far, most teachers also teach mathematics conventionally, and like students in general, they are only given additional study hours and assignments. Thus, this study seeks to answer this gap. It is hoped that this research can contribute to new scientific references for mathematics education regarding effective learning designs for slow learner students and Indonesian knowledge treasures.

Literature Review

Slow learner students

Slow learner students have low or below normal cognitive abilities but do not include mental retardation (Khabibah, 2017; Larrivee & Horne, 1991). These students are not considered children with special needs. It is just that they have problems with interest in the education system in schools and tend to easily understand things that are concrete and close to students' daily lives (Borah, 2013; Muppudathi, 2014; Ramlakshmi, 2013). Slow learner students have characteristics, such as *first,* slow learner are recurrently immature in their relations with others and do poorly in school; *second,* they cannot do multifaceted or complex problems and work very slowly; *third,* they lose track of time and cannot convey what they have learned from one task to another well; *fourth*, they do not easily master skills that are academic in nature, such as the time tables or spelling rules; *fifth*, perhaps the most

exasperating trait is their inability to have long-term goals, they live in the present, and so have considerable problems with time management perhaps due to a short attention span and poor concentration skills (Borah, 2013).

Indonesian realistic mathematics education (IRME)

Indonesian Realistic Mathematics Education (IRME) is a mathematics approach in Indonesia that adopts Realistics Mathematics Education (RME) initiated by Hans Freudenthal, a mathematics expert from the Netherlands (Hadi, 2017). IRME is a meaningful learning process carried out in a context and can be imagined by students (Wijaya, 2012). Realistic mathematics education in Indonesia does not always have to use real-world problems. The most important thing is that abstract mathematics can be made real in students' minds (Hadi, 2002). In line with this, students are allowed to develop knowledge of abstract mathematical concepts into things that can be imagined (Zulkardi, 2002). Thus, IRME is a meaningful learning approach that can improve conceptual understanding by using a context and real things that students can imagine.

IRME has five characteristics. *First,* use of contexts for phenomenologist exploration. Context or realistic problems are used to learn mathematics: context and teaching materials related to the school environment and students. Context does not have to be a real-world problem but can be in games, props, or other situations as long as it is meaningful and can be imagined in students' minds. Using context, students are actively involved in exploring problems; second, use of models for mathematical concept construction (Use of models for progressive mathematics). A model is a vertical tool in mathematics that cannot be separated from the mathematical process. In general, there are two models in Realistic Mathematics Education, namely the mode of and mode for; *Third*, use of student creations and contributions. Students should think actively and have the freedom to develop problem-solving strategies to understand mathematical concepts and students' creativity in learning mathematics; *Fourth,* student activity and interactivity on the learning process. The student learning process will be more fun if students communicate their ideas to each other. The use of interactions in mathematics learning is beneficial in developing students' cognitive and affective abilities simultaneously. The teacher is active in designing teaching materials and classroom activities; *Fifth, i*ntertwining mathematics concepts, aspects, and units. Mathematics learning cannot be separated from the linkages of other learning materials, so that the concept of mathematics must be considered in the learning process (Gravameijer, 1999; Sembiring, 2010; Zulkardi, 2002).

Methodology

Research design, site, and participants

This study uses the Single Subject Research (SSR) method, which is an experimental research method to see and evaluate a certain intervention on the behavior of a single subject with research that is carried out repeatedly in a certain time (Harrera & Kratochwill, 2005; Kazdin & Tuma, 1982; Neuman & McCormick, 1995; Prahmana, 2021; Sunanto et al., 2005). This SSR method aims to clearly explain the effect of an intervention that is given repeatedly

in a certain time (Neuman & McCormick, 1995). This method has the characteristic of using a single subject; this allows researchers to see the effect of an intervention or treatment given to a single subject which is difficult to see in group subjects (Prahmana, 2021). This SSR method was chosen because it is effective for single-subject research and is in line with the research objectives, namely to see the effect of an intervention in learning using a pen and money context regarding the direct and inverse proportion material with the PMRI approach.

This research uses the A-B design, the first condition was called baseline (A), and the second condition was called intervention (B). In the baseline (A) condition, the subjects were assessed at several sessions until they appeared stable without intervention after baseline (A) condition then stabilized with intervention (B) condition applied within a certain period of the time until the data was stable (Fraenkel, Wallen, & Hyun, 2009; James, 2016). This design research has no repeated measurement where the baseline phase (A) and the intervention phase (B) occurs. Each is done only once for the same subject. This design cannot be concluded that changes in target behavior are caused solely by independent variables (intervention). This research was conducted during seven sessions with a single subject of class 7th-grade slow learner students. In the baseline phase, there are have three sessions (1 session per day for 45 minutes) to see the initial ability of the subject before being treated on direct and inverse proportion learning material. Then, the intervention phase was conducted for four sessions (1 session per day for 90 minutes). This phase is given treatment by applying the IRME approach to direct and inverse learning material then proceeded to test the subject's ability test after being given treatment.

The behavior measured in this study is only a level of mathematical understanding or only one behavior. This study uses the pen and money context by implementing an IRME approach to determine the role of context in introducing the concept of direct and inverse proportion for a slow learner student. The researcher designed the learning process that was conducted during seven sessions, with the baseline phase is three sessions, and after that intervention phase is four sessions, starting from using the context of pens and money to the implementation of the concept of direct and inverse proportion to solve some daily problems. Furthermore, researchers used the SSR method to describe the development of slow learner students in direct and inverse proportion learning.

The subject of this research is one of the 7th-grade slow learner students at Muhammadiyah 2 Depok Junior High School, Yogyakarta, Indonesia. Students have a difficult understanding of the direct and inverse proportion concept. Based on the results of observation in this class of students tend to be passive and difficult to accept the explanation given by the teacher, midterm scores are relatively low, and the IQ test results depend on a score of 90 or at the low categories.

Data collection and analysis

This research was conducted in seven meetings in the even semester of the academic year 2019/2020 at Muhammadiyah 2 Depok Junior High School, Indonesia. The first three meetings are the baseline phase in which the researcher gives several problems related to the concept of direct and inverse proportion that students must resolve. In each meeting, the

researcher explains how the question must be solved without helping how to solve it. The results of this phase are used as a basis for researchers in designing learning activities that are implemented in the next four phases, which is the intervention phase. In the intervention phase, researchers implement learning activities that have been designed using the IRME approach and using the context of pen and money. At the end of the learning process at each meeting, the researcher provides an evaluation problem that must be solved by students. The results of this evaluation are used as a basis for the process of developing students' understanding of the concept of direct and inverse proportion. In this study, the dependent variable is an understanding of direct and inverse proportion and student learning outcomes, while the independent variable is the IRME approach using the context of pen and money.

Research data were collected with audio, photo and video documentation, and written documentation each phase that its baseline phase and intervention phase to see how the effect of an intervention that implemented to slow learner student (Fraenkel, Wallen, & Hyun, 2009; Neuman & McCormick, 1995). The instrument used was based on data collection techniques, namely videos and photos of the learning process of a slow learner student to analyze how the effective intervention, and also student exam sheets to validate the slow learner student's understanding of direct and inverse proportion. The video is used to describe the learning activities at the intervention stage and when students work on the questions given by the researcher. Photos are used to document the ongoing learning process, and the results of students' written tests are the basic material for conducting analysis and also as evidence in conducting research. Students' written test sheets contain answers to completing questions given by researchers, with each item validated by the lecturer as a validator. The validation process begins by creating a question form that contains indicators of direct and inverse proportion understanding to slow learner student by researchers. Each question is created and developed based on the textbooks used at school and indicators designed by researchers. Furthermore, the questions that have been made are validated by the lecturer qualitatively related to the content and contents of the questions. This instrument is used to see the effects that have occurred after the study was conducted.

The data in this research were analyzed using analysis in conditions and between condition (Creswell, 2007; Tankersley, Harjusola-Webb, & Landrum, 2008) with 6 phase of analysis that is first, the length of condition, which stated the number of sessions or meetings conducted during the study in the baseline or intervention phase; second, the tendency of direction to see the description of the behavior of the subjects; third, the stability tendency is used to see the stability of each phase, in this research the stability tendency is used by 10% if the data is clustered at the top and 15% if the data is clustered at middle or bottom; fourth, trace data or trace tendencies, in each measurement condition used to see whether the data can be said to decrease (-), up (+) or flat (=); fifth, the level of stability and range see the range of data groups in baseline conditions and intervention conditions; sixth, the level change that indicates the number of data changes in a condition.

Analysis between conditions is the same as analysis in conditions; both discuss the same thing (Horner et al., 2005; Freankel, Wallen, & Hyun, 2009). Analysis between conditions has five principles, first, the number of variables changes that are the number of variables approved in the research; second, the direct tendency and the influence can take

data on in condition analysis, changes in both conditions can have a good effect marked by a positive sign and can have a bad effect marked by a negative sign; third, the change in the stability tendency from baseline to intervention is to see changes in post-intervention conditions based on in condition analysis; forth, level changes are used to see the changes that occur based on the point difference, the data is the data of the last session baseline conditions and the first session data on the intervention conditions then the difference between the two is calculated, a positive sign (+) indicates improvement and a negative sign (-) indicates worsening; and fifth, the percentage of overlap done by look again at the upper and lower limits of the baseline phase and calculate the number of data points in the intervention phase, which is in the range of baseline phase, if the percentage of overlap is getting smaller than the effect of the intervention on target behavior is also getting smaller (Freankel, Wallen, & Hyun, 2009; Sunanto et al., 2005).

Findings

Researchers conducted a test at the baseline phase (conditions before intervention). The baseline phase (conditions after intervention) on slow learner students determines how the intervention's effects are given to slow learner students. This is to see whether there is an increase in direct and inverse proportion after learning using the pen and money context and using the IRME approach. The results showed that the pretest score was greater than the posttest score, meaning that the students better understood the concept of direct and inverse proportion after being given intervention in the form of learning using the pen and money context and using the IRME approach from before the intervention was given or it meant that there was an increase in students' cognitive understanding of the concept of direct and the inverse proportion after being given learning using the pen and money context and the IRME approach. The results of the comparison of the tests in the baseline phase and the intervention phase can be seen in Table 1.

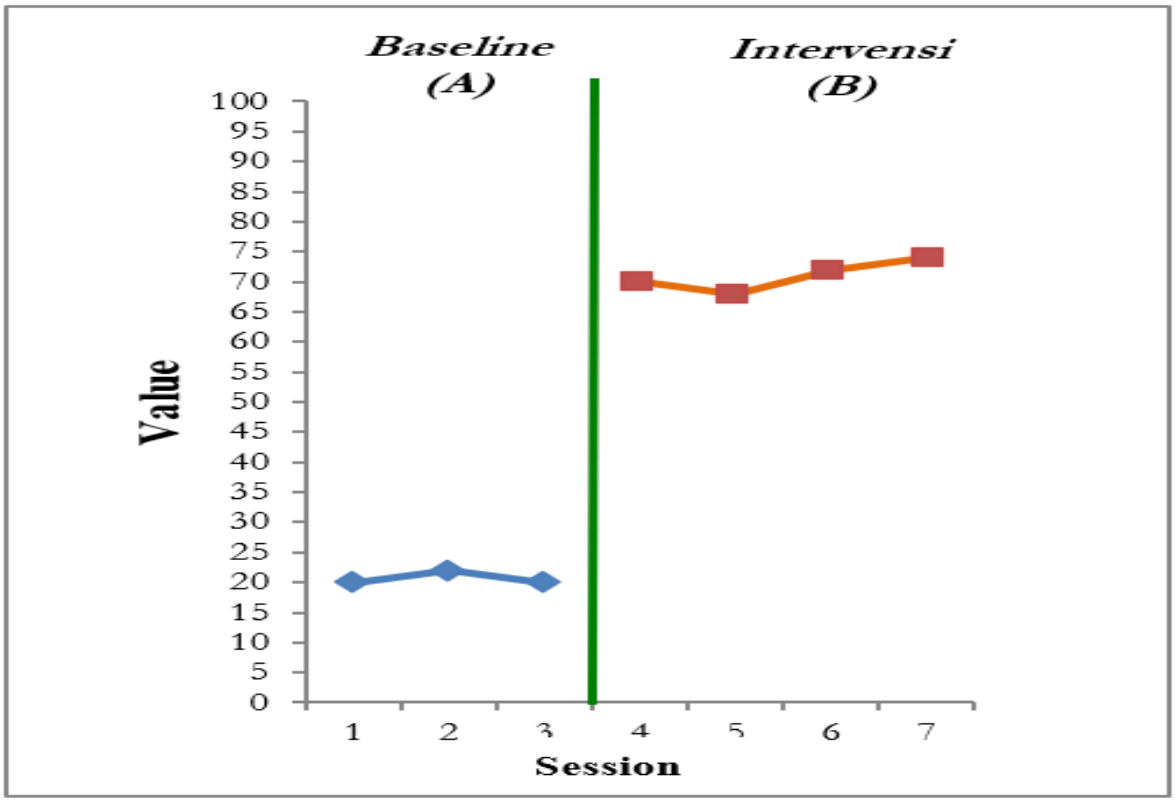
Table 1. *Subject evaluation results*

Phase	Date	Score
Baseline	13 January 2020	20
	17 January 2020	22
	20 January 2020	20
Intervention	27 January 2020	70
	31 January 2020	68
	3 February 2020	72
	7 February 2020	74

Table 1 shows the score obtained by the subject in completing a matter of evaluating the comparative material worth and reversing value. It appears that in the initial conditions

before the treatment or baseline phase, the scores obtained are very low. The scores obtained in the first session until the third session are 20, 22, and 20, while in the intervention phase or after being treated, the subject's score has increased. Scores obtained by subjects in the fourth session to the seventh session are 70, 68, 72, and 74. The results obtained by the subjects can be seen in the graph in Figure 1.

Figure 1. *The data analysis of visual baseline and intervention*

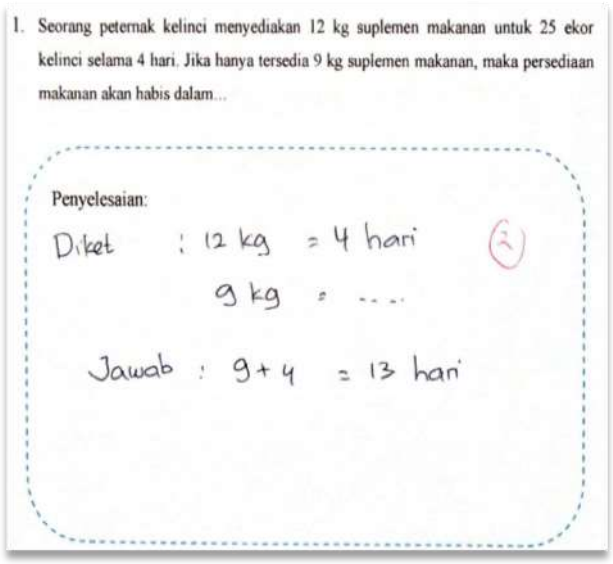


Baseline phase

Giving the baseline phase was done for three days. In the baseline phase, the researcher evaluated direct and inverse proportion learning material without any treatment. In the first session, the researcher instructed the subject to complete the evaluation questions, but the subject seemed doubtful about the problems. Then the researcher directed the evaluation questions, and the subject starts working. The value obtained by the subject is very low because the subject does not understand the material of test as shown in Figure 2.

Figure 2. *Results of results work in the baseline phase 1*

Indonesian version


1. Seorang peternak kelinci menyediakan 12 kg suplemen makanan untuk 25 ekor kelinci selama 4 hari. Jika hanya tersedia 9 kg suplemen makanan, maka persediaan makanan akan habis dalam...

Penyelesaian:

Diket : 12 kg = 4 hari (2)

9 kg = ...

Jawab : 9 + 4 = 13 hari

English version

1. A rabbit breeder provides 12 kg of supplement foods for 25 rabbits for 4 days. If only 9 kg of supplement foods are available, then the supplement food will run out in …

Answer:

12 kg = 4 days

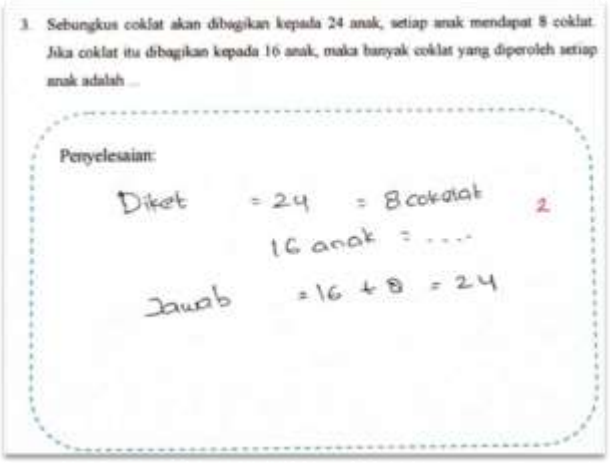
9 kg = …..

9 + 4 = 13 days

Then in session 2, the researcher instructed the subject to work on an evaluation problem test. But the subject did not understand the concept of inverse proportion. The subject was only able to rewrite what was known and asked in the evaluation problem, shown in Figure 3.

Figure 3. *Results of results work in the baseline phase 2*

Indonesian version


3. Sebungkus coklat akan dibagikan kepada 24 anak, setiap anak mendapat 8 coklat. Jika coklat itu dibagikan kepada 16 anak, maka banyak coklat yang diperoleh setiap anak adalah ...

Penyelesaian:

Diket = 24 = 8 coklat 2

16 anak = ...

Jawab = 16 + 8 = 24

English version

3. A pack of chocolates will be divided among 24 children; each child gets 8 chocolates. If the chocolate is distributed among 16 children, then the amount of chocolate that each child gets is …

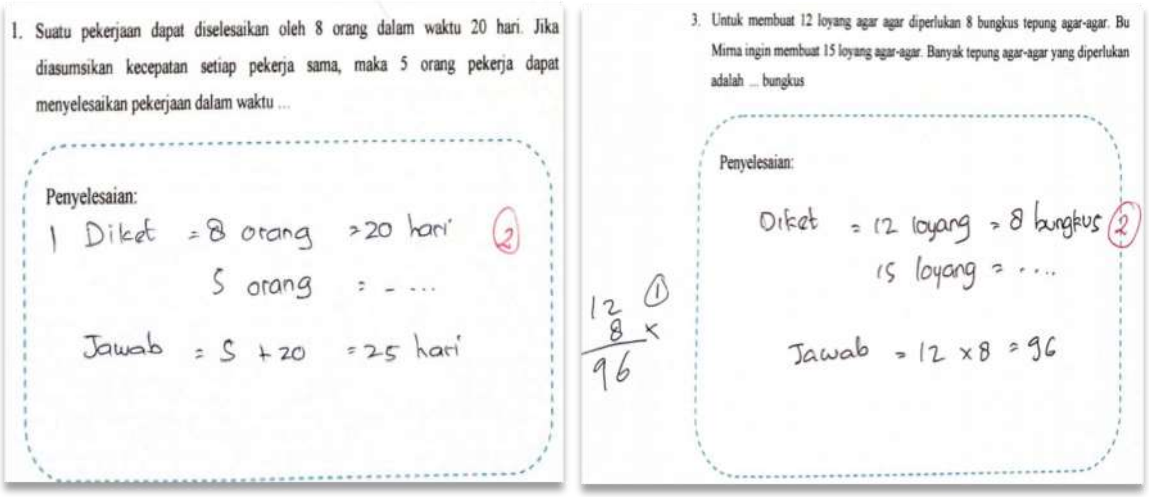
Answer:
24 = 8 chocolates
16 children = ….

16 + 8 = 24

In session three, the researcher re-instructed the students to work on the evaluation questions direct and inverse proportion concept. In the combined evaluation problem between direct and inverse proportion, students cannot distinguish the direct proportion and the inverse proportion—shown in Figure 4.

Figure 4. *Results of results work in the baseline phase 3*

Indonesian version



English version

1. A work can be completed by 8 people in 20 days. If, it is assumed that the speed of each worker is the same, then 5 workers can complete the work in ...

Answer:

8 people = 20 days

5 people = ….

5 + 20 = 25 days

3. To make 12 pans of jelly, we need 8 packets of jelly flour. Mrs. Mirna wants to make 15 pans of jelly. A lot of jelly flour that is needed is … sachets.

Answer:

12 pans of jelly = 8 sachets

15 pans of jelly = ….

12 x 8 = 96

Intervention phase

Giving the intervention phase was done for four days. The intervention given was in the form of IRME approach in learning with direct and inverse proportion. The context used for the direct proportion learning is to buy a pen, and the context used for the inverse proportion learning is to distribute pens, as shown in Figure 5. Correspondingly, the use of

context influences the student responses when the context used has been experienced by students themselves that can give correct answers based on what is happening in their daily lives (Utari et al., 2015).

Figure 5. *Use of the IRME approach using the context of money and pen*

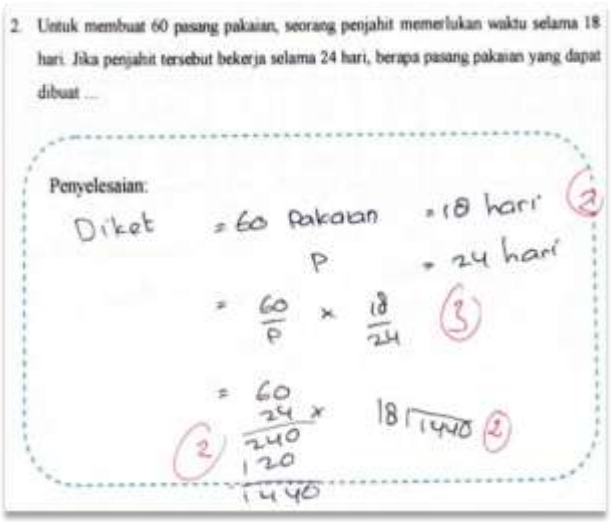
Using a pen and money as a mathematical model aims to help students move from concrete to abstract mathematical comprehension. Then the researcher asks the student's responsibility to give another example of the direct proportion understanding. After understanding the concept of the direct proportion, the researcher gives a little explanation to work on the direct proportion problem, as shown in Figure 6.

Figure 6. *Discussion about direct proportion*

Next, the researcher instructs the students to work on the direct proportion evaluation test sheets prepared. In the first session, students can understand the concept of direct proportion well, but students still have difficulty with the concept of division. It can be seen in Figure 7.

Figure 7. *Student work results in the intervention phase 1*

Indonesian version



English version

3. To make 60 pairs of clothes, a tailor takes 18 days. If the tailor works for 24 days, how many pairs of clothes can he makes …

Answer:
= 60 clothes = 18 days
= P = 24 days
= (60/p) x (18/24)
= 60 x 24 = 1.440

1.440 : 18

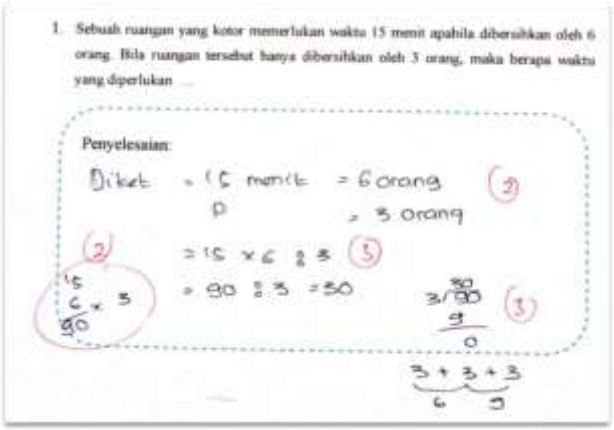
In the second session, researchers used the concept of dividing a pen to stimulate students to understand the concept of direct proportion. The researcher instructed students to distribute 6 pens to two people with the same amount as Figure 8.

Figure 8. *Student work results in the intervention phase 1*

Then the researcher gives an evaluation test sheet to test how students understand the inverse proportion concept. With the results obtained, students can understand the concept of the inverse proportion, shown in Figure 9.

Figure 9. *Student work results in the intervention phase 2*

Indonesian version



English version

1. A dirty room takes 15 minutes if cleaned by 6 people. If the room is only cleaned by 3 people, how much time will it takes …

Answer:

= 15 minutes = 6 people

P = 3 people

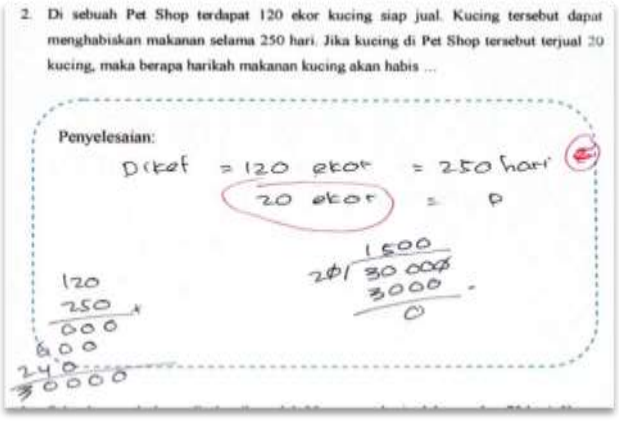
= 15 x 6 : 3

= 90 : 3 = 30

Furthermore, giving the last intervention phase, the fourth phase, the researcher instructs students to work on direct and inverse proportion evaluation again. The researcher asks students to give more attention for the order of the questions so that there is no error when answering questions so that the results obtained by students are good enough as shown in Figure 10.

Figure 10. *Student work results in the intervention phase 3*

Indonesian version



English version

2. In the pet shop, there are 120 cats that are ready to sell. These cats can eat all food for 250 days. If the cat in the pet shop sells 20 cats, then how many days will the cat food run out ...

Answer:

= 120 cats = 250 days

20 cats = p

120 x 250 = 30.000

30.000 : 20 = 1.500

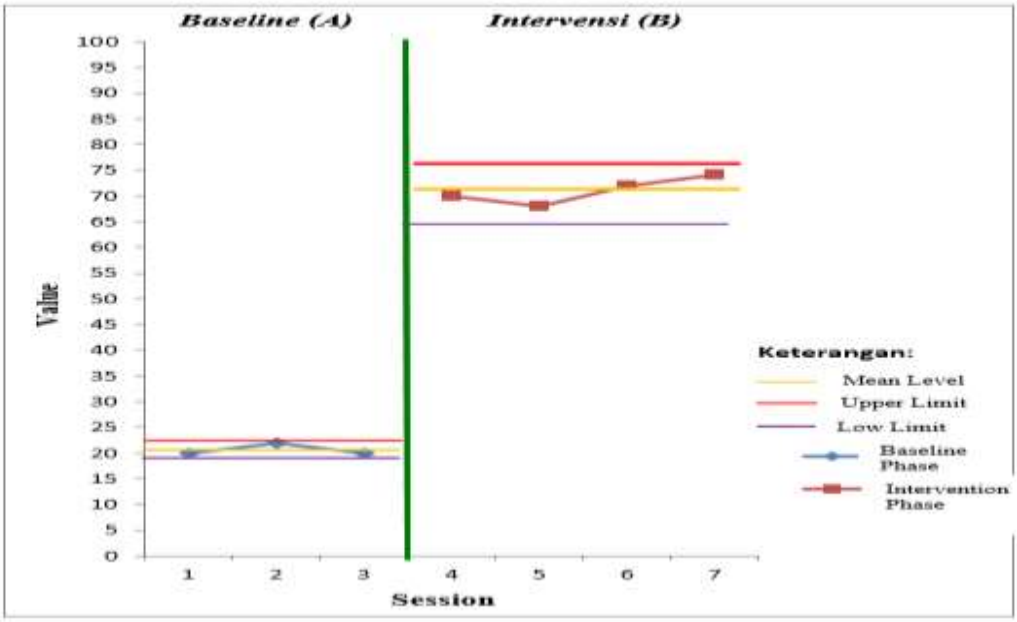
The results obtained in the intervention phase showed an understanding of the concept of direct and inverse proportion after being treated in the form of the IRME Approach. Previous research could improve understanding of mathematical concepts direct proportion using a realistic mathematical approach (Hamidah, Putri, & Somakim, 2017). Furthermore, the data obtained were analyzed within and between conditions, as follows:

In condition analysis

Length of conditions, figure 1 shows a graph of student learning outcomes using A-B design. Code A states the baseline phase, and code B states the intervention phase. The length of the session for the baseline phase is three sessions, and the length of the intervention phase is four sessions.

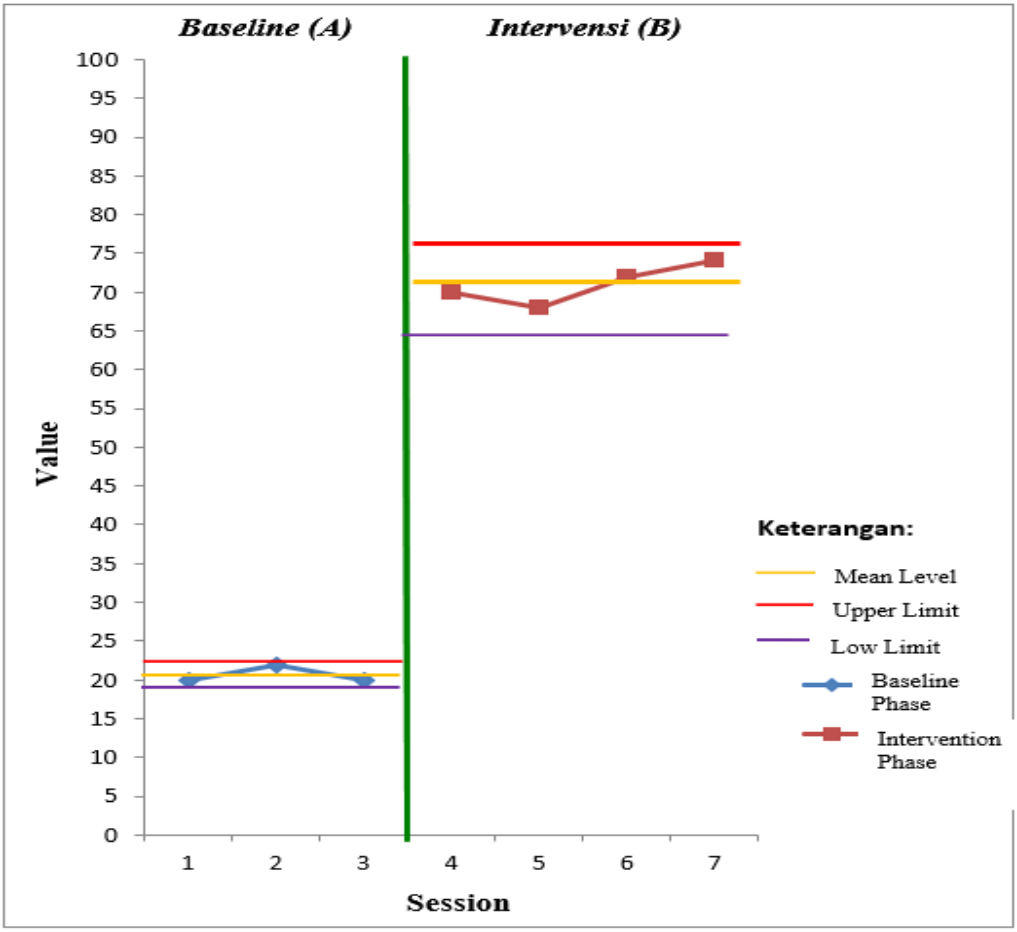
Direction tendency, figure 11 shows the tendency of direction obtained by the intersection of vertical lines dividing equal parts in each phase with the graph (split middle). The direction tendency is based on the median data point of the ordinate value with each session meeting as the ordinate or dividing into two parts of all sessions in each condition with a vertical line (first line) (Sunanto et al., 2005). This section is also divided into two parts by one vertical line (second and third lines). The second and third vertical lines intersect the line graph from the intersection drawn lines connecting them both to obtain the direction of the line.

Figure 11. *Estimated direction tendency toward subject*



Stability tendency, the stability criteria use a 15-stability tendency in the baseline phase of the intervention phase because the data are clustered at the bottom. Figure 12 shows that the baseline phase data points are three data points in the upper limit (red) and low limit (purple). The calculation result in the baseline phase is 100%. The data is declared stable. There are four data points in the intervention phase in the upper limit (red) and lower (purple). The result of the calculation in the intervention phase is 100%, then the data are declared stable.

Figure 12. *Estimated stability tendency toward subject*



Trace tendency, both phases show a horizontal tendency due to changes that improve but are less visible. *Level stability,* the calculation of the level of stability and can be seen in the calculation of the stability tendency. The baseline data phase is stable with a range of 20-22, and the intervention phase of the data is stable with a range of 69-74. *Level change*, a difference of 0 is obtained at the baseline phase, which means no change occurred, and an

intervention phase of difference 4 is obtained, indicating that the change has improved. All components that have been calculated are summarized in Table 2.

Table 2. *Visual analysis results in conditions*

No	Condition	A	B
1.	Length of Conditions	3	4
2.	Direction Tendency		
3.	Stability Tendency	Stabil (100%)	Stabil (100%)
4.	Trace Tendency		
		Stabil	Stabil
5.	Stability Level		
		20-22	68-74
		20-22	74-70
6.	Change Level		
		(0)	(+4)

Between condition analysis

In this study, an inter-condition analysis was done by comparing the intervention phase (B) and the baseline phase (A), which is 2:1, which means that the code for the baseline phase is code 1 and the intervention phase is code 2 (Sunanto et al., 2005).

Number of variables, the variable that is changed is the slow student's understanding of the direct and inverse proportion. In table 3, the number 1 is written, which means that only one variable has been changed. *Change in direction tendency*, changes in the direction of the tendency in the analysis between conditions can be determined by taking data from the analysis of conditions. Writing changes in the direction of the same direction as the analysis in conditions, both of which have a good effect (+). *Change in stability tendency*, changes in stability trends in the analysis between conditions can be determined by looking at the data on the stability of the analysis stability under conditions. In this study, the changes that occur from the baseline phase to the intervention phase are stable to stable. *Level change*, the final session point data for the baseline phase is 20, and the first session point data for the intervention phase is 70. Then the two data are calculated differently to get 50 for a comparison of condition B: A. the (+) sign means an increase from the previous data. *Percentage of overlap,* determination of overlap data in the baseline phase comparison and intervention is by (1) looking back at the upper and lower limits of the baseline and intervention phases, 22.32 and 19.02, (2) calculate many data points in the intervention phase (B) in the baseline phase (A) range, which is 0., (3) the overlap percentage is 0%; the smaller the percentage of overlap means the better the effect of the intervention on target behavior. All components of data analysis between conditions can be summarized as in Table 3.

Table 3. *Summary of visual analysis results between conditions*

No	Comparison of Condition	B: A (2:1)
1.	The number of variables changed.	1
2.	Change in direction tendency and the influence	 (=) (=)
3.	Change in stability tendency	Stable to stable
4.	Level change	(20-70) (+) 50
5.	Percentage of overlap	0%

From the two data analysts, namely deep analysis and analysis between conditions, it can be concluded that the research data obtained is valid and stable data, there is no overlapping or overlapping data, and no data is influenced by other factors or variables outside the research variables. Thus, these data can be used as a basis for concluding the effects of the intervention given in the form of implementing direct and inverse proportion learning with the IRME approach. When viewed from the posttest value, which is greater than the pretest score, and from the review of photos, videos during the learning process and from the results of student evaluations, it can be concluded that the effect of the intervention has a positive effect or there is an increase in cognitive understanding of slow learner students in understanding the material—direct and inverse proportion.

Discussion

The result has a beneficial effect or improved insight of understanding the principle of direct and inverse proportion after students were given involvement in learning using a pen and money sense with the IRME approach. Thus, the IRME approach can improve student learning in understanding the direct and inverse proportion. Following previous researchers, the use of Indonesian Realistic Mathematics Education (IRME) has helped students understand the concept of direct and inverse proportion (Izzabella, 2017; Muttaqin & Putri, 2017; Nofriati, Hartono, & Somakin, 2020).

In a realistic mathematics education approach, the appropriateness of selecting a context is when the context can serve as a starting point for the reinvention of mathematical concepts by students and when the context can bridge students' informal knowledge with students' formal knowledge (Gravemeijer & Doorman, 1999; Dorman, 2001; Gravemeijer, 1999). Contexts should be chosen that students easily recognize, using simple and clear language to provide maximum support for developing mathematical concepts (Hadi, 2002; Van den Heuvel-Panhuizen, 1998). In this study, the context of pen and money familiar to students and close to everyday life can act as a starting point for students to rediscover the

concept of direct and inverse proportion and bridge students' informal knowledge with students' informal formal knowledge. It can be seen from student worksheets and student evaluation results when students can complete the direct and inverse proportion questions, which are already formal. Pen and money are only one of the many contexts that can be used to understand slow learner students about the concept of direct and inverse proportion. Each slow learner student has general characteristics and has different special characters (Borah, 2013; Williamson & Field, 2014). So, the teacher or the next researcher needs to carry out a wider exploration of other effective contexts to be used in understanding slow learner students regarding the concept of direct and inverse proportion.

In the answers to the results of the student evaluations, it can also be seen that students can abstract the direct and inverse proportion concept and solve problems in everyday life. This study proved that learning with the IRME approach positively affected the mathematical literacy skills of representation and problem-solving in everyday life around students. To encourage these abilities, Yuanita, Zulnaidi, and Zakaria (2018) state that in addition to adjusting the learning method with the IRME approach, teachers also need to provide meaningful experiences solving problems they face in everyday life dealing with contextual problems. This will certainly be very easy for students because understanding the concept has been bridged by a real context and exists in students' daily lives. From several positive effects, it can be seen that after the intervention is given to slow learner students, it can be concluded that IRME in the context of pen and money is effectively implemented for slow learner students to improve their cognitive abilities regarding direct and inverse proportion material. This research has a position and contribution to provide solutions or references that can answer gaps in previous research. It is hoped that the results of this study can contribute to references about new science regarding effective learning for students who are slow to learn mathematics and can also contribute to the world of science and education in Indonesia.

Conclusions

The intervention in providing learning about direct and inverse proportion with the context of pen and money and the IRME approach positively affects slow learner students or an increase in students' cognitive understanding. The ability to slow learner students' mathematical understanding before being treated is shown on an average score of 20.67 based on a scale of 100. Furthermore, it is treated in the form of an Indonesian Realistic Mathematics Education approach with the context of money and pens that show an average score of 71. Therefore, these research results can contribute as alternative solutions to answer the gap in effective learning for slow learner students.

Disclosure Statement

This research is an original work and does not contain questions that defame or violate the rights or violate the rights or privacy of others, or contain material or instructions that could cause harm or injury. The authors state there are no conflicts of interest regarding this research, authorship and publication of this article.

Acknowledgments

We would like to thank Universitas Ahmad Dahlan for providing facilities and opportunities to develop this research to completion, especially to Dr. Andriyani, M.Si., and Fariz Setyawan, M.Pd., as the validator for our research instruments and also Uswatun Khasanah, S.Si., M.Sc., as the head of mathematics education department who support this research to completion. Then, we thank SMP Muhammadiyah 2 Depok and their teacher for allowing us to carry out the research.

References

Borah, R. R. (2013). Slow learners: Role of teachers and guardians in honing their hidden skills. *International Journal of Educational Planning & Administration, 3*(2), 139-143.

Brennan, W. K. (2018). *Curricular needs of slow learners* (Vol. 4). London: Routledge.

Chauhan, S. (2011). Slow learners: Their psychology and educational programmers. *International Journal of Multidisciplinary Research, 1*(8), 279-289.

Creswell, J, W. (2007). *Qualitative inquiry and research design: Choosing among five traditions.* Thousand Oaks, CA: Sage Publications.

Dina, A., Mawarsari, V. D., & Suprapto, R. (2015). Implementasi kurikulum 2013 pada perangkat pembelajaran model discovery learning pendekatan scientific terhadap kemampuan komunikasi matematis materi geometri smk. *Jurnal Karya Pendidikan Matematika, 2*(1), 22-31.

Dorman, J. P. (2001). Associations between classroom environment and academic efficacy. *Learning Environments Research, 4*(3), 243-257.

Fany, R. (2018). Meningkatkan kemampuan matematika (operasi hitung penjumlahan dan pengurangan) melalui media snake game untuk anak *slow learner*. *Doctoral Dissertation*. Malang: University of Muhammadiyah Malang.

Fraenkel, J. R., Wallen, N. E., & Hyun, H. H. (2009). *How to design and evaluate research in social science*. New York: McGraw Hill.

Gravemeijer, K. (1999). How emergent models may foster the constitution of formal mathematics. *Mathematical Thinking and Learning, 1*(2), 155-177.

Gravemeijer, K. (2008). RME theory and mathematics teacher education. In *International Handbook of Mathematics Teacher Education*: Volume 2 (pp. 283-302). Brill Sense.

Gravemeijer, K., & Doorman, M. (1999). Context problems in realistic mathematics education: A calculus course as an example. *Educational Studies in Mathematics, 39*(1), 111-129.

Hadi, S. (2002). *Effective teacher professional development for the implementation of realistic mathematics education in Indonesia*. Enschede: University of Twente.

Hadi, S. (2017). *Pendidikan Matematika Realistik*. Depok: RajaGrafindo Persada.

Hadi, S., & Kasum, M. U. (2015). Pemahaman konsep matematika siswa SMP melalui penerapan model pembelajaran kooperatif tipe memeriksa berpasangan (Pair Checks). *Edu-Mat: Jurnal Pendidikan Matematika, 3*(1), 59-66.

Hamidah, D., Putri, R. I. I., & Somakim. (2018). Eksplorasi pemahaman siswa pada materi perbandingan senilai menggunakan konteks cerita di SMP. *Jurnal Riset Pendidikan dan Inovasi Pembelajaran Matematika (JRPIPM), 1*(1), 1-10.

Hasibuan, H. Y., Syamsuri, S., Santosa, C. A. H. F., & Pamungkas, A. S. (2020). Profil pembelajaran matematika pada anak berkebutuhan khusus ragam slow learner di kelas inklusif smp garuda cendekia Jakarta. *Journal of Medives: Journal of Mathematics Education IKIP Veteran Semarang, 4*(1), 37-51.

Herrera, G. C., & Kratochwill, T. R. (2005). Single-case experimental design. In S. W. Lee (Ed.), *Encyclopedia of School Psychology* (pp. 501–504). Thousand Oaks, CA: Sage Publications.

Horner, R. H., Carr, E. G., Halle, J., McGee, G., Odom, S., & Wolery, M. (2005). The use of single-subject research to identify evidence-based practice in special education. *Exceptional children, 71*(2), 165-179.

Izzabella, S. E. (2017). Penerapan pendekatan pmri pada materi perbandingan di kelas viii SMP. *MATHEdunesa, 6*(3), 88-97.

James, K. P. (2016). Single-subject research method: The needed simplification. *British Journal of Education, 4*(6), 68-95.

Jannah, A. F., & Prahmana, R. C. I. (2019). Learning fraction using the context of pipettes for seventh-grade deaf-mute students. *Journal for the Education of Gifted Young Scientists, 7*(2), 299-321.

Karaca, S. Y., & Özkaya, A. (2017). The effects of realistic mathematics education on students' math self-report in the fifth-grade mathematics course. *International Journal of Curriculum and Instruction, 9*(1), 81–103.

Kazdin, A. E., & Tuma, A. H. (1982). *Single case research design*. San Fransisco: Jossey-Bass.

Khabibah, N. (2017). Penanganan instruksional bagi anak lambat belajar (Slow Learner). *Didaktika: Jurnal Pemikiran Pendidikan, 19*(2), 26-32.

Larrivee, B., & Horne, M. D. (1991). Social status: A comparison of mainstreamed students with peers of different ability levels. *The Journal of Special Education, 25*(1), 90-101.

Martin, R., & Martin, W. (1965). *Methods and psychology of teaching the slow learner*. Wyoming: Cheyenne Public School.

Muppudathi, G. (2014). Role of teachers on helping slow learners to bring out their hidden skills. *International Journal of Scientific Research, 3*(3), 98-99.

Musyani, Y., & Nurhastuti, N. (2019). Efektivitas pendekatan realistic mathematics education untuk meningkatkan hasil belajar matematika bagi anak berkesulitan belajar. *Jurnal Penelitian Pendidikan Khusus, 7*(1), 8-12.

Muttaqin, H., & Putri, R. I. I. (2017). Design research on ratio and proportion learning by using ratio table and graph with oku timur context at the 7th grade. *Journal on Mathematics Education, 8*(2), 211-222.

Neuman, S. B., & McCormick, S. (1995). *Single-subject experimental research: Applications for literacy*. Newark: Order Department, International Reading Association.

Nofriati, N. F., Hartono, Y., & Somakim. (2020). Learning Direct and Inverse Proportion Using Musi Tour. *International Journal on Emerging Mathematics Education, 3*(2), 139-151.

Prahmana, R. C. I. (2021). *Single subject research (Teori dan Implementasinya: Suatu Pengantar)*. Yogyakarta: UAD Press.

Prahmana, R. C. I., Zulkardi, & Hartono, Y. (2012). Learning multiplication using Indonesian traditional game in third grade. *Journal on Mathematics Education, 3*(2), 115-132.

Ramlakshmi, B. (2013). Slow learners: Role of teachers in developing the language skills. *Shanlax International Journal of English, 2*(1), 21-28.

Risdiyanti, I., Prahmana, R. C. I., & Shahrill, M. (2019). The learning trajectory of social arithmetic using an Indonesian traditional game. *Elementary Education Online, 18*(4), 2094-2108.

Rofiah, N. H., & Rofiana, I. (2017). Penerapan metode pembelajaran peserta didik slow learner. *NATURALISTIC: Jurnal Kajian Penelitian Pendidikan dan Pembelajaran, 2*(1), 94-107.

Sembiring, R. K. (2010). Pendidikan matematika realistik Indonesia (PMRI): Perkembangan dan tantangannya. *Journal on Mathematics Education, 1*(1), 11-16.

Sunanto, J., Takeuchi, K., & Nakata, H (2005). *Pengantar penelitian dengan subject tunggal*. Tsukuba: Center for Research on Internasional Cooperation in Education Devolpment (CRIED).

Tankersley, M., Harjusola-Webb, S., & Landrum, T. J. (2008). Using single-subject research to establish the evidence base of special education. *Intervention in School and Clinic, 44*(2), 83-90.

Utari, R. S., Putri, R. I. I., & Hartono, Y. (2015). Konteks kebudayaan palembang untuk mendukung kemampuan bernalar siswa smp pada materi perbandingan. *Jurnal Didaktik Matematika, 2*(2), 27-37.

Van den Heuvel-Panhuizen, M. (1998). *Realistic mathematics education as work in progress. Theory into practice in mathematics education*. Kristiansand, Norway: Faculty of Mathematics and Sciences.

Vasudevan, A. (2017). Slow learners-causes, problems and educational programmes. *International Journal of Applied Research, 3*(12), 308-313.

Walker, R. N. (1951). Realistic arithmetic testing for slow learners. *Journal of Exceptional Children, 17*(5), 136-141.

Wanabuliandari, S., & Purwaningrum, J. P. (2018). Pembelajaran matematika berbasis kearifan lokal gusjigang kudus pada siswa slow learner. *Eduma: Mathematics Education Learning and Teaching, 7*(1), 63-70.

Warnemuende, C. (2008). Helping parents help the slow learner. *Principal, 87*(3), 32-35.

Wijaya, A. (2012). *Pendidikan matematika realistik (suatu alternatif pendekatan pembelajaran matematika)*. Yogyakarta: Graha Ilmu.

Williamson, W. J., & Field, J. C. (2014). The case of the disappearing/appearing slow learner: An interpretive mystery. *Journal of Applied Hermeneutics*, 1-26.

Yuanita, P., Zulnaidi, H., & Zakaria, E. (2018). The effectiveness of realistic mathematics education approach: The role of mathematical representation as mediator between mathematical belief and problem solving. *PloS One, 13*(9), e0204847.

Zulkardi, Putri, R. I. I., & Wijaya, A. (2020). Two decades of realistic mathematics education in Indonesia. In *International reflections on the Netherlands didactics of mathematics* (pp. 325-340). Cham: Springer.

Zulkardi. (2002). *Developing a learning environment on realistic mathematics education for Indonesian student teachers*. Enschede: University of Twente.

Biographical notes

KARTIKA DYAH WARDANI, S.Pd., is a fresh graduate with Cum Laude predicate from the Mathematics Education Departement, Faculty of Teacher Training and Education, Universitas Ahmad Dahlan, Yogyakarta, Indonesia

Dr. **RULLY CHARITAS INDRA PRAHMANA** is Associate Professor in Mathematics Education, Faculty Teacher Training and Education, Universitas Ahmad Dahlan, Yogyakarta, Indonesia