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Social Arithmetic Learning Design Using the Sociodrama Method with the PMRI Approach

Navel O. Mangelep[1*], Frisca M. Pongoh[2], Murni Sulistyaningsih[3], Eunike Mandolang[4], Ade Mahniar[5]

[1,3]Mathematics Education Study Program, FMIPAK, Universitas Negeri Manado
[2]Marine Transportation Management Study Program, Politeknik Pelayaran Sulawesi Utara
[4]Primary School Teacher Education Study Program, FIP, Universitas Katolik De La Salle Manado
[5]Primary School Teacher Education Study Program, FIP, Universitas Negeri Gorontalo

[*]e-mail: navelmangelep@unima.ac.id

ABSTRAK

Kemampuan numerasi sangatlah penting dimiliki siswa saat ini. Namun, masih banyak siswa yang memiliki kemampuan numerasi yang rendah. Topik-topik seperti aritmetika sosial sangat membutuhkan kemampuan numerasi yang tinggi. Tujuan penelitian ini menghasilkan *local instructional theory* pada materi aritmetika sosial menggunakan metode sosiodrama dengan pendekatan PMRI. Penelitian ini dilaksanakan di SMP Negeri 2 Tondano dengan subjek penelitian adalah kelas VIII A (Kelas *Pilot Experiment*) dan kelas VIII B (Kelas *Teaching Experiment*). Metode penelitian yang digunakan adalah metode *design research* yang meliputi *preliminary design*, *teaching experiment*, dan *retrospective analysis*. Dalam penelitian ini, data dikumpulkan melalui rekaman video, dokumentasi, catatan lapangan, dan observasi. Sedangkan data dianalisis menggunakan analisis kualitatif. Hasil penelitian menunjukkan bahwa LIT yang dihasilkan memenuhi kriteria valid, praktis, dan efektif bagi siswa dalam mempelajari topik aritmetika sosial. Disisi lain, terdapat peningkatan kemampuan matematika formal yang ditunjukkan melalui pemahaman konseptual siswa dalam menerapkan pengetahuan dan pengalaman mereka ketika memecahkan permasalahan pada tingkatan situasional, referensial, dan umum. Oleh karena itu desain pembelajaran aritmetika sosial menggunakan metode sosiodrama dengan pendekatan PMRI sangat bermanfaat dalam meningkatkan pemahaman dan motivasi siswa dalam pembelajaran matematika pada materi aritmetika sosial.

Kata kunci: Desain Pembelajaran, Aritmetika Sosial, Sosiodrama, PMRI

ABSTRACT

Numeracy skills are essential for students today. However, there are still many students who still need to improve their numeracy abilities. Topics such as social mathematics require high numeracy skills. This research aims to produce a local instructional theory on social arithmetic material using the sociodrama method with the PMRI approach. This research was conducted at SMP Negeri 2 Tondano, with research subjects in classes XI MIA 1 (Pilot Experiment Class) and XI MIA 2 (Teaching Experiment Class). The research method used is the design research method, which includes preliminary design, teaching experiment, and retrospective analysis. This research collected data through video recordings, documentation, field notes, and observations. Meanwhile, the data was analyzed using qualitative analysis. The research results show that the resulting LIT is valid, practical, and effective for students studying social arithmetic topics. On the other hand, there is an increase in formal mathematics abilities, as demonstrated by students' conceptual understanding of how to apply their knowledge and experience when solving problems at the situational, referential, and general levels. Therefore, using the sociodrama method with the PMRI approach, the social arithmetic learning design is instrumental in increasing students' understanding and motivation in learning mathematics on social arithmetic material.

Keywords: Learning Design, Social Arithmetic, Sociodrama, PMRI

INTRODUCTION

Mathematics is a scientific discipline that advances human thinking. In fact, mathematics is a subject that is not interesting in the eyes of students (Seruni et al., 2019; Wulandari, 2020; Domu & Mangelep, 2023), which results in very few people interested in learning mathematics because the learning system is objectionable and not suitable for students (Dwiqi et al., 2020; Judijanto et al., 2024). This also happens at all levels of education, from elementary school to higher education (Ermita et al.,

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2024). As stated in the study by Ermita et al. (2024) show that even at the tertiary level, students need help understanding mathematical concepts. Therefore, to provide education that is fun for children so that children can have high interest and achievement, there are three Cs that must be considered, namely children, content (material) and context (situation) (Edo & Bulu, 2018; Kumesan et al., 2023). So that the right treatment and appropriate material will have a positive effect if it is not delivered in the right context (situation) (Umayah et al., 2019; Harahap, 2021; Lohonauman et al., 2023); this applies to all subjects in school, including mathematics.

Studying mathematics will certainly have a big impact on students because mathematics can always be connected to calculating a value per unit, partial value, or overall value. However, it is not just about calculating; it uses a comparison of values, either at cost (worth) or at a price (not worth). For this reason, learning mathematics requires examples of problems in everyday life that support a discussion concept in order to solve problems easily and precisely (Mangelep, 2013; Asri & Noer, 2015; Gazali, 2016). However, mathematics, which has an abstract nature, often needs help understanding the concepts of the material in mathematics learning (Mangelep, 2015; Dahlan & Permatasari, 2018; Permatasari, 2021).

Mathematics learning should start with recognizing the problem. Teachers as facilitators can use problems that students often encounter in everyday life and combine them with mathematics learning material. (Ningsih, 2014; Mulyati, 2016; Mangelep, 2017; Sulistyaningsih et al., 2018; Chisara et al., 2019) This is useful for preventing student's misconceptions. With the problems used by the teacher, students are gradually guided to master the mathematical concepts being taught, considering the many difficulties students encounter in mathematics lessons.

Some of the students' difficulties in understanding mathematics learning include social arithmetic material, where students have difficulty understanding the weight of an item which is expressed in gross, tare and net terms (Mangelep, 2017; Arifin, 2018; Pangaribuan, 2023). Another difficulty is that students have difficulty calculating in formula form, such as the discount on an item, which is usually expressed in the form of a percentage (%) (Rusmiati & Chotimah, 2022; Wiranti & Dhianti, 2023; Mangelep et al., 2023). This also happened to students at SMP Negeri 2 Tondano. Based on initial observations carried out by researchers for $\pm$ 3 months. Evidently, students demonstrate a lack of comprehension in mathematics during the learning process, as indicated by their tendency to remain mute or seek assistance from their peers when posed with questions. When assigned tasks, pupils tend to replicate responses from peers that they see as more intelligent.

Then, students always need more time to learn mathematics. This is seen in the passive learning disposition exhibited by pupils during the learning process when they refrain from posing inquiries when they encounter difficulty comprehending the subject matter presented by the teacher. This kind of student learning attitude certainly has causal factors. Based on the researcher's observations, this is caused by several external factors. Namely, teachers rarely use learning methods that are suitable for the learning material, and there is a need for additional learning media that attract students' interest in learning. In contrast, the learning media used only whiteboards are used for presenting writing or drawing sketches using markers.

Another problem encountered by researchers is the rare use of supporting learning methods and media in the mathematics learning process due to the teacher's lack of knowledge of learning methods so that the teacher's presentation of the material is only monotonous using conventional methods and does not provide opportunities for students to be independent and creative. With this way of learning, of course, the learning process becomes very boring for students because the activities are limited to listening to explanations of the material, taking notes, and giving assignments. As a result, students' mathematics learning outcomes still need to be higher when viewed from the Minimum Completeness Criteria (KKM) determined by the school, namely 70. However, students only get an average learning outcome of 63.5.

In order to address the issues mentioned and enhance students' comprehension, it is necessary to use alternative measures in the form of instructional designs that incorporate effective learning processes, as well as engaging educational resources that are appropriate for their age. Judging from the average age of junior high school students, namely 12-15 years, they are classified as teenagers in accordance with the phase of children's literary development who tend to like fairy tales, mysteries, and stories in the form of fairy tales, love, and events (Juwita, 2017; Erviana, 2018; Mangelep et al., 2023). This theory can be seen in the daily lives of those who prefer watching cartoons or reading comics rather than

studying (Retnowati, 2014; Venus, 2017). For this reason, the use of designed methods and media can be an appropriate alternative to make the mathematics learning process successful (Mardhiyana & Sejati, 2016; Fitriani et al., 2019; Mangelep et al., 2023). In this research, the researcher acts as a teacher to design learning using the sociodrama method and comic media, which includes stories and the roles of cartoon characters.

Comic media is an image that plays a character that has a storyline and can attract the reader's attention; the aim is to provide entertainment to the reader (Subroto et al., 2020; Nafala, 2022), while sociodrama is a teaching method by showing students about problems. The socialdrama method is by showing students the problems in social life that students encounter every day, which are role-playing by students under the leadership of the teacher and is also a way of teaching by dramatizing forms of student behaviour in daily social life activities (Latifa & Juanda, 2014; Fathurohmah, 2018).

The use of comic media needs to be supported in learning approaches that are relevant to mathematics learning. One suitable approach is the Indonesian Realistic Mathematics Education (PMRI) approach. PMRI is suitable for this study as a learning approach because it uses a real context and is close to students (Mangelep et al., 2024). In this case, comic media can be used as a context or starting point in learning mathematics. Various studies have shown that PMRI is suitable as an approach to exploring context and is effective in improving student learning outcomes (Domu & Mangelep, 2023)

Referring to the definition above, in this research, the researcher used the sociodrama method by designing social arithmetic material related to buying and selling prices, profits and losses, rebates/discounts and the weight of an item, which is usually expressed in gross, tare and net terms. Using this method can improve students' ability to understand and analyze and have a solution method for actively searching for answers. Then, use comic media containing pictures with storylines of students' social lives, which, of course, students often use in carrying out their daily activities. Using comic media can improve students' ability to understand and analyze and make it easier for students to learn with an active attitude, of course, with a good understanding of the material being studied through a meaningful learning trajectory.

METHOD

This research used design research methods. This method was chosen to achieve the main objective of this research, namely producing a local instructional theory on social arithmetic material using the socio-drama method and the PMRI approach. Gravemeijer and Van Eerde (Prahmana, 2017) define design research as a study methodology that aims to develop Local Instruction Theory (LIT) by bringing together researchers and educators to improve the overall quality of learning experiences.

The research stages consist of three stages, namely preliminary design, teaching experiment, and retrospective analysis, as in image 1 below.

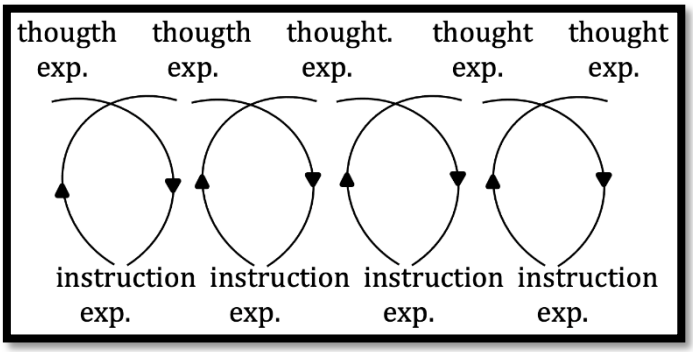

Figure 1. Cyclic process in design research (Mangelep et al., 2023)

The subjects of this research were 23 students of SMP Negeri 2 Tondano in class VIIIA as the pilot experiment class and 23 students in class VIIIB as the teaching experiment class. Meanwhile, data collection techniques were carried out using video recordings, documentation, written data, and

observation. Regarding data analysis techniques, this research uses retrospective qualitative data analysis with the Hypothetical Learning Trajectory (HLT) as a guide.

RESULT AND DISCUSSION

A. Preliminary Design

At this stage, the researcher implemented the initial idea of role-playing using comic media and sociodrama methods in learning social arithmetic by reviewing literature and analyzing the curriculum. After that, the researcher made observations at SMP Negeri 2 Tondano regarding the media and methods that would be used and ended by designing a Hypothetical Learning Trajectory (HLT).

1. Comic Media and Sociodrama Methods in Learning Design for Social Arithmetic Material.

The use of comic media in the learning design of this social arithmetic material will only be used for questions on each discussion topic, meaning that word-problem on the discussion topic were designed and presented in comic form. However, the answers or solutions to the questions will be completed not only by writing on the student worksheets (LKS) but spontaneously by role-playing using the sociodrama method, which in this lesson was designed to make students dare to express their opinions orally. By using this media and method, teachers will be able to find out students' understanding of social arithmetic.

Teachers must predict the mental activities that students will carry out during classroom learning. Imagining and anticipating what is called HLT will be implemented in real student learning. HLT into every learning activity was very important for designing student learning activities. Learning activities are closely related to learning trajectories, which function as a roadmap of learning content for students to follow throughout the learning process. In addition, the learning trajectories, learning activities, and settings used to teach social arithmetic will function as local learning theories (local Instructional Theory) in a particular learning process.

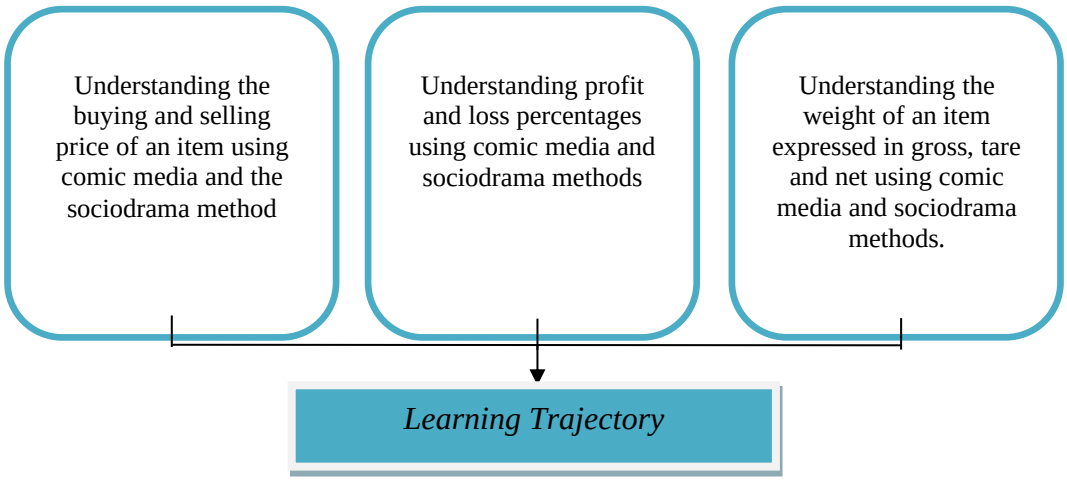

Figure 1. Learning Trajectory for Learning Social Arithmetic

The activities are designed to teach students about buying and selling prices, profit and loss percentages, as well as gross, tare and net weight of goods. These activities are based on the expected learning path and cognitive processes of students. Learning activities are separated into 4 activities and completed in 5 meetings.

This research aims to increase students' understanding of social arithmetic concepts that are interconnected in everyday life. The relationship discussed is the relationship between student learning trajectories, learning activities, and materials. The image below depicts social arithmetic learning activities as outlined in the Hypothetical Learning Trajectory (HLT).

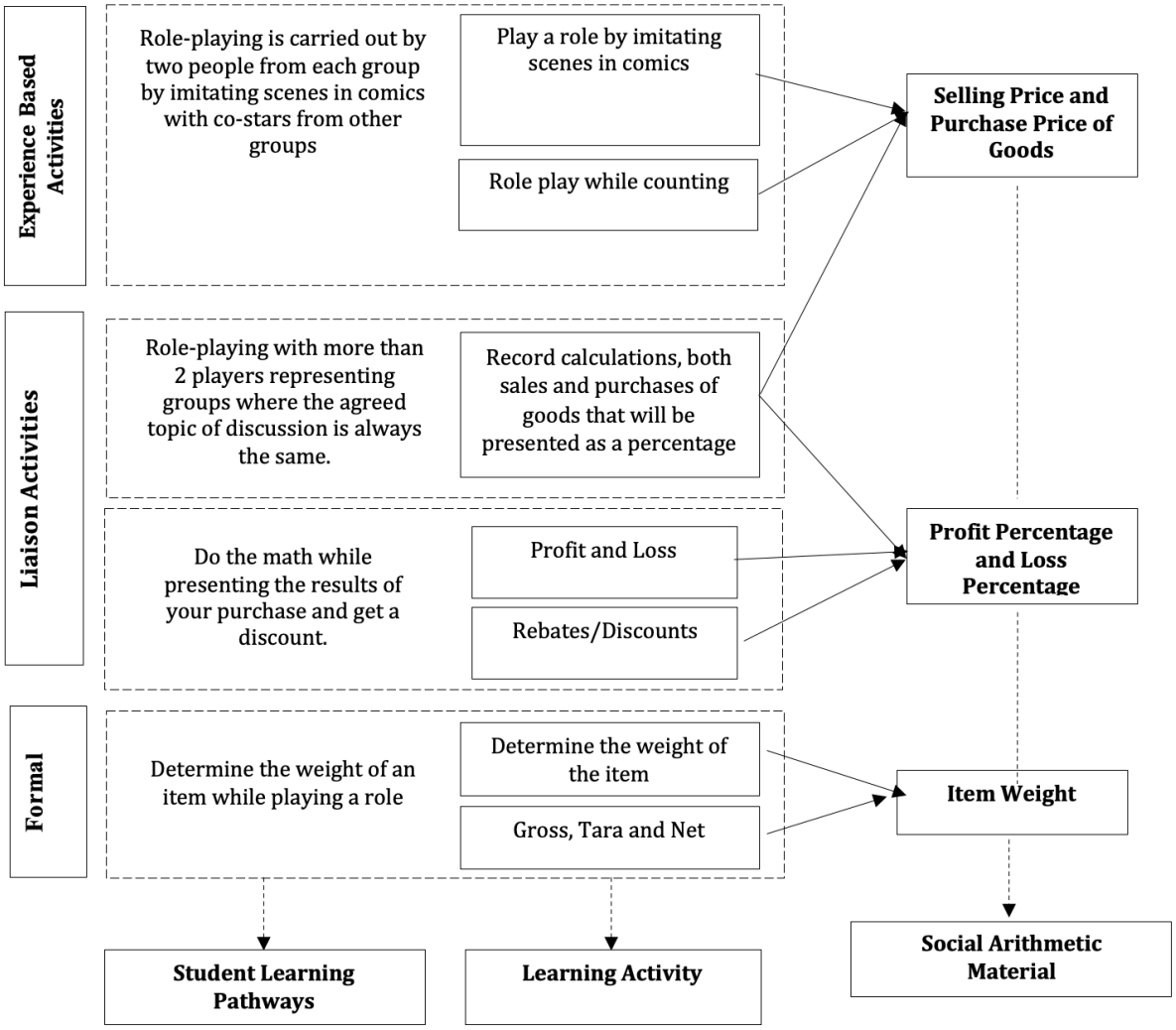

Figure 2. Learning activities for social arithmetic material

2. Role Playing by Imitating Comic Scenes

Students carry out role-playing exercises by imitating scenes depicted in comics. After that, students address situational problems related to role-playing exercises. The teacher begins the lesson by organizing students into groups of 6-7 people and explaining the group study guidelines. The teacher discusses comics and role plays, asks students about their experiences with the comics, and demonstrates them in front of the class with the students.

The teacher then distributes comics and Student Worksheets (LKS) to each group and directs students to solve the questions on the LKS that have been provided. Students are asked to present their work in front of the class by acting out scenes, calculating, and completing assigned worksheets for subsequent discussion. Objective: Assess students' ability to recognize social arithmetic concepts such as buying and selling prices, profit and loss percentages, and the weight of items in a game, aiming to foster students' understanding of terms related to profit (winning) and loss (losing).).

3. Conjecture

The following conjectures or presumptive proportions, predictions or conjectures in social arithmetic learning activities can be seen in the following table:

Table 1. Research Conjecture

CONJECTURE (At the Beginning of Learning)	
Teacher Activity	Student Activity
The teacher asks students about the names of comics that they like or often see or read in their daily lives and whether students like to be the characters in the comics they like. Then, the teacher asks whether they are familiar with role-playing or have ever played it.	➢ Does anyone know and often play roles or imitate figures in cartoons or comics? The terms "know and often" were used to ascertain students' familiarity with games and media as well as the frequency of their engagement with those games and media. Through this question, students are expected to understand the game protocol, thus making the subsequent learning process easier. ➢ Possible student answers: ➢ I know, I don't know, often play during recess or at home.
The teacher uses the word "can" and invites students to communicate about this game, with the aim of stimulating students so that they are able to share all their knowledge about role-playing, which will later make it easier for them in the learning process based on the HLT that has been designed.	➢ Can anyone tell me how to play a role? Does the figure being imitated have a different character from you, both in nature and age? ➢ Possible student answers: You can or you can't; if you imitate diligent and rich people, you can buy anything, and if you imitate lazy and poor people, you will definitely lose in every way.
The teacher invites students to practice it in front of the class in the hope that there will be similarities in the rules of the game in the class.	➢ Is there anyone willing and able to demonstrate it in front of the class? ➢ Possible student responses: I want, I don't like, I can't.
CONJECTURE (Questions and statements contained in the Student Worksheet (LKS)	
Teacher Activity	Student Activity
» The reward? This question aims to encourage students to reach an agreement regarding the additional value that will be exchanged during this game, where the comics that are distributed will later be a topic of discussion that will be processed into role scenes regarding social arithmetic material such as buying and selling prices, profit and loss percentages, and the weight of an item in this lesson. In this game, the number of comics that will be distributed corresponds to the number of topics discussed.	❖ Possible student answers: • Buying goods and reselling them at a price higher than the purchase price will make a profit. • Selling goods for less than the purchase price will result in a loss. ❖ • By determining the weight of goods in gross, tare, and net, we can determine the weight of contents, packaging, or contents-packaging.
While playing, answer the questions below: A fruit seller bought 12 durians. He paid with 3 hundred thousand notes and got Rp. 30,000.00 in change.	❖ Possible student answers: • Students can answer the questions given accurately. These students have knowledge of the media and games they use, as well as strong

a. Determine the total purchase price. b. Determine the purchase price of each fruit. c. If the trader only buys 8 durians, how much does he have to pay? The questions above aim to assess students' understanding of media and games and their relationship to the concept of social arithmetic related to buying and selling prices in these games.	skills in discerning the value of an item in terms of both selling and buying prices. • Some questions can be answered correctly by students. These students understand the media and games they use but have less understanding of price dynamics when it comes to buying and selling goods. • Students are not able to solve all the questions given accurately. These children do not understand the media and games they participate in and have limited awareness of the price dynamics of goods.
Explain your answer: This question is asked to find out students' explanations in answering the questions in the previous question. The hope is that students can explain the answers they wrote in the LKS and then present them in the discussion session.	❖ Possible student answers: • Students are expected to provide an explanation based on the contents of the worksheet provided before the game, as well as a strong understanding of the selling price and buying price of the item. • Students can provide explanations, but they do not match those included in the previously provided worksheet. These children are knowledgeable about the media and games they participate in but lack understanding of the price dynamics involved in buying and selling goods. • Students fail to provide explanations that match the contents of the worksheet that has been provided previously. These children lack understanding of the media and games they play, as well as awareness of the price dynamics of goods.

CONJECTURE
(Class Discussion)

Teacher Activity	Student Activity
Class discussions were held to dig deeper into student responses recorded on the Student Worksheet (LKS). Discussion is used to align student understanding with the intended goal. Various student responses using different approaches can be considered, allowing students to choose the method that is most effective for them ultimately. After the conversation, the teacher instructs students to conclude the learning that took place. At the end of each meeting, students will provide an assessment of the actors' playing, facial expressions and creative thinking. Assessment is included in the worksheet. The	The things that need to be discussed between teachers and students at this stage are: • Discussion to determine the "rewards" in this game, which will influence the topic of discussion and the worksheet given at the end of the game. • Discussion to determine the relationship between sales price and purchase price with the comic story that is imitated through role-playing and the worksheet provided. Discussion to determine the best actor and good calculation methods when answering questions while playing a role

assessment method is to give a score of 10-100, and the winner who gets the highest score at the end of the lesson will be counted.	

B. *Teaching experiment*

At this stage, students will respond to questions on the worksheet that relate to the challenges encountered in earlier exercises, as well as development questions that encompass the broader issues of past problems. At this stage, students engage in role-playing exercises using comics provided by the teacher, rather than simply completing LKS response sheets.

This stage transforms models into mathematical representations, aiming to stimulate students' creative thinking as they progress toward a formal understanding of the themes covered in social arithmetic.

1. Starting Point

Using role-playing to simulate scenes from comics as a basis for teaching social arithmetic concepts. This exercise is according to plan at the conceptual design stage, focusing on developing students' language skills regarding the selling price and buying price of an item through role play. Students are provided with a framework for role-playing, familiar games, and humorous media that they often encounter at school or home. Before starting the learning activity, the teacher provided the context of the game and asked the students whether they had played it, and all students responded affirmatively.

The learning process begins with the teacher organizing students into groups of 6-7 people and giving them the opportunity to choose a name for their group. Group members discuss and agree on the group name: Group 1 as Mickey Mouse, Group 2 as Barbie, and Group 3 as Doraemon.

The teacher then asks the group that received the initial material to play a role-play by re-enacting the comic scene in front of their friends. The teacher acts as a mediator while students discuss until reaching an agreement. The rules of the game in imitating the game using materials were finally agreed upon. This rule is very important to provide uniform viewpoints in the game, thereby preventing differences that could affect understanding of content, writing and worksheets.

After all students have the same rules that have been mutually agreed upon, the teacher distributes comics to each group with different discussion topics, along with worksheets that the students will work on later. For the first topic, students who are tasked with playing in front of the class are first given worksheets to be done by the acting group. The Point is that in simulating comic scenes, they are clear when counting because the scenes in the comic are about the story being drawn to be simulated. Another reason the teacher gives worksheets first to the acting group is that usually, the first group still needs clarification or is shy in front of the class because they don't have any examples from their friends; this will have an impact on how to count later.

Then, after playing, each student is distributed the same worksheet as the group to work on as an evaluation. If their answers are different, this indicates whether the students understand the material well or not. This is proven; at the end of the game, they properly calculate the results of the selling and buying prices in the worksheet provided.

2. Learning Activities

The activities in this section aim to guide students to develop strategies for understanding social arithmetic material by linking the designed game activities, the understanding they already have, as well as the media and methods used with the following experiments:

a. The first topic experiment is about the selling price and buying price of an item

Learning experiments are carried out by providing examples of buying and selling transactions that students find in their surrounding environment. After the example is given, the teacher will provide a simulation involving students with the aim of students being flexible in the learning process. Next, the teacher asks students to pay attention to what scenes is in the comic given by the teacher to each group that has been divided.

After the first group paid attention to the scenes in the comic, the teacher gave worksheets for the acting group to work on first. After the worksheet had been completed,

the teacher called a group named Mickey Mouse to play a game in front of the class. In contrast, the other groups paid attention to gaining an understanding of the topic and getting the calculation results correctly.

The questions contained in the Student Worksheet (LKS) are:
A trader buys 40 kg of oranges at a price of IDR 6,500.00 per kg. Then, 30 kg of them were sold at IDR 7,000.00 per kg, and the rest were sold at IDR 6,000.00 per kg. Calculate a. purchase price, b. sales price, c. the amount of profit or loss from the sale.

The LKS also includes scores that will be given to each group regarding how to play in several categories, namely mimicry, how to solve problems, and students' creative thinking, and will be included in each LKS given and will be discussed at the end of the meeting.

When the groups are playing, the teacher gives worksheets to each group. When working on the LKS, there is a discussion about how to convey the topic by acting and the process of calculating the final results, which will be discussed after the group has finished playing. Everything is recorded in the following dialogue:

Teacher : That was good. Wasn't the Mickey Mouse group playing roles in front?
Student : Good ma'am
Teacher : Well, now try to look at the LKS for each group. For question a, is the purchase price the same as that given by the Mickey Mouse group, with the answer to question a being IDR 260,000.00?
Student : Same
Teacher : OK, let's count together. Earlier, the trader bought 40 kg of oranges, Rp. 6,500.00 per Kenya. What is 6,500 times 40?
Students: Rp. 260,000.00 shouted the students who felt their answer was correct.
Teacher : SMART! Now, the different answers can be corrected.
Student : OK, ma'am.
Teacher : Now, the Mickey Mouse group returns to their seats. Give a round of applause to the Mickey Mouse group.

Based on the dialogue above, the teacher really emphasizes that all students have the same perspective when carrying out games and calculations when playing roles and when calculating manually. Remember that teachers include praise to motivate students to be more enthusiastic about learning.

After ±20 minutes, the teacher invited each group to present their answers in front of the class, and this time, Barbie's group had the opportunity to present their answers to question b.

In this presentation session, there was no active discussion because most of the answers from each group were the same as the answers presented by the Barbie group. The only difference was in the order of work, such as the following dialogue:

Teacher : How do you calculate sales for the Barbie group?
Student : Look, ma'am, there were 40 kg of oranges, and they were sold for 30 kg.
Teacher : So how many kg is left?
Student : 10kg ma'am.
Teacher : But 30kg and 10kg are sold at different prices, so how do you calculate it?
Student : Let's do it like this, ma'am...
Sales price:
=(30 x Rp. 7,000.00) +(110 x Rp. 6,000.00)
= Rp. 210,000.00 + Rp. 60,000.00
= Rp. 270,000.00

Teacher : The answer is absolutely correct. Does anyone have the same answer as the Barbie group?
Student : Same, ma'am. We multiplied the price and then the number of rakes and answered the Doraemon group.
Teacher : It's OK, but are the results the same?
Student : Same, ma'am.
Teacher : Let's give applause for the Barbie group

For question c, the teacher asks for answers from each group. All the results are the same, which indicates that students understood the first topic of discussion through games and discussions that took place during the learning process.

b. Second Topic Experiment About Profit or Loss Percentage

At the beginning of the lesson, the teacher reminds students about the formula for calculating the percentage of profit or loss as well as social arithmetic material learning activities based on the worksheet they worked on the previous day, especially question c on the worksheet related to the relationship between profit and loss which the teacher will relate to the game of acting or playing. The role is to imitate the comic given by the teacher later in the second group or the Barbie group. However, once again, the teacher emphasizes the comic scene, which is drawn only in outline and will be developed by the students according to their thoughts. For this reason, the sociodrama method plays a very important role in exploring students' understanding.

This second discussion topic is definitely more difficult in terms of calculations because it uses formulas. For this reason, before entering the second topic teaching experiment, the teacher brings introductory media, such as sales brochures for discounted shop goods, and explains the topic to the students in front of the class.

After giving examples, the teacher will ensure and invite discussion with students that students have understood the topic through the teacher's explanation in front of the class, as in the following dialogue:

Teacher : Do you understand how to use the profit percentage and loss percentage formulas and how to calculate them?
Student : yes, ma'am.
Teacher : now we watch the second group, namely the Barbie group, appear in front of the class.

Through the dialogue above, the teacher can conclude that students have understood the second topic of discussion in the social arithmetic material, namely profit percentage and loss percentage, because the teacher provides examples of problems that students often encounter.

In this second teaching experiment, the teacher did not distribute worksheets before the second group played the game as in the first experiment. Still, here, the teacher asks that the students concentrate on their accompanying display in front of the class in order to stimulate students to be more active in this activity which the students will find errors or something that is considered odd during the game process, considering that the group playing uses their mindset to develop discussion topics while playing roles.

After the second group had finished performing in front of the class, the teacher invited the second group or the Barbie group to return to their seats, and the teacher immediately distributed worksheets where the questions on the worksheet were the same as the problems that the Barbie group had solved when they appeared earlier. Worksheets are given the same way to find out how students solve problems, from story problems that directly act out to formal problems, but still based on the context of everyday problems. The questions contained in the LKS are:

A trader buys 1 quintal of rice at a price of IDR 6,000.00 per kg. The trader sold the rice and got IDR 20,000.00. Determine the trader's profit or loss percentage.

Based on the questions above, the teacher only gave students around 15 minutes to complete the questions on the worksheet, considering that these questions had been touched on in the game by the Barbie group and the problems students often encountered in their daily lives. After the specified time is up, the teacher asks if any groups want to present in front of the class. The Doraemon group also showed their hands to present the results of their group discussion in front of the class. Still, it was only represented by their group leader named Amel, as in the following dialogue:

Teacher : Please pay attention to Amel's answer and see whether it is the same as your work or not. Please Amel.
Amel : So, the profit percentage is 3.3376.
Teacher : What's the loss?
Amel : There is no loss, ma'am because the trader made a profit of IDR 20,000.00, so immediately enter the result into the formula 3.33%
Teacher : Is there a difference in the answer from the Doraemon group?
Student : No, ma'am.
Teacher : That means everyone understands that if they make a profit, immediately enter it into the profit percentage formula, and if the trader makes a loss, immediately enter it into the loss percentage formula, then we will get the results. Understand?
Student : Understand ma'am.
Teacher : Amel, please go back to the place. Everyone claps because the answers are correct.

Through the dialogue above, we can see from the teacher that playing roles while explaining the material is more quickly understood by students because they independently play roles while explaining the material through their way of thinking, which is easy to digest and understand by themselves and their classmates. Not only that, but they had no problems in solving formal questions.

c. Topic Experiments About Gross, Tare, and Netto

In this third experiment, the teacher explains a little about what gross, tare and net are. While explaining the weight of goods, which is usually expressed in gross, tare and net form, the teacher gives examples using introductory media that supports the teacher's explanation.

They immediately began because the comic had been given to the last group, namely the Doraemon group, so the teacher immediately told the last group to come to the front of the class and do a role play. Role-playing in this third topic emphasizes that you have to be more relaxed in playing while delivering material about what is gross, tare and net. Why do you have to be more relaxed? This is the last topic, and it is quite easy compared to topics 1 and 2.

In this session, the acting students were very relaxed because they were in the last group and had seen examples of role-playing from their previous group friends. In this last topic, the teacher immediately gave a worksheet and asked representatives from each group to work on the board. The aim was to find out whether their understanding was the same or different.

The process of determining and calculating what was expected was achieved, as seen from the way it was done, namely that students quickly worked on the worksheet given and answered it correctly. At this final meeting, we will also discuss who the winning group will be by getting the highest score from the assessment of each group included in each worksheet given. The winning group was the Barbie group, with a total score of 260

combined with the scores of several categories, namely: Mimic category = 85, problem-solving category = 85, and creative thinking category = 90.

C. Retrospective Analysis

1. Answers to the First Research Question

This research involves the use of role-playing and sociodrama methods to imitate scenes in comics, encouraging students to think independently in their learning activities, especially with a focus on social arithmetic material. The learning process might be a strong reason to answer further research questions.

What is the Role of role-playing games using comic media and sociodrama strategies in increasing students' understanding of social arithmetic material in class VII SMP N 7 Tondano?

Activities inspired by participants' expertise and interest in comics will be utilized in this research to answer research questions. Explanation of students' understanding of concepts related to buying and selling prices, profit, and loss percentages, as well as gross, tare and net values in role-playing scenarios.

a. Role Playing Game to Build Students' Language of Selling Prices and Buying Prices

After playing the role play and completing the Learning Toolkit (LKS), the teacher directs students to participate in discussions and record problem-solving responses from the LKS. Next, they presented their findings to the class. Students can achieve the desired results by understanding and utilizing their language in this game. In this context, the selling price refers to the price set by the seller for the buyer, while the purchasing price is called the capital or cost of goods from the sales place, such as a factory.

b. Role Playing Modified Using Comic Media and Sociodrama Methods

In the second discussion topic, students were more emphasized in using sociodrama strategies, where the worksheet given to students had problems that were the same as those played by the second group. Without teacher guidance in working on worksheets, students are able to work well. Students, by Role-playing using media they like, namely comics and sociodrama methods, can make students independent and bring out students' language about the topic being discussed. With a fast and good understanding, at the end of the lesson, the teacher gives evaluation questions in the hope that students will be able to work on the questions formally.

c. Role Playing, Determining and Calculating Gross, Tare, and Netto

The final task in this learning design centres on checking the weight of goods, which are usually expressed in gross, tare and clean units. After the simulation, the teacher distributes worksheets to each group and directs members to present their findings on the whiteboard simultaneously. Productive discussions occurred during presentations regarding answers to questions on their worksheets. This interaction shows that the child understands and is quite enthusiastic in responding to the subjects presented on the blackboard.

Students can utilize role-playing with comedic media and sociodrama techniques to increase their understanding of social arithmetic topics, including purchase and sale prices, profit and loss percentages, and gross, tare, and net values. This setting is particularly favourable for formal education in social arithmetic.

2. Answers to the Second Research Question

The second Research Question investigates the development of students' understanding within the designed learning trajectory and the transition from role-play activities to independent work on worksheets. This emphasizes increasing students' confidence in speaking and the need for a spontaneous mindset during activities.

As stated in the second research question:

What is the student's learning trajectory in learning social arithmetic by Role-playing using comic media in class VII of SMP Negeri 2 Tondano?

The activities in this research created a learning trajectory from counting while playing a role, calculating using their mindset, and answering questions on the worksheet in groups.

a. Learning Path of Selling Price and Buying Price of an Item

At the beginning of learning, students are taught the concept of selling price and buying price of an object. The instructor introduces role plays that are already familiar to students, making it easier for teachers to implement them. Apart from that, the media used was well received by students. Conventional learning is time-consuming and less successful for students in acquiring social arithmetic information, but this tailor-made learning approach is more efficient. The teacher acts as a mediator to guide students in finding a more effective approach, thereby enabling the sociodrama method to facilitate independent and spontaneous learning in estimating and calculating the selling and buying prices of goods.

b. Learning Path Profit Percentage and Loss Percentage

To guide students in calculating the profit percentage and loss percentage, it is no different from the topic of selling price and buying price of an item, only the researcher slightly modified the rules of the game, namely that the other group had to concentrate fully on the playing group in order to get a good understanding. The worksheet was given at the end of the game. The acting group here is more spontaneous in conveying material through games because it is different from the previous group in that the questions given have been worked on before appearing in front of the class. Still, the questions are answered directly while playing. The result is that students' understanding of the topic is deeper when working on questions.

c. Gross, Tara, and Net Learning Trajectories

The ultimate goal of this research is to instruct students to engage in a more relaxed manner. Discussing the weight of an object, which is usually expressed in gross, tare and net weight, is easier than previous topics. Discussing subjects through games makes it easier for all parties to answer the worksheets offered quickly and accurately.

The teacher succeeded in facilitating students' understanding of the problem by immediately immersing them in practice. Students have engaged in a series of activities involving experiential learning using comic media and sociodrama methodology, ultimately aiming to increase understanding and develop learning trajectories.

CONCLUSION

Based on the results and discussion above, this research shows that the use of the sociodrama method with the PMRI approach is very useful for triggering and increasing students' motivation to learn mathematics on social arithmetic material. In addition, this research has produced a local instructional theory that is valid, practical, and effective for students in studying social arithmetic topics. In addition, there is an increase in formal mathematics abilities shown through a conceptual understanding of social arithmetic, where students apply their knowledge and experience in solving social arithmetic problems at the situational, referential, and general levels.

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