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## Problem-Based Learning (PBL) Model to improve numeracy and self-confidence of middle school students

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### Abstract

Numerasi merupakan hal penting untuk dikembangkan karena terkait dengan kemampuan peserta didik dalam memecahkan masalah matematika dalam kehidupan sehari-hari. Penelitian ini bertujuan untuk meningkatkan numerasi dan kepercayaan diri peserta didik melalui penerapan model pembelajaran *Problem Based Learning* (PBL). Jenis penelitian adalah penelitian tindakan kelas (PTK) dengan adaptasi model Kemmis dan Mc Taggart. Subjek dari penelitian ini adalah 30 peserta didik kelas VII SMP Negeri 1 Depok. Instrumen pengumpulan data yang digunakan meliputi lembar angket percaya diri dan tes numerasi. Teknik analisis data angket percaya diri dan hasil tes numerasi dihitung rata-rata, dikategorikan, dan dianalisis nilai gain skornya. Hasil penelitian ini menunjukkan bahwa numerasi dan kepercayaan diri siswa meningkat setelah pembelajaran PBL. Peningkatan numerasi peserta didik dilihat dari peningkatan gain skor peserta didik dari siklus 1 ke siklus 2. Model pembelajaran *Problem Based Learning* juga meningkatkan kepercayaan diri pada peserta didik berdasarkan peningkatan kategori yang dicapai peserta didik dari siklus 1 ke siklus 2. Oleh karena itu, peneliti lain dapat menggunakan model PBL untuk meningkatkan rasa percaya diri dan numerasi peserta didik pada materi lainnya.

Numeracy is important to develop because it is related to students' ability to solve mathematical problems in everyday life. This research aims to improve students' numeracy and self-confidence through the application of the Problem Based Learning (PBL) learning model. The type of research is classroom action research (CAR) with an adaptation of the Kemmis and Mc Taggart model. The subjects of this research were 30 class VII students at SMP Negeri 1 Depok. The data collection instruments used included a self-confidence questionnaire and numeracy test. Data analysis techniques for self-confidence questionnaires and numeracy test results are averaged, categorized and the gain score value analyzed. The results of this research show that students' numeracy and self-confidence increase after PBL learning. The increase in students' numeracy can be seen from the gain-score of students' numeracy test from Cycle 1 to Cycle 2. The Problem Based Learning model also increases students' self-confidence based on the increase in categories achieved by students from Cycle 1 to Cycle 2. Therefore, the researcher Others can use the PBL model to increase students' self-confidence and numeracy in other materials.

**Keywords:** Mathematics, Numeracy, Problem-Based Learning, Self-Confidence.

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## INTRODUCTION

Mathematics is closely tied to its practical application in everyday life. The Ministry of Education and Culture initiated the National Literacy Movement in 2016 to enhance national literacy, competitiveness, quality of life, character development, and 21st-century skills (Ambarwati & Kurniasih, 2021). According to (Kemdikbud, 2017), six types of literacy are essential: literacy, numeracy, digital, scientific, financial, and cultural and citizenship literacy.

Numeracy enables students to acquire, interpret, apply, and communicate numerical information to solve real-life problems and analyze information in various forms (Geiger et al., 2015). PISA defines numeracy as the ability to formulate, use, and interpret mathematics in diverse contexts, including reasoning mathematically and utilizing mathematical concepts, procedures, and facts to describe, explain, and predict events (OECD, 2019). Numeracy is crucial for students to address mathematical problems relevant to real-life applications (Hasanah et al., 2016). It forms the foundation for informed decision-making when integrated into mathematics learning. Students with strong mathematical literacy can effectively analyze, reason, and communicate their knowledge and skills, solving and interpreting mathematical problems (Wardani et al., 2017). Anwar (2018) states that numeracy empowers students to tackle problems by applying appropriate mathematical concepts.

Despite its importance, numeracy remains a challenge for Indonesian students. PISA results show that Indonesian students' mathematics scores range from 360-390, below the global average of 500 (OECD, 2019; 2023). At SMP 1 Depok, class VII students also struggle with numeracy, with an average score of 66.1 on social arithmetic tests and a 56% completion rate. These results indicate the need to improve students' numeracy and learning outcomes.

In addition to cognitive abilities, students' attitudes, such as self-confidence, are crucial. Self-confidence defined as the belief in one's ability to perform tasks or showcase skills (Patmonodewo, 2000; Tanjung & Amelia, 2017). Self-confidence is importance in someone abilities and perception (Hendriana, 2018; Andriani & Aripin, 2019). The

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Ministry of Education and Culture (Vita, 2016) outlines nine indicators of self-confidence, including daring to appear in front of the class, expressing opinions, trying new things, and providing constructive criticism. Hendriana (2018) and Eviliasani et al. (2018) add indicators such as believing in one's abilities, facing problems positively, being independent in decision-making, and having a positive self-concept.

Interviews with mathematics teachers at JHS 1 Depok revealed that students lack confidence in class discussions and explaining their work. Teachers also noted difficulties in learning social arithmetic material. To improve numeracy and self-confidence, innovative learning approaches are needed. Problem-Based Learning (PBL) is a suitable model, as it involves students in problem-solving and group discussions.

Rahmah et al., (2023) describe PBL as a model that presents contextual problems for direct student involvement in problem-solving. Utami (2013) and Suprihatiningrum (2013) highlight PBL's effectiveness in enhancing critical thinking and problem-solving skills. PBL includes student orientation toward problems, organizing students to address problems, guiding investigations, developing and presenting work results, and evaluating the problem-solving process (Kemdikbud, 2017; Putri et al., 2019). Studies by Indah et al. (2016) and Andri et al. (2019) demonstrate that PBL improves students' numeracy and self-confidence.

This research is novel in its focus on the dual enhancement of numeracy and self-confidence among junior high school students through the implementation of Problem-Based Learning (PBL) specifically on social arithmetic material. While previous studies have explored the benefits of PBL in various mathematical topics, this study uniquely addresses the gap by applying PBL in the context of social arithmetic, an area less frequently examined. Additionally, the research provides empirical evidence from an Indonesian educational setting, offering valuable insights and practical implications for improving educational practices in similar contexts. By integrating a detailed examination of self-confidence indicators, this study contributes to a more holistic understanding of student development, highlighting the interconnectedness of cognitive and affective educational outcomes.

Through the explanation above, the question in this research is “Do the numeracy and self-confidence of students at Junior High School 1 Depok class VII F improve after PBL learning on social arithmetic material?”.

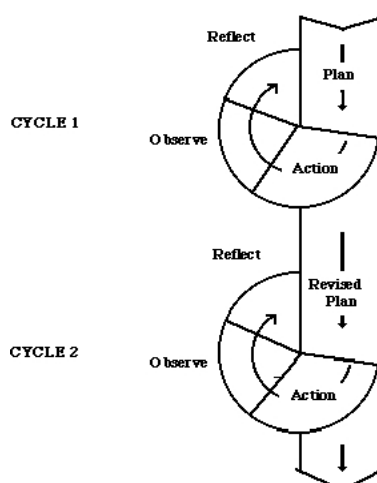
### **METHODS**

This research adopts a classroom action research approach, employing the Kemmis and McTaggart model, which encompasses planning, action, observation, and reflection or evaluation activities (Jalaludin, 2021). In this research, researchers used the PBL model in learning. The steps for PBL learning are: 1) student orientation toward problems; 2) organizing students toward problems; 3) guidance on investigations or problem-solving processes individually or in groups; 4) developing and then presenting the results of the work; 5) analyzing and evaluating the problem-solving process. At the problem orientation stage, researchers prepared realistic problems on students' worksheets about profit, loss, tax, and interest. At the organizing students toward problems stage, students observe and identify the problems presented. At the guidance on investigations stage the teacher guides students in solving problems. At the develop and then present the results of the work stage, several groups come forward to present the answers on the worksheet and other groups confirm the answers and ask if there is anything different. At the analyze and evaluate stage, teachers and students evaluate and conclude together about social arithmetic material.

The research process unfolds in distinct stages, with each phase serving a specific purpose. In the planning stage, the researchers meticulously prepared supporting materials aligned with the learning plan. Following the planning phase, the action stage ensued, where the researchers executed the learning process based on the lesson plan and students' worksheets. The observation stage involved the researcher closely monitoring the unfolding of the learning process, keenly observing the dynamics within the classroom. Finally, in the reflection stage, the researcher synthesized the observations and concluded the effects of implementing the PBL learning model. This reflective process allowed for a comprehensive understanding of the model's efficacy in enhancing both numeracy and self-confidence among the students.

The classroom action research model employed in this study is adapted from Kemmis and McTaggart, as illustrated in Figure 1.





**Figure 1.** Flow of Classroom Action Research according to Kemmis and McTaggart

This classroom action research was carried out in 2 cycles. Each cycle has 3 meetings and includes a *post-test*. The research subjects were students in class VII of JHS 1 Depok, Special Region of Yogyakarta, totaling 30 students. The research was conducted from March to May 2023.

The data collection was carried out by administering numeracy tests and distributing self-confidence questionnaires. The numeracy test questions consist of 4 about the topic of social arithmetic in everyday life problems. Indicators of students' numeracy abilities are (1) being able to use various kinds of numbers and symbols related to basic mathematics to solve problems in various contexts of daily life, (2) Analyzing information displayed in various forms (graphs, tables, charts, diagrams and etc.), and (3) interpreting the results of the analysis to predict and make decisions (Baharuddin et al., 2021).

The student self-confidence questionnaire consists of 20 closed statements. Indicators of students' self-confidence are dare to appear in front of the class, dare to express opinions, dare to try new things, express opinions on a problem or topic, volunteer as class president or other class administrator, volunteer to do assignments or problems on the board, trying new useful things, expressing constructive criticism of other people's work, providing strong arguments to defend opinions (Vita, 2016).

Before it was used, the instruments were validated by one lecturer and one master's student in the Mathematics Education study program at Sanata Dharma University. After the data is collected, the data is analyzed quantitatively and qualitatively.



Apart from that, to calculate the increase in student learning outcomes, the following N-gain formula is used.

$$N - gain = \frac{\text{posttest score} - \text{pretest score}}{\text{ideal score} - \text{pretest score}} \quad (1)$$

The improvement in learning outcomes is assessed using the n-gain value. If the n-gain value is negative, it indicates a “decrease” in students' scores. Conversely, if the n-gain value is positive, it signifies an “improvement” in students' scores.

After calculating the N-gain value, this value can be categorized according to the following Table 1.

**Table 1.** N-gain Score Criteria (Nismalasari, et al., 2016)

N-Gain Value	Categories
$0.7 \leq \text{N-gain} \leq 1$	High
$0.3 \leq \text{N-gain} < 0.7$	Medium
$0 \leq \text{N-gain} < 0.3$	Low

After the numeracy test score data is analyzed and the PBL model is said to be able to improve students' numeracy if at least the score of 80% of students improve.

Data obtained from the results of a self-confidence questionnaire consisting of 20 statement items with an answer range of 1 to 4, these results are calculated and the final results are categorized into 4 categories, namely very high, high, low, and very low with the score guidelines in Table 2.

**Table 2.** Guidelines for Categorizing Self-Confidence Questionnaire Results

Conclusion Criteria	Categories
Score $\geq 65$	Very high
$65 > \text{Score} \geq 55$	High
$55 > \text{Score} \geq 35$	Low
Score $< 35$	Very Low


After the student self-confidence data is analyzed and categorized based on Table 2, the PBL model can increase students' self-confidence if all students are at least in the high category.

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### RESULT AND DISCUSSION

The research instruments used in this study comprised five student worksheets focused on social arithmetic topics. In the first meeting, the worksheet covered profit, loss, and breakeven points. The second meeting's worksheet addressed the percentage of profit and loss. The third meeting focused on tax calculations, while the fourth meeting's worksheet dealt with simple interest. The fifth and final meeting explored gross, tare, and net weights. Figure 2 below shows the example of the problem in the students' worksheet.



**UNTUNG, RUGI, IMPAS**

**Kamu harus tau!**

Kalian tentu pernah membeli suatu jajanan di kantin sekolah. Di dalam satu proses jual beli tentu ada yang berperan sebagai penjual dan pembeli. Sebagai pembeli, tentunya kamu menginginkan membeli jajanan dengan harga yang murah. Sedangkan sebagai penjual tentu menginginkan untung sebesar-besarnya. Sebagai penjual, adakalanya mengalami untung dan tak jarang juga mengalami rugi.

Apakah kalian tahu kapankah penjual mendapatkan keuntungan dan mengalami kerugian?

Untuk memahami tentang keuntungan dan kerugian amati masalah 1 berikut!

**MASALAH 1**

"Koperasi kejujuran" SMP N 1 Depok menjual beberapa minuman botol. Petugas Koperasi membeli 4 dus minuman botol dengan harga Rp 19.200 per dus. Kemudian minuman botol tersebut dijual dengan harga Rp 4000 per botol. Apabila seluruh minuman botol tersebut terjual habis (Ket: 1 dus berisi 6 botol)

**Translate:**

You must have bought some snacks at School canteen. In a buying and selling process, of course there are those who act as sellers and buyers. As a buyer, of course you want to buy snacks with low price. Meanwhile as the seller certainly wants as much profit as possible. As a seller, sometimes experienced profits and not infrequently too suffer a loss.

Do you know when the seller makes a profit and experiences loss?

To understand the advantages and disadvantages, observe problem 1 below!


**Problem 1**

The canteen of SMP N 1 Depok sells several bottled drinks. The officers buy 4 boxes of bottled drinks at a price of IDR 19,200 per carton. Then the bottled drink is sold at a price of IDR 4000 per bottle. If all the bottles are sold out

(Note: 1 box contains 6 bottles)

Figure 2. The example of problem in student worksheet 1

There is another example of student worksheet about the discount. It can be seen in Figure 3 below.



**Masalah 3**

Anita berencana berlibur ke Jogja Bay dengan mengajak Ayah, Ibu, Adik, dan Kakak. Anita kemudian mencari info tentang Jogja Bay di Instagram, dan menemukan info diskon seperti gambar di samping. Anita bersama keluarga pergi pada akhir pekan dan memilih untuk berangkat pagi. Harga tiket masuk sebesar Rp100.000,00. Setelah mendapat diskon, berapakah harga yang harus dibayar oleh Anita?

**Translate:**

Anita plans to go on holiday to Jogja Bay by inviting her Father, Mother, Brother and Sister. Anita then looked for information about Jogja Bay on Instagram, and found info discount as shown in the picture below. Anita with family went on the weekend and chose to leave early. The entrance ticket price is IDR 100,000.00. After get a discount, what price must be paid by Anita?

Figure 3. The example of problem in student worksheet 2

All instruments have been validated and received a valid category. This Classroom Action Research (CAR) was carried out in two cycles, including Cycle 1 and Cycle 2. Study carried out includes planning, acting, observing, and reflecting stages for each cycle.

## Cycle 1

### *Planning stage*

At the planning stage, the researcher prepared a teaching module using the PBL model on material about profit and loss, profit percentage and loss percentage, and taxes. Apart from that, the researcher also prepared 3 students' worksheets for the same topic. Researchers also prepared numeracy test questions and self-confidence questionnaires.

### *Action stage*

In the action stage, the researcher carried out learning in class VII in 3 meetings. The learning process uses the PBL model in the teaching modules that have been prepared.

### *Observe stage*

#### *Results of student self-confidence*

In assessing students' self-confidence levels, a comprehensive approach was undertaken by self-confidence questionnaire. The outcomes of the self-confidence questionnaire at the end of Cycle 1 are detailed in Table 6 below. This meticulous examination of self-confidence provides valuable insights into the evolving dynamics of students' perceptions and self-assurance throughout the learning cycles.

**Table 3.** Cycle 1 Student Self-Confidence

Conclusion Criteria	Categories	Number of Students	Percentage
Score $\geq 65$	Very high	14	46.7 %
$65 > \text{Score} \geq 55$	High	14	46.7 %
$55 > \text{Score} \geq 35$	Low	2	6.7 %
Score $< 35$	Very low	0	0 %

The analysis of Table 3 reveals a diverse distribution of self-confidence levels among the students. Notably, 2 students, constituting 6.7% of the total, fall within the low-confidence category. In contrast, a significant portion of the class demonstrated high levels of self-confidence, with 14 students (46.7%) classified in the high category, and an equal number categorized as very high, contributing another 46.7% to the total.

Observations indicate that many students exhibit confidence by actively participating in class discussions, expressing their opinions freely, and demonstrating assurance in their ability to perform well in post-tests and daily assessments. However, a nuanced aspect emerges from the findings of classroom observations and questionnaires. While students readily share their opinions when prompted by the teacher, a considerable number express feelings of embarrassment and nervousness when spontaneously asked to contribute. This duality in behavior underscores the complexity

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of student confidence dynamics, pointing toward potential areas for targeted intervention and support.

### *Result of student numeracy*

Table 4 presents the post-test scores of Class VII students at JHS 1 Depok. This comprehensive approach aims to systematically enhance students' understanding of social arithmetic concepts, providing a cohesive framework for their learning journey in the initial cycle of PBL.

**Table 4.** Result of Numeracy Test Cycle 1

	Pretest 1	Posttest 1	Gain Criteria
Minimum score	25	26	
Maximum score	98	100	
Mean	66,10	81,27	
Standard deviation	21,73	15,11	
Decrease			7
Gain score "high"			9
Gain score "medium"			13
Gain score "low"			1

The average *post-test 1* score was 81.27. Apart from that, if you look at the n-gain score, there were 7 students whose scores decreased, and 23 other students experienced an increase in their grades.

### *Reflect stage*

Reflection is carried out after the learning activity ends. The results of the reflection regarding students' self-confidence are that a small number of students still do not dare to ask questions about things they don't understand from the teacher's explanation or other groups' presentations, so the researcher plans to make improvements by motivating more students to dare to ask questions. There is still a small number of students who do not dare to express their ideas/opinions, so researchers must encourage students to express their ideas more. Apart from that, based on the results of the self-confidence questionnaire, shows that there are still students who are in the low category. Based on the results of the numeracy test in Cycle I, there was 7 students that the score decreased from the pretest. So, it means that we have to continue to Cycle 2.

## Cycle 2

### *Planning stage*

At the planning stage, researchers prepared teaching modules using the PBL model on a single, gross, tare, and net interest material. Apart from that, the researcher also prepared 2 students' worksheets for the same topic. Researchers also prepared numeracy test

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questions and self-confidence questionnaires.

### *Action stage*

In the action stage, the researcher carried out learning in class VII in 3 meetings. The learning process uses the PBL model in the teaching modules that have been prepared.

### *Observe stage*

*Result of student self-confidence*

**Table 5.** Cycle 2 Students' Self-Confidence

Conclusion Criteria	Categories	Number of Students	Percentage
Score $\geq 65$	Very high	12	40 %
$65 > \text{Score} \geq 55$	High	18	60 %
$55 > \text{Score} \geq 35$	Low	0	0 %
Score $< 35$	Very low	0	0%

Examining Table 5 reveals a noteworthy shift in the distribution of students across self-confidence categories, a particularly significant decrease in those classified under the very high criteria. This decline is attributed to challenges faced by many students in comprehending the bank interest subtopic and the gross, net, and tare subtopics during cycle 2. As a result, students exhibit a reluctance to vocalize their answers or opinions.

Despite this, a positive trend emerges with an increase in the number of students falling within the high self-confidence category during cycle 2. Notably, there is a significant improvement, as no students are categorized under the low self-confidence criteria, indicating that all students have developed the confidence to express their opinions in class, feel confident in test-taking situations, and foster positive dynamics within their peer groups. This nuanced analysis sheds light on the evolving dynamics of self-confidence among students and underscores the potential impact of the learning model on their overall confidence levels.

*Result of student numeracy*

The implementation of the Problem-Based Learning (PBL) learning model is carefully planned by the researcher, focusing on guiding students through a systematic understanding of social arithmetic concepts. To facilitate this process, Student Worksheets have been developed and utilized. Student worksheet 4 centers on the single interest subtopic, while Student worksheet 5 encompasses the gross, net, and tare subtopics.

Following the completion of students' worksheets 4 and 5, an assessment of

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students' comprehension was conducted through post-test 2. The results of this assessment are presented in Table 5, illustrating the post-test scores of Class VII students at JHS 1 Depok.

**Table 6.** Result of Numeracy Test Cycle 2

	Pretest 2	Posttest 2	Gain Criteria
Minimum score	25	48	
Maximum score	92	100	
Mean	60,20	81,57	
Standard deviation	18,21	15,33	
Decrease			0
Gain score "high"			15
Gain score "medium"			6
Gain score "low"			9

The analysis of post-test results reveals that the average score for post-test 2 stands at 81.57. If we look at the pretest to posttest scores in cycle 2, all students experienced an increase in their scores. Most of the improvements are significant, namely at high criteria. This further strengthens that PBL can improve students' numeracy.

### ***Reflect stage***

Based on the reflection carried out at the end of Cycle 2, social arithmetic learning on single interest, gross, tare, and net material has gone well using the PBL model. Students' self-confidence also increased, this can be seen from the results of the student self-confidence questionnaire which showed that all students were in the high and very high categories, and no students were in the low category. In addition, the numeracy test shows that all of the students' score increased, so we do not have to continue the cycle.

Students' self-confidence after participating in learning using the PBL model in social arithmetic material from Cycle 1 to Cycle 2 has increased. Based on the results of Cycle 1, as many as 14 students, or 46.7% had very high self-confidence. Apart from that, 14 other students, or 46.7% of students were in the high category, and the remaining 2 students, or 6.7% were in the low category. In Cycle 2, this increased, namely that there were no students who had low self-confidence. A total of 12 students or 40% had very high self-confidence, and another 18, or 60% had high self-confidence. This is also by research conducted by Andri (2019), affirming the role of the Problem-Based Learning model in boosting students' confidence. The increase in self-confidence questionnaire scores from the high category (70.56) in Cycle 1 to the very high category (80.06) in Cycle 2 serves as tangible evidence of the model's positive influence on students' perceptions of their abilities. These collective findings contribute to the growing body of evidence

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supporting the effectiveness of the Problem-Based Learning model in both numeracy development and the cultivation of self-confidence among students.

Apart from that, other research conducted by Hendirana, Johanto & Utari (2018) also showed that students' self-confidence in getting treatment with the PBL approach obtained better grades than that of students taught by conventional teaching. This is in line with research by Ramadhani (2018) and Rafli & Yusnadi (2018) that the enhancement of students' mathematical problem-solving ability and self-confidence using problem-based learning was higher than conventional learning. Thus, it further strengthens that PBL can increase students' self-confidence.

Students' numeracy abilities after applying the PBL model to social arithmetic material always show an increase from Cycle 1 to Cycle 2. If we look at the n-gain from pretest to posttest, in Cycle 1 there were still students whose scores did not increase, whereas in Cycle 2 all students experienced an increase in scores. The outcomes of the data analysis conducted by the researchers revealed that PBL model can increase numeracy among Class VII students at JHS 1 Depok. The efficacy of the Problem-Based Learning model in fostering focus and confidence among students during teacher interactions is noteworthy. Engaging in group discussions further bolsters students' confidence, fostering a collaborative environment where outcomes are derived from shared thinking. The emphasis on detailed problem reading in the student's worksheet contributes to the overall success of the model in elevating students' numeracy.

These findings align with previous research, such as Fitriono and Rochmad (2015), which advocated for the PBL model with the PMRI approach and PISA assessment, noting its positive impact on students' mathematical literacy abilities. Similarly, research by Franita (2019) underscored the efficacy of PBL in improving students' numeracy. Based on research by Purnadewi and Widana (2023), the implementation of the PBL model based on local wisdom can improve students' science numeracy and learning activities. This is also supported by research by Siska and Maarif (2023) that the STEM-based PBL model has a significant influence on students' numeracy abilities. Several studies increasingly show that PBL can improve students' numeracy.

According to research by Annisa et al (2023) PBL learning plays a role in students' mathematical understanding. Because students' mathematical understanding develops, it will also support students' numeracy abilities. Numeracy problem solving abilities are also related to students' metacognitive abilities (Cahyani et al., 2022). Apart from that,



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based on research by Jannah et al (2022) that numeracy ability is also influenced by student learning achievement. Students with high achievements are able to complete all levels of numeracy/mathematical literacy, while those with medium levels have a maximum of up to level 4, and low achievers only reach level 2. Therefore, there are many things that support students' numeracy abilities, so teachers need to pay attention to these factors which can support students' numeracy abilities. Based on the research findings, it is recommended that future researchers broaden the scope of their studies by applying the PBL model to various mathematical topics beyond social arithmetic, ensuring the model's effectiveness across different content areas. Practically, the findings suggest several contributions to the educational field. Teacher training programs should incorporate PBL training to equip educators with the necessary skills to implement this model effectively. Incorporating local cultural elements into the PBL model can make learning more relatable and effective.

### **CONCLUSION**

In conclusion, numeracy and self-confidence of students at Junior High School 1 Depok class VII F improve after PBL learning on social arithmetic material. The increase in students' numeracy can be seen from the gain score, in Cycle 2 all of the students' scores increased. The Problem Based Learning model also increases students' self- confidence based on the increase in categories achieved by students from Cycle 1 to Cycle 2. Therefore, other researchers can apply PBL to social arithmetic topics or other mathematical topics.

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### CONFLICT OF INTEREST

The authors declare no conflict of interest regarding the publication of this manuscript. In addition, the ethical issues, including plagiarism, misconduct, data fabrication and/or falsification, double publication and/or submission, and redundancies, have been completed by the authors.

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**Margaretha Madha Melissa:** Conceptualization, writing - original draft, editing, and visualization; **Erfiana Nur Laila:** formal analysis, and methodology; **Marcelia Puspita Ningrum:** formal analysis, and visualization; **Odilia Rosa Kusuma:** validation, and methodology.

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