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Investigation of Students' Difficulties in Mathematical Language : Problem-Solving in Mathematical Word Problems at Elementary Schools

Agusfianuddin[1*], Tatang Herman[2], Turmudi[3]
[1*]Doctoral Students of Elementary Education Program, Post-Graduate School,
[2,3]Lecturer of Mathematics Education Program, Faculty of Mathematics and Science Education, Universitas Pendidikan Indonesia.
*Corresponding Author. Email: agusfianuddin@upi.edu

Abstract: This research investigates students' mathematical language difficulties in solving word problems in elementary school. This research method uses a descriptive with a qualitative approach. The research subjects were 52 fifth-grade elementary school students using a purposive sampling technique with students of different abilities, namely upper, middle and lower abilities. Data collection techniques included triangulation data sources through tests, interviews, and questionnaires, as well as data analysis techniques, namely data reduction, data presentation, and drawing conclusions. Research findings show that students with upper and middle ability problem solving are in the "low" category, and students with lower ability are in the "very low" category. Students' difficulties in mathematical language are most dominant in sentence indicators. The dominant error is that students do not write down what they know and ask. The influencing factors are internal factors: students are not used to reading long questions, so word problems are more difficult than telling stories directly; not careful; difficulty connecting to concepts (creating models); and students focus on mathematical symbols, not the language of the problem. External factors: Students are rarely introduced to word problems; the teacher does not use a special approach to word problems material learning; the language in the word problems is not yet communicative and authentic (based on real events, there are actors, settings and themes that are liked); and the environment is less supportive. This research concludes that mathematics word problems have a language structure from informal to formal (symbols) arranged in words, phrases, sentences and discourse. Word problems must be designed with communicative and more authentic language, more continuous learning of word problems is provided in each learning topic, and the learning environment at school and home must be mutually supportive.

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Introduction

Mathematics is significant in developing human thinking, bringing about strategic and systematic thinking processes to analyze and solve problems in various contexts (Raduan, 2010; Phonapichat, 2014). Problem-solving in mathematics at school is usually manifested in the form of word problems. Mathematical problem-solving is a process whereby an individual is confronted with mathematical concepts, skills, and processes to solve mathematical problems (Roebyanto, 2017). Meanwhile, mathematical word problems are texts that depict everyday activity situations using verbal language with questions to be answered using mathematical operations (Verschaffel et al., 2000, as cited in Pongsakdi et al., 2016). Furthermore, mathematical word problems are textual descriptions of mathematical

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problem situations that must be solved with mathematical concepts and procedures (Martin & Mullis, 2013; Phonapichat, 2014). The mathematical procedures referred to are related to problem-solving strategies. Several problem-solving strategies, one of which is developed by Polya (1985) in solving mathematical word problems, include: (1) understanding the problem, where students comprehend the problem, determining what is known and what is asked in the problem; (2) devising a plan, where they plan the solution. A model is required in the solution plan; (3) carrying out the plan, where they execute the plan outlined in the second step, checking each step in the plan and writing it in detail to ensure its correctness; and (4) looking back, where they review the process and results. This review involves drawing conclusions to return the answer to the problem context (according to the problem's question).

Generally, the ability to solve mathematical word problems among students in Indonesia is still relatively low. The research conducted by Agusfianuddin et al. (2020) indicates that one of the difficulties students encounter in solving mathematical word problems is translating mathematical language into correct mathematical symbols. Lowrie & Patahudin (2015) state that the language used in teaching is descriptive of experiences, an active learning activity that develops specific mathematical language to be understood by learners. Thus, language factors play a crucial role in correctly solving mathematical word problems. Meanwhile, Fatmanissa, N. (2017) suggests that language challenges in word problems remain an urgent issue to investigate. The use of problem-solving strategies in teaching word problems to assess students' abilities has proven insufficient. Word problems have two characteristics: mathematical and language.

Therefore, in a discussion related to language, one must understand the definition and hierarchical subsystems of language. Language experts have formulated definitions of language as a system of arbitrary sound symbols used by social group members to cooperate, communicate, and identify themselves (Achmad & Abdullah, 2013; Chaer, 2014). Furthermore, the hierarchical subsystems of language consist of phonology, morphology, syntax, and semantics (Verhaar, 2001; Achmad & Abdullah, 2013; Chaer, 2014). Explanations of the hierarchical subsystems of language are as follows: Firstly, phonology is the study that deals with the sound of each letter in a word. For example, the word "naik" consists of the letters (n, a, i, and k). Hence, phonology is a component that is not particularly important in this research because mathematical word problems are given to higher classes, not lower classes, that still need to learn letter sounds.

Secondly, morphology and syntax (abbreviated as morphosyntax). According to Chaer (2014), morphosyntax consists of (1) words, language units with one meaning. Or words are strings of letters enclosed by two spaces with one meaning. One example of a mathematical word in word problems is the words "naik" (rise), "turun" (fall), "bertambah" (increase), and so on; (2) Phrases. According to Verhaar (2001), a phrase is a group of words that form a functional part of a longer discourse. According to Chaer (2014), a phrase is a syntactic unit, one level below a clause or one level above a word. Mathematical phrase examples in mathematical word problems include phrases like "less than," "more than," "6 times," and so on. (3) Sentences are organized arrangements of words containing complete thoughts (Chaer, 2014). Clauses and sentences have more or less the same grammatical units/structures, so clauses in this writing are included in sentences. Mathematical sentence examples in word problems include "three years ago, the grandmother's age was 60 years," "the mother is 25 years younger than the grandmother," and so on; and (4) Discourse is a complete language unit, making it the highest or largest grammatical unit in the grammatical hierarchy. An example is the entire text of a mathematical word problem. Thirdly, semantics

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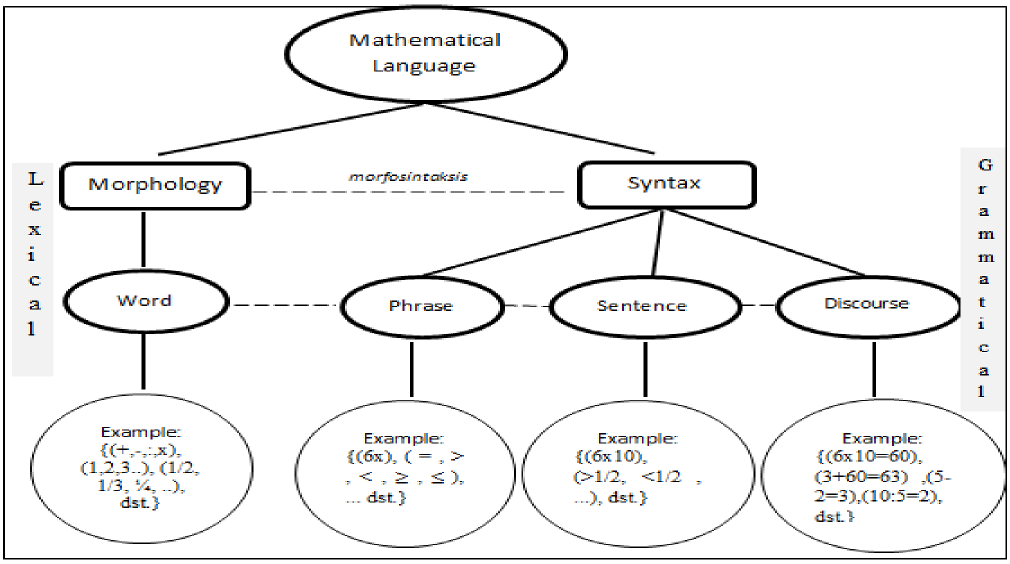
is the science that studies lexical and grammatical meanings. Lexical meaning is the actual meaning (based on dictionaries), for example, the word "sepeda" (bicycle) means a two or three-wheeled vehicle with handlebars, a seat, and a pair of foot-operated pedals for propulsion, and so on. Grammatical meaning is a word that is combined with other elements; for example, the elements "ber" and "sepeda" mean "bersepeda" or riding a bike, and so on (Chaer, 2014).

Meanwhile, in their research, Gafoor, K, A. et al. (2015) discuss more specifically the language structure found in mathematical language structure. According to them, mathematics has its language consisting of several components, namely: (1) content, (2) structure, and (3) function. Where content consists of lexical and grammatical; the structure itself consists of morphology, syntax, and phonology; and the function consists of semantics and pragmatics. Esty, 1992 (as cited in Gafoor, K, A., et al., 2015), mathematical language has specific language features that cannot be compared with other languages, such as representation, equations, process symbols, and relational symbols, while other languages have grammar, syntax, vocabulary, word order, synonyms, negation, conventions, idioms, abbreviations, sentence structures, and paragraph structures.

Language structure is crucial for teachers when designing mathematical word problems. Issues were found among primary school teachers in Alas District who inadequately present word problems to students, resulting in students experiencing difficulties in problem-solving, specifically in word problems. This research must be conducted so that teachers can design authentic and more communicative word problems for students and familiarize students with problem-solving in mathematics through word problems. Based on the objective of this research, which is to investigate students' difficulties in mathematical language when solving word problems, teachers should be able to teach word problems created by themselves that pay attention to the mathematical language structure within them. Furthermore, the mathematical language structure in word problems should be taught by teachers to students, paying attention to words, phrases, sentences, and discourse (the entire text) in the word problems. The mathematical language structure in word problems is illustrated in Figure 1.



Gambar 1. Structure of Mathematical Language in Word Problems

In the above figure, indicators of mathematical language difficulties are depicted, as shown in the following table.

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Table 1. Indicators of Difficulties in Mathematical Language

Mathematical Language	Indicator
Word	Students' difficulty in understanding and converting words into other mathematical symbols, for example: in word problems, the word "bertambah" or "naik" for "+" ; the word "berkurang" or "turun" for "-" ; and the word "setengah" for "½" and so on;
Phrase	Students' difficulty in understanding and transforming phrases into other mathematical symbols, for example: the phrase "6 kali" for "6 x", the phrase "kurang dari" for "<", and the phrase "lebih dari atau sama dengan" for "≥", and so on.
Sentence	Students struggle with understanding and translating sentences into mathematical symbols, such as: the sentence "A has marbles 6 times as many as B" translates into mathematical terms as "A has 6 × B marbles," and the phrase "more than half" translates into "> ½," and so on.
Discourse	Students struggle to understand and transform discourse (the entire text) into other mathematical symbols, for example: students have difficulty understanding the relationship between each mathematical element in word problems. For instance: "A has marbles 6 times as many as B's marbles". "B has 10 marbles." The connection between sentences, i.e., "6x10", and so on.

Research Method

This research method utilised descriptive research with a qualitative approach. According to Moleong (2018), qualitative research is an approach that employs naturalistic methods to seek and understand phenomena experienced by research subjects. The sampling technique used in this study was purposive sampling, which involves selecting samples based on specific criteria (Creswell, J., 2015). The research subjects consisted of 52 fifth-grade students who were categorised into three different ability groups: high, medium, and low. The research occurred in public elementary schools across Alas District, Sumbawa Regency, NTB Province. Data collection techniques involved tests and interviews, where tests were administered to students and interviews were conducted with students and teachers. Data analysis was carried out in three stages: data reduction, data presentation, and drawing conclusions (Miles and Huberman, as cited in Sugiyono, 2018). The validity of the research data was ensured through triangulation of data sources, including student ability tests, semi-structured interviews with students and teachers, and questionnaires distributed to students. Furthermore, to measure the categories of students' mathematical language abilities in solving word problems, a scale was used as follows.

Table 2. Measurement of Mathematical Language Ability

Percentage (%)	Category
>75 % - 100 %	High
>50 % - 75 %	Sufficient
>25 % - 50%	Low
0 % - 25 %	Very Low

(Suryanto, 2021)

Results and Discussion

In this stage, the researcher investigates the test results of three students as participants with different abilities: high, medium, and low. These three students solved 8 mathematical word problems with indicators of mathematical language difficulties, namely word difficulty, phrase difficulty, sentence difficulty, and discourse difficulty. The test results

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depict that the students' answers have errors in each item. Table 3 presents the level of mathematical language difficulty of these three students, as follows.

Table 3. Results of the Questionnare and Tests on Students' Mathematical Language Ability

Students	*Morfosintaksis*								*Percen-tage*	*Category*
	Words		*Phrases*		*Sentence*		*Discource*			
	Questions									
	1	*2*	*3*	*4*	*5*	*6*	*7*	*8*		
HA	√	x	√	x	x	√	√	X	50 %	Low
MA	√	√	x	√	x	x	x	√	50 %	Low
LA	x	x	x	x	x	x	x	X	0 %	Very low
Average	***50%***		***33%***		***17%***		***33%***		***Sentence Difficulty***	

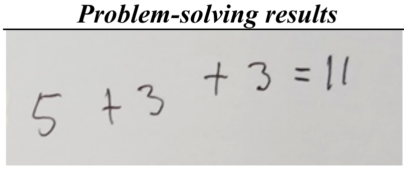
Explanation: x = Difficulty (0) ; √ = Understanding (1)
HA = high-ability; MA= medium-ability; LA= low-ability

Description of Table 3 above shows that the high-ability student (HA) and the medium-ability student (MA) had difficulty answering word problems categorized as "low", while the low-ability student (LA) was categorized as "very low". The average scores for each student's mathematical language proficiency indicators in solving word problems are as follows: (1) words 50%; (2) phrases 33%; (3) sentences 17%; and (4) discourse 33%. Therefore, the most dominant difficulty for students lies in the sentence indicator of mathematical language proficiency. Descriptions of each indicator of mathematical language proficiency are as follows.

1). Mathematical Words

The indicator of mathematical words is presented in questions number 1 and number 2. The difficulty in words in question number 1 is related to the words "naik" (rise) and "turun" (fall). An example of question number 1 "*Andaikan saya sedang berada di lantai 3 di suatu gedung perkantoran yang merupakan gedung berlantai 25. Dari lantai 3 saya **naik** 7 lantai dan kemudian **turun** 5 lantai, dan **naik** kembali 11 lantai. Pada lantai berapakah posisi saya sekarang? (multiple choice questions)*". In question number 1, students can choose from the answer options provided in the question (a. 7; b. 11; c. 15; and d. 16) based on their problem-solving results. In question number 1, the student who experienced difficulty is the low-ability student (LA). The problem-solving process undertaken by the LA student resulted in choosing option b (11), prompting the researcher to conduct an interview with the student. The problem-solving process and interview results for the LA student are as shown in Table 4 below.

Table 4. Mathematical language difficulties in students LA

Problem-solving results	***Interview results***		
	*P*	:	Are you having difficulty with question number 1?
	S	:	Yes Sir
	P	:	Why is your answer 11?
	S	:	Because it ends on the 11th floor.
	P	:	According to the question, what floor are you on now?
	S	:	On the 3rd floor.
	P	:	How many floors are there in total?
	S	:	There are 25 floors.
	P	:	Why is your answer 5 + 3 + 3 = 11?
	S	:	Because the number 3 appears twice, then there is the number 5, and finally the number 11.
	P	:	Why is the number 7 not being added?
	S	:	Confused, sir.

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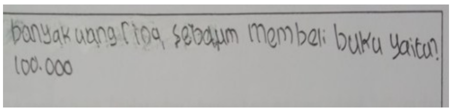
Based on the above Table 4, the low-ability (LA) student had difficulty with the words "naik" (rise) and "turun" (fall) in representing them into mathematical symbols. The word "naik" should be represented by the mathematical symbol "+" and the word "turun" should be represented by the mathematical symbol "–". Therefore, the correct answer is 3 + 7 – 5 + 11 = 16 (option d). Meanwhile, in question number 2, the difficulty lies in the word "seperempat" (one-fourth). An example of question number 2 "*Rina menggunakan **seperempat** dari uangnya untuk membeli buku, yaitu Rp75.000,00. Berapa banyak uang Rina sebelum membeli buku?(multiple choice questions)"*. In question number 2, the answer options are (a. 100,000; b. 200,000; c. 350,000; and d. 300,000). The problem-solving difficulty in question number 2 is experienced by both the high-ability (HA) and low-ability (LA) students. The LA student did not write down the problem-solving procedure but directly chose answer option 100,000 (a). Meanwhile, the HA student also did not correctly document the problem-solving procedure but directly wrote the conclusion of the answer, as seen in Table 5 along with the interview results with the researcher, as follows.

Table 5. Mathematical language difficulties in students *HA*

Problem-solving results			***Interview results***
	*P*	:	Are you having difficulty with question number 2?
	S	:	Yes
	P	:	What is known in the problem?
	S	:	Rina bought a book priced at 75,000 (while reading the problem).
	P	:	How much money did she have before buying the book?
	S	:	100.000
	P	:	Why 100,000? Why not 200,000 or 300,000?
	S	:	I don't understand yet, sir.
	P	:	If a quarter (1/4) of Rina's money is known to be 75,000, then a quarter (1/4) of 100,000 would be how much?
	S	:	I don't know, sir.

Based on Table 5 above, both the high-ability (HA) and low-ability (LA) students had difficulty with the word "seperempat" (one-fourth) in representing it into mathematical symbols. Consequently, the students assumed that Rina's money was 100,000. However, "seperempat" actually equals 75,000 (1/4 = 75,000). Therefore, 1 = 75,000 x 4 = 300,000. This means the correct answer is option d.

Thus, the researcher's conclusion regarding students' difficulties with mathematical words is that the students are not thorough and do not understand the meanings of mathematical words in word problems. This finding is consistent with the research conducted by Rindyana & Chandra (2012) and Seifi et al. (2012), which found that students have difficulty solving mathematical word problems because they cannot define the vocabulary in the word problems. Similarly, the research by Verschaffel et al., 2000 and Verschaffel et al., 2010 (cited in Fatmanissa, 2017) found that in solving mathematical word problems, students tend to focus only on numbers or symbols rather than vocabulary. In those studies, the word problems were presented in the students' native language, so the challenge was not translation-related but rather how students made meaning from the vocabulary.

2). Mathematical Phrases

The indicator of mathematical phrases in question number 3 is "6 kali" (6 times). In question number 3, the students who experienced problem-solving difficulties are the

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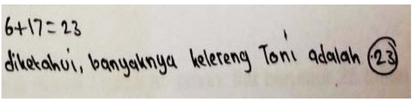
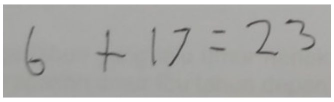
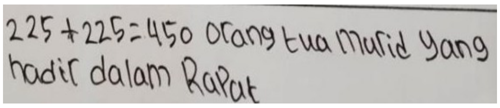
medium-ability (MA) and low-ability (LA) students. An example of question number 3 "*Toni memiliki kelereng sebanyak **6 kali** kelereng Jono, jika Jono memiliki 17 kelereng. Berapakah banyak kelereng Toni?(multiple choice questions)"*. The answer options for question number 3 are (a. 102; b. 23; c. 11; and d. 642). Based on the problem-solving results, both the medium-ability (MA) and low-ability (LA) students faced a common difficulty, which is representing the phrase "6 kali" (6 times) into mathematical symbols, as seen in Table 6 below.

Table 6. Mathematical language difficulties in students *MA and LA*

Problem-solving results MA	***Problem-solving results LA***
	

The interview results with both students revealed that they simply matched the numbers in each answer option with the result of adding two numbers without considering the phrase "6 kali" as the key to the answer in the question. However, the correct interpretation of the phrase "6 kali" should be "6 times the number of marbles Jono has". Therefore, 6 x 17 = 102. Next, in question number 4, the difficulty lies in the phrase "lebih dari setengah" (more than half). An example of question number 4 "*Sebanyak 225 orang tua siswa diundang dalam suatu rapat di sekolah. Menurut kepala sekolah, diperkirakan **lebih dari setengah** orang tua yang diundang akan menghadiri rapat. Berapa banyak orang tua yang akan hadir dalam rapat menurut kepala sekolah?(subjective answer)"*. Question number 4 is a subjective question, meaning it has more than one possible answer, and students can choose their answer based on the problem-solving procedure they consider correct. In question number 4, the students who experienced difficulty with the phrase are the high-ability (HA) and low-ability (LA) students. The LA student did not write down their answer. Meanwhile, the HA student's problem-solving process and interview results are described in Table 7 below.

Table 7. Mathematical language difficulties in students H*A*

Problem-solving results	***Interview results***
	*P* : Are you having difficulty with question number 4? *S* : Not *P* : What is known in the problem? *S* : 225 parents were invited to the meeting by the school principal. *P* : What else is known and what is being asked? *S* : More than half of the parents attended. How many parents will attend? *P* : Why is your answer 450 parents will attend? *S* : Because more than half, so 225 + 225 = 450. *P* : Why is your answer like that (225+225)? *S* : Because it's more than half. *P* : Please read the question carefully.

In this case, both students KA and KB struggled to represent the phrase "lebih dari setengah" (more than half) into mathematical symbols. Student KA represented the phrase "lebih dari setengah" as doubling 225 parents, resulting in 225 + 225. However, the correct answer should be half of 225, which is 225 : 2 = 112.5 or rounded to 113. Since it's "more than half,"

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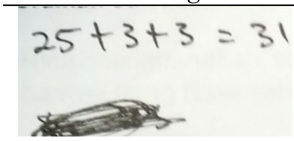
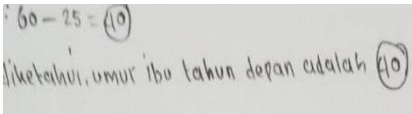
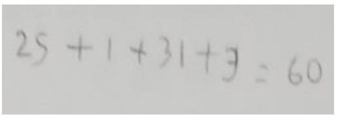
the correct answer could be 114, 115, 116, and so on. Rahmania & Rahmawati (2016) conducted a study analyzing students' difficulties with mathematical language through word problems. An example of a word problem given to students is: "A farmer has a rectangular piece of land. The width of the land is 6 meters less than its length. If the perimeter of the land is 60 meters, determine the area of the farmer's land." In this problem, some students struggled with the phrase "lebih pendek" (less than) and thus gave incorrect answers, misunderstanding that the width subtracted by 6 is the length. Furthermore, the research by Roccomini et al. (2015) found that students struggle with phrases in word problems, such as understanding the phrase "garis paralel" (parallel lines). Roccomini et al. (2015) attempted to address this difficulty by using graphical representations in word problems, depicting "a pair of elves" walking on tracks that will not intersect, serving as a replacement for parallel lines or lines that run parallel.

3). Mathematical Sentences

The indicator of mathematical sentences in question number 5 is every sentence present in the problem. An example of question number 5 "*Tiga tahun yang lalu umur nenek adalah 60 tahun. Ibu berumur 25 tahun lebih muda dari nenek. Berapakah umur Ibu tahun depan?(multiple choice questions)*". In question number 5, the answer options are (a. 31; b. 40; c. 50; and d. 39). Investigation of the problem-solving results shows that both students KA, KM, and KB provided incorrect or wrong answers. Each of them had different problem-solving outcomes, as shown in Table 8 below.

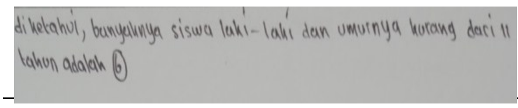
Table 8. Mathematical Language Difficulties for Students HA, MA, and LA

Problem-solving results HA	*Problem-solving resultsMA*	*Problem-solving results LA*
		

Based on the interview results, the researcher can describe the problem-solving outcomes of the three students as follows: they struggled to represent the sentence "tiga tahun lalu umur nenek 60 tahun" (three years ago, the grandmother's age was 60 years), which, when simplified, becomes "the grandmother's age now is 63 years." In this case, the students only focused on the number 60, while they overlooked the phrase "tiga tahun lalu" (three years ago). Furthermore, in the sentence "ibu berumur 25 tahun lebih muda dari nenek" (the mother is 25 years younger than the grandmother), the students only focused on the number 25, while they failed to pay attention to the phrase "lebih muda" (younger).

Next, the difficulty with mathematical sentences in question number 6 is based on every sentence present in the problem. An example of question number 6 *"Dari 25 orang siswa kelas V SD diketahui 7 orang berumur lebih dari 11 tahun dan 15 orang siswa perempuan. Diantara siswa perempuan 5 orang berumur lebih dari 11 tahun. Berapakah banyaknya siswa laki-laki dan umurnya kurang dari 11 tahun ?(multiple choice questions)"*. In question number 6, the answer options are (a. 6 people; b. 7 people; c. 8 people; and d. 9 people). In this question, students KM and KB experienced difficulty. Student KB did not provide an answer, while student KM chose option a (6 people), as described in the problem-solving description in Table 9 below.

Table 9. Mathematical Language Difficulties for Student MA

Problem-solving results			***Interview results***
	P	:	Are you having difficulty with question number
	S	:	Yes

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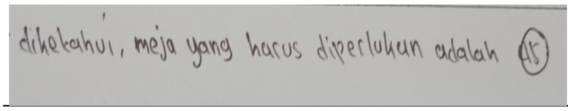
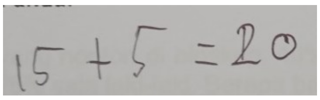
P	:	What is known in the problem?"
S	:	(The student reads the question again)
P	:	What else is known and what is being asked?
S	:	(The student reads the question again)
P	:	Why is your answer 6 people?
S	:	The question is difficult and lengthy, sir.

Based on the problem-solving outcome conducted by KM and reinforced by the In the interview results, it is evident that KM struggled to interpret each sentence in the problem. According to KM, the problem was too difficult. If the problem were simplified, the student might understand each sentence better. For example "*Siswa kelas V ada 25 orang dan 15 orang diantaranya perempuan. Berumur lebih dari 11 tahun berjumlah 5 orang perempuan dan 2 orang laki-laki. Berapakah siswa laki-laki umurnya kurang dari 11 tahun? (multiple choice questions)*". In question number 6, the design separates the number of genders and ages into different sentences, thus challenging students to think at a higher level. It also contributes to the student's difficulty due to the lengthy questions. Research conducted by Gafoor, A.K., et al., (2015) and Seifi, et al., (2012) found that one of the language difficulties students face in solving mathematical word problems is not only identifying keywords (known and unknown), but also analyzing sentences, exceptionally long sentences in word problems.

4). Mathematical discourse

The indicator for discourse (the entire text) in questions number 7 and 8 refers to the entire text in the question. An example of question number 7 "*Sebanyak 150 siswa diundang pada acara perayaan ulang tahun kepala sekolah yang bertempat di rumah makan. Jika siswa diminta menempati meja makan dengan masing-masing 6 kursi di setiap meja. Berapa meja yang diperlukan?(multiple choice questions)".* Question number 7 has answer options (a.20; b.25; c.30; and d.45). Students who experienced difficulties in problem-solving are MS and MB. The description of their problem-solving results can be seen in Table 10 below.

Table 10. Mathematical Language Difficulties in Students MA and LA

Problem-solving results MA	*Problem-solving results LA*
	

Based on the problem-solving results conducted by students KM and KB and the interviews with both, the researcher concludes that their difficulties lie in representing each sentence in the discourse into mathematical symbols. Consequently, they needed help finding the appropriate arithmetic operations to use in problem-solving. Meanwhile, the next discourse difficulty lies in question number 8. An example of question number 8 *"Tiga loyang kue, masing-masing dipotong menjadi 4 sama besar. Masing-masing potong kue dihiasi buah ceri dalam jumlah yang sama. Agus memakan 1 potong kue. Sekarang tinggal tersisa 22 buah ceri. Berapa jumlah buah ceri dalam 1 loyang kue? (multiple choice questions)".* The answer options for question number 8 are (a.4; b.8; c.22; and d.24). The students who encountered difficulties in problem-solving are students KA and KB. Student KB did not provide an answer. Meanwhile, student KA described their problem-solving process in Table 11 below.

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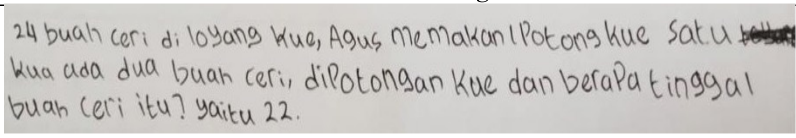
Table 11. Difficulties in Mathematical Language for Student HA

Problem-solving results HA


Based on the problem-solving results of students KA and KB, along with their interview outcomes, the researcher concluded that their difficulty lies in representing sentences within the discourse into mathematical symbols due to the lengthy texts. The study by Ulu (2017) found that students struggle to answer mathematical word problems and often perform arithmetic operations (addition, subtraction, multiplication, and division) without understanding the underlying reasons. Additionally, research by Fatmanissa, N., et al. (2017); Gafoor, A.K., et al. (2015); and Seifi et al. (2012) suggest that discourse in mathematical word problems is constructed by language. Various language difficulties in solving word problems include challenges in identifying key terms (known and unknown), mathematical vocabulary comprehension, analyzing lengthy sentences, and understanding the entire discourse.

Some of the mistakes made by students in answering word problems with mathematical language difficulty indicators from questions 1 to 8 include: 1) not writing down what is known and what is asked; 2) making inappropriate models or not making any model at all; 3) not documenting the problem-solving procedure or documenting it incorrectly; and 4) providing answers that do not align with the context. Similar to the research conducted by Gunawan, A. (2017), the types of errors students make in solving word problem scenarios include several aspects: 1) understanding the problem by documenting what is known and what is asked (failure to document, incomplete documentation, copying verbatim from the problem, or documenting known information when asked about it, or vice versa); 2) creating mathematical models (failure to create a model, or creating an inaccurate model); 3) performing calculations (not following procedures, or making incorrect calculations); and 4) drawing conclusions (not aligning with the context of the answer, not documenting at all, or copying verbatim from the question). In their research, Sepeng, P., et al. (2013) stated that students' difficulties in answering text-based mathematical word problems are caused by their lack of understanding of the mathematical vocabulary present in the text or problem.

The investigation through direct interviews with mathematics teachers revealed factors contributing to students' language difficulties in solving word problems, both internal and external. Internal factors include: 1) students are not accustomed to reading lengthy problems, making word problems more challenging than direct storytelling; 2) lack of attention to detail among students; 3) difficulty in connecting concepts (creating models); dan 4) students' focus is on mathematical symbols rather than the language of the problem. External factors include: 1) students are rarely introduced to word problems; 2) minimal use of media in teaching; 3) lack of specific approaches to teaching word problem materials; dan 4) lack of support from both family and school environments. In their research, Utari, et al. (2019), found that factors influencing students' learning difficulties in solving word problems include internal factors such as students' negative attitudes towards mathematics, lack of motivation, leading to less carefulness and understanding of mathematical concepts. External factors also play a role, such as teachers' lack of teaching variety and utilization of learning media, as well as an unsupportive family environment due to parents' insufficient attention to their children's learning.

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Field observations indicate that students experience more difficulty with the mathematical sentence indicator than the discourse indicator. According to interviews with teachers, some word problems with discourse indicators, despite containing long sentences, use communicative language. However, some problems with sentence indicators include not only having long sentences but also using language that is less communicative or authentic (not in line with students' experiences). This aligns with the findings of Sumarwati (2013), indicating that language usage in word problems is generally difficult for students to understand, suggesting that their construction may not align with students' language competencies or lack communicativeness. Communicative word problems are easier for students to understand because they involve actors, settings, and themes that students like and are familiar with.

The theoretical implications of this research findings are that mathematical word problems have a language structure ranging from informal to formal mathematical language (symbols) in the form of words, phrases, sentences, and discourse (the entire text). The mathematical language in word problems is not easy for students to learn; it requires practice in thinking, reading, speaking, and writing about information to represent it accurately. The practical implications of this research findings are that teachers should design word problems with communicative and authentic language, continuous practice of word problems should be provided in every learning topic, and the learning environment at school and home should support each other.

Conclusion

The conclusion drawn from this research is that students with high and medium abilities face a "low" level of difficulty in solving mathematical word problems. In contrast, those with low abilities encounter a "very low" difficulty level. According to the average scores of mathematical language abilities, the primary challenge for students is the indicator of mathematical sentences. The most common mistake students make in problem-solving is failing to write down the known and asked-for information. Factors contributing to students' difficulties in mathematical language can be classified as internal and external factors. Internally, students are not accustomed to reading lengthy problems, making word problems more challenging than direct storytelling; they lack precision, struggle with connecting concepts (creating models), and often focus on mathematical symbols rather than the language of the problem. Externally, students are seldom exposed to word problems, teachers do not employ specific approaches in teaching word problem materials, the language in word problems lacks communicativeness or authenticity (corresponding to real-life events, including actors, settings, and preferred themes), and the learning environment lacks support.

The theoretical implications of this research suggest that mathematical word problems exhibit a language structure ranging from informal to formal mathematical language (symbols) across various forms, including words, phrases, sentences, and discourse (the entire text). Learning mathematical language in word problems is challenging for students and requires practice in thinking, reading, speaking, and writing about information to represent it accurately. The practical implications underscore the importance of teachers designing word problems with communicative and authentic language, providing ongoing learning of word problems in each topic, and fostering a supportive learning environment for students in school and home settings.

Recommendation

Future researchers should involve more teachers in developing contextual mathematical word problems since teachers are the ones who have a better understanding of the actual learning situations and environments of students. Mathematics teachers should be able to develop mathematical word problems using communicative and authentic language in classroom learning.

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