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Preschool children's skills in solving mathematical word problems

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This study aims to investigate the mathematical word problem-solving skills of preschool children 5-6 ages. To achieve this objective, the data were collected in four preschools (n=162). A mathematical word problem test was used as data collection tools. In this study, it was found that the children's skills at solving mathematical word problems based on addition and subtraction were at a medium level. In terms of sub-categories, the children were found to do better with result-unknown problems but to have difficulties with initial-unknown problems. The most difficult problem type for the children was the compare category. Next, it was found that the children's achievement was higher when they were addressed with "you-language", with you the second person singular form in Turkish. Gender was found to be an inefficient variable. However, it was observed that the children's achievement increased as they grew older. As a result, it is not only result-unknown problems they have but also different examples from other categories in preschool.

Key words: Preschool period, problem solving, mathematical word problems.

INTRODUCTION

Problems are difficult situations that a person has not previously encountered and feels unprepared to solve. For preschool children, the world is new; as a result, each new situation that they encounter is in fact a natural problem. When children in this period of life first come across a new situation, they primarily wonder about it. Thereafter, however, they approach this situation with more flexibility and reason (NTCM, 2008).

Problem solving opens a new horizon in children's mathematical thinking and presents them with opportunities to understand mathematics. Consequently, problem-solving skills are an important tool to evaluate children's mathematical thinking (Charlesworth and Leali, 2012).

According to National Council of Teaching of Mathematics (NCTM, 2000), students should be acquainted with new information through problem-solving skills from preschool until the end of secondary school, improve their mathematical problem-solving skills, use different strategies to solve problems and implement their already-acquired knowledge in new and different situations. In other words, it has been noted that problem solving is at the centre of mathematics teaching. Similarly, De Corte et al. (2000) claim that inclusion of verbal problems into the school curriculum is potentially important as they show children when and how to implement their mathematical knowledge into daily life situations.

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Carpenter et al. (1985) mention that children can analyze some simple word problems such as addition and subtraction before they start their formal education. They add that children can make use of their fingers, physical objects around them or very sophisticated counting strategies in order to understand the relationships given in problems. However, the mathematical problems that preschool children must solve are limited with respect to age characteristics. These children do not need to know mathematical symbols (+, -, =). They can only answer certain problems that are correctly formulated in word form. For example, a child may not solve the operation 3+2=?; however, he can easily answer a word problem such as “Adam has 3 marbles. He wins 2 more in the game. How many marbles does he have now?”

Mathematical word problems

Solving mathematical word problems helps children make connections between conceptual and mathematical knowledge. Through problem solving, they can easily establish and develop these connections. These problems teach students to make use of the knowledge and skills that they have learned in school while solving problems in their real lives. According to the revision of the related literature (Nesher et al., 1982; Carpenter and Moser, 1981; Nesher, 1980; Van De Walle, 2001), the researchers categorized the verbal problems related to addition and subtraction in terms of the relationshops they were based on. In line with their analysis of prior research Nesher et al. (1982) said that they can group word problems semantically in three groups: combine, change and compare. This categorization was handled differently in the past research. To exemplify; combine problems were referred as “static” by Nesher (1980) and as “part-part-whole” by Carpenter and Moser (1981). Also, change problems were called as “joining and separating² by Carpenter and Moser (1981) and as dynamic by Nesher (1980). In this research, the explanation by Van De Walle (2001, p. 109) was followed as it extensively covered all other groupings. Therefore, in line with this explanation; word problems were grouped in four as joining, separating, part-part-whole and comparing. In expressing these problems, there are three elements: beginning, change and conclusion. The problems were sub-categorized when one of these elements was unknown. The explanations related to this categorization and sub-categories were given below:

Join problems: In these problems, there are three amounts: the initial, the change (the part being added or joined) and the result (the amount that results from the operation). One of these may be the unknown element in the problem. The sub-categories and examples based on them are as follows:

Join: Result unknown: Sara had 3 marbles. Eren gave her 4 more. How many marbles does Sara have altogether?
Join: Change unknown: Sara had 3 marbles. Eren gave her some more. Now Sandra has 7 marbles. How many did Eren give her?
Join: Initial unknown: Sara had some marbles. Eren gave her 4 more. Now Sandra has 7 marbles. How many marbles did Sara have to begin with?
Separate: In separate problems, the initial amount is the whole or the largest amount, whereas in join problems, the result is the whole. In separate problems, the change means the difference in a quantity from the initial quantity. The sub-categories and related examples are as follows:

Separate: Result unknown: Sara had 7 marbles. She gave 4 marbles to Eren. Now Sandra has 7 marbles. How many marbles does Sara have now?
Separate: Change unknown: Sara had 7 marbles. She gave some to Eren. Now Sandra has 3 marbles. How many did she give to Eren?
Separate: Initial unknown: Sara had some marbles. She gave 4 to Eren. Now Sandra has 3 marbles left. How many marbles did Sara have to begin with?

Part-part-whole problems: Part-part-whole problems involve two parts that are combined into one whole. The combining may be a physical action or a mental combination in which the parts are not physically combined. The sub-categories and related examples are as follows:

Part-part-whole: Whole unknown: Eren has 3 yellow marbles and 4 blue marbles. How many marbles does he have?
Part-part-whole: Part unknown: Eren has 7 marbles. Three of his marbles are yellow marbles, and the rest are blue marbles. How many blue marbles does Eren have?

Compare problems: Compare problems involve the comparison of two quantities. The third amount is not actually present but is the difference between the two amounts. However, the third amount is the difference between the two already-given amounts. The sub-categories and the related examples are as follows:

Compare: Difference unkown: Eren has 7 marbles and Sara has 4 marbles. How many more marbles does Eren have than Sara?

Compare: Larger unknown: Eren has 3 more marbles than Sara. Sara has 4 marbles. How many marbles does Eren have?

In the related literature, studies about pre-school children's problem solving skills are available (Altun et al., 2001; Carpenter et al., 1983; Carpenter et al., 1993; Davis and Pepper, 1992; Manchesa et al., 2010; Monroe, and Panchyshyn, 2005; Patel and Canobi, 2010; Tarım, 2010; Tarım and Artut, 2005). However; it has been thought that more studies about preschool children skills in problem solving are needed. In Turkey, no studies investigating pre-school children's addition-subtraction based mathematical word problems in line with the categories mentioned above have been found. Therefore, it has been thought important to consider the children's all answers to all problem categories regarding age factor.

In relation to this, Cummins et al. (1988) state that word mathematical problems are clearly demanding for children to solve. They claim that this can derive from the difficulty in understanding abstract or ambiguous language, so it was thought that it can be important to investigate the effect of the language used during the presentation of the problems on the children's performance of word mathematical problems.

In line with this background, the research questions of this study are as follows:

1.What is children's general achievement of word mathematical problems based on addition and subtraction ?
2.How is the children's general achievement of word mathematical problems based on addition and subtraction in terms of gender and age ?
3.What is the children's' achievement of problems with small numbers and problems with large numbers in each category ?
4.What is the children's achievement of problem solving for the problems in each category in terms of the language used (you-language, show-language) ?

METHOD

Sample

The sample of this study was children 5-6 ages attending four preschools in a city in the South of Turkey. Children between 5-6 years of age were divided into three groups according to months (60-66 months, 67-70 months, 71 months and older). Their problem-solving skills were analyzed in detail. One hundred sixty-two children (88 girls and 74 boys) participated in the study, which aimed to investigate the children's skills relating to word mathematical problems. Furthermore, because one of the main objectives of this study was to analyze whether the method of presenting problems in class affected children's achievement, 16 children (10 girls and 6 boys) were interviewed. The children were, on average, 68 months old and were not yet literate. Table 1 gives information on the ages and genders of the children in the study.

As seen in Table 1, while the children 67-70 months old were mostly girls, the numbers of girls and boys in the other age groups were nearly equal.

For detailed interviews, a total of 16 children from different achievement levels were chosen from 162 children by the teachers: 5 children from the low level, 6 children from the mid-level and 5 children from the high level.

Data collection tools

A word mathematical problem test was used as a data collection tool. The problem test was prepared by the researcher herself, referring to the related literature and including all the problem categories (Carpenter and Moser, 1981; Van De Walle, 2001). This test was presented to 5 experts in the field of mathematics teaching and 3 preschool teachers to obtain their feedback. The test was revised to incorporate their comments and then finalised.

In the joint category of the problem test, there are 24 items (Appendix 1): 10 in the join category, 4 in the separate category, 4 in the part-part-whole category and 6 in the compare category. Problems in each category were presented in two different ways; with small numbers and big numbers. For example; 5 of the 10 problems in the join category were based on small numbers (the numbers from 1 to 5) and the other five were based on large numbers (one of the numbers in the problem was five or higher). Also, the problems were organized in a way that their results would be 10, the highest.

Table 2 shows the categories and sub-categories in the problem test and the symbolic models of the problems. The KR-20 value of the mathematical word problem test was estimated as 0.90.

Cummins et al. (1988) state the difficulties children experience in understanding the expression in the problem cause children to face with word mathematical problems. Therefore; the way that the problems in the problem test of this study was presented was changed and administered to 16 children. By doing so, it was aimed to determine the effect of the language used and the way the problems was presented on the children' understanding of the problems and their problem solving skills.

This problem test given above was presented differently and re-administered to 16 children. The problems that could not be solved in their initial versions were re-asked to the same children using "you-language". "You-language" (with you the second person singular form in Turkish) is the language adaptation of the problem, focusing on the child as an active doer of the operation. If this method did not work, the problem was re-asked using "show-language". "Show-language" is a way of guiding the child to use his fingers or other objects to visualise the mathematical operation in the problem.

Data collection

The data collection was conducted in two phases. In both phases, the children were individually interviewed in quiet classrooms in their schools. During the interviews, some objects (counting blocks and beans) were available for the children to use to solve word mathematical problems. Before the children were interviewed, a short introductory speech was given to help them understand the process. Each phase is explained below.

In the first phase, the problems in the problem test were verbally asked to the children. Before the researcher asked the question, she gave instructions, such as "You can use your fingers or counting blocks to answer the questions." The child answered the question using any objects that he wanted or through mental calculation. The researcher recorded the children's answers on a form. The interviews lasted 30-35 minutes. Correct answers were coded as "1". Incorrect answers were coded as "0". Partially correct answers were also coded as "0".

The aim of the second phase was to determine whether the way

Table 1. The gender and age characteristics of the children (n=162).

Age group	Gender				Total	
	Female		Male			
	F	%	F	%	f	%
1 (60-66 months)	20	43	26	57	46	100
2 (67-70 months)	45	65	24	35	69	100
3 (71 months and older)	23	49	24	51	47	100

Table 2. The structure of the problems in the problem test

Main category	Sub-category	Problem no	Symbolic model
Joint	Result unknown	1	1+3=?
		3	4+2=?
		7	2+3=?
		9	5+3=?
		11	4+5=?
		13	3+6=?
	Initial unknown	2	?+3=4
		4	?+3=7
	Change unknown	15	2+?=5
		18	3+?=8
Separated	Initial unknown	5	?-1=4
		6	?-3=5
	Change unknown	8	4-?=1
		10	7-? =2
Part-part-whole	Whole unknown	12	2+3=?
		17	3+5=?
	Part unknown	14	1+?=4
		16	3+?=8
Comparism	Difference unknown	19	3-2=?
		20	6-3=?
	Larger unknown	21	?-1=2
		24	?-2=3
	Smaller unknown	22	5-?=3
		23	7-?=4

of presenting the problems to children influenced their problem-solving achievement. Sixteen children participated in this phase. The steps were as follows:

Step 1. The problems are read as they are in the problem test. The children are not given any clues. If the child is able to solve the problem, his method of solving it is recorded. The number of times that the question is read to the child is also recorded. If the child cannot solve the problem, then the child proceeds to the next step.

Step 2. The problem is asked to the child using "you-language".
For example, "Eren had 1 balloon, . Sara gave him 3 more. How many balloons does Eren altogether?"

This problem is reformulated as follows:

Table 3. The Kruskall Wallis Test results of the problem test total scores according to age

Age	n	Mean of the rank	sd	χ^2	Significant difference
1 (60-66 months)	46	73,33	2	7,24	3>1, 3>2
2 (67-70 months)	69	76,50			
3 (71 months and older)	47	96,84			

"You had 1 balloon. Then, I gave you 3 more balloons. How many balloons do you have now?"

If the child gives the correct answer, then the next question is asked. If the answer is not correct, then the child proceeds to the next step.

Step 3. The problem is asked through "show-language". *The problem is reformulated as follows:*

"Eren had 1 balloon. Show me (through fingers or counting objects). Then, Sara gave him 3 more balloons. Show this to me, too. How many balloons does Eren have now?

If the child gives the correct answer, the next problem is asked. If the answer is not correct, the child is regarded as unsuccessful in solving this problem.

Data analysis

The data based on 162 children were statistically analysed. Because the normality assumption was not met in the data obtained, non-parametric tests were used for the analysis of the data. The Mann-Whitney U test was used to compare the children's total scores according to gender. The Kruskall Wallis test was used to compare the total scores with regard to age groups. For descriptive purposes, frequencies and percentages were calculated for some variables.

To describe the interview data with 16 children, frequencies and percentages were calculated. Questions 9, 21, 22, 23 and 24 were not considered because they could not be answered by the children.

FINDINGS

First, the data based on the problem test administered to 162 children were analysed. The data analysis showed that the mean score of 24 problems was 12.59 (SS=4.99). The means of the children's scores were, respectively, 6.04 (SS=2.34) of 10 join problems, 2.74 (SS=1.17) of 4 separate problems, 3.00 (SS=1.30) of 4 part-part-whole problems and .79 (SS=1.39) of 6 compare problems.

No significant difference was found in the total scores on all the questions between girls and boys (U=2999.50, $p>.05$). Consequently, gender was not considered in the follow-up analysis. Table 3 notes the findings of the Kruskall Wallis test by age group.

As seen in Table 3, a significant difference was observed in the children's scores from the problem test by age group (Chi-square (2)=7.24, $p=.03$). Children 71 months and older were found to have better results than children 60-66 and 67-70 months old. Tables 4, 5, 6 and 7 show the percentages of correct answers to the problem test by age group.

Table 4 shows that the children mostly gave correct answers to result-unknown questions. Taking a closer look at this group, it is observed that the achievement scores were higher with the problems with smaller numbers than the problems with larger numbers. The achievement scores were very low with the initial-unknown problems. In general, it was found that the scores improved as the children grew older.

As seen in Table 5, in the sub-categories of the separate problems, more mistakes were found in the initial-unknown problems than in the change-unknown problems. Especially in the initial-unknown problems, the percentage of correct answers was low when the problems included larger numbers. Similarly, in the change-unknown sub-category, the achievements were higher on the problems including small numbers than on those with large numbers. In a general sense, the percentage of correct answers increased in the separate category as the children grew older.

As Table 6 shows, in both sub-categories of the part-part-whole category, the percentage of correct answers to the problems with small numbers was higher than those to the problems with large numbers. Additionally, children 60-66 and 67-70 months old gave similar numbers of correct answers; however, children 71 months old and older gave more correct answers. Additionally, it was found that the percentage of correct answers was similar in problems of part-unknown and whole-unknown.

Table 7 shows that the percentage of correct answers was quite low in all the age groups and in each sub-category of compare problems. Although the difference was small, there were more correct answers in each sub-category of compare problems with small numbers. The incorrect answers in the compare category were then examined, and it was observed that most of the children could identify which quantity was the greater of two but could not identify to what extent the quantity was greater or smaller than the other.

As for the influence of the problem presentation on the children's problem-solving achievement, the interview

Table 4. The frequencies and percentages of answers to the join problems according to age.

Category	Sub-category	Symbolic model		60-66 months (n=46)	67-70 months (n=69)	71 months and older (n=47)
Join	Result Unknown	1+3=?	f	45	66	45
			%	97.8	95.7	95.7
		4+2=?	f	38	61	43
			%	82.6	88.4	91.5
		2+3=?	f	41	63	43
			%	89.1	91.3	91.5
		5+3=?	f	35	60	40
			%	76.1	87.0	85.1
		4+5=?	f	27	43	35
			%	58.7	62.3	74.5
		3+6=?	f	22	38	33
			%	47.8	55.1	70.2
	Initial Unknown	?+3=4	f	14	15	17
			%	30.4	21.7	36.2
		?+3=7	f	11	9	6
			%	23.9	13.0	12.8
	Change Unknown	2+?=5	f	19	31	27
			%	41.3	44.9	57.4
		3+?=8	f	13	21	19
			%	28.3	30.4	40.4

Table 5. The frequencies and percentages of the answers to the separate problems according to age.

Category	Sub-category	Symbolic model		60-66 months (n=46)	67-70 months (n=69)	71 months and older (n=47)
Separated	Initial Unknown	?-1=4	f	31	47	45
			%	67.4	68.1	95.7
		?-3=5	f	11	22	21
			%	23.9	31.9	44.7
	Change Unknown	4-?=1	f	37	57	43
			%	80.4	82.6	91.5
		7-? =2	f	33	56	42
			%	71.7	81.2	89.4

data with 16 children were analysed. Table 8 illustrates the distribution of the answers.

As observed in Table 8, half of the children's answers were wrong. Then, the correct answers were considered, and it was found that 18% of the children could not solve the problems in their first reading but could solve the same problem when "you-language" and "show-language" were used.

Table 9 gives descriptive information about the method of presenting the problems along with the children's achievement.

A close look at Table 9 reveals that the answers of the low-achieving children were (91%) incorrect. However, when the problems were asked through "you-language" and "show-language", correct answers at the rate of 8% were obtained. Half of the answers of the medium-

Table 6. The frequencies and percentages of the answers to the part-part-whole problems according to age

Category	Sub-category	Symbolic model		60-66 months (n=46)	67-70 months (n=69)	71 months and older (n=47)
Part-part-whole	Part Unknown	2+3=?	f	36	51	41
			%	78.3	73.9	87.2
		3+5=?	f	31	45	38
			%	67.4	65.2	80.9
	Whole Unknown	1+?=4	f	36	53	44
			%	78.3	76.8	93.6
		3+?=8	f	26	47	37
			%	56.5	68.1	78.7

Table 7. The frequencies and percentages of the answers to the compare problems according to age.

Category	Sub-category	Symbolic model		60-66 months (n=46)	67-70 months (n=69)	71 months and older (n=47)
Comparism	Differences Unknown	3-2=?	f	9	14	15
			%	19.6	20.3	31.9
	Result unknown	6-3=?	f	9	9	11
			%	19.6	13.0	23.4
	Larger Unknown	?-1=2	f	11	15	6
			%	23.9	21.7	12.8
		?-2=3	f	3	6	2
			%	6.5	8.7	4.3
	Smaller Unknown	5-?=3	f	5	2	3
			%	10.9	2.9	6.4
		7-?=4	f	4	2	2
			%	8.7	2.9	4.3

Table 8. The distribution of the children's answers regarding the method of presenting the problems

	Incorrect	First reading	Second reading	"You-language"	"Show-language"	Total
f	146	63	27	24	28	288
%	51	22	9	8	10	100

achieving children (45%) were incorrect; however, when the problems were presented through "you-language" and "show-language", correct answers at the rate of 26% were received. As for the answers of the high-achieving children, the correct answers were at the rate of 42% at the end of the first reading and 23% at the end of the second reading. When "you-language" was used, 8% of the answers were correct, and when "show-language" was preferred, 11% were correct. In terms of the structures of the problems, Table 10 shows the distribution of the children's answers according to the method of problem presentation.

When the structures and methods of presenting the problems were considered together, it was observed that some of the children gave correct answers when the problems were presented by means of "you-language" or "show-language". Especially when we recalled that the numbers of correct answers to part-part-whole and

Table 9. The distribution of the answers based on the presentation method according to achievement level.

Achievement level		Incorrect	First reading	Second reading	"You-language"	"Show-language"	Total
Low	f	82	1	0	4	3	90
	%	91	1	0	5	3	100
Medium	f	49	24	7	13	15	108
	%	45	22	7	12	14	100
High	f	14	38	21	7	10	90
	%	16	42	23	8	11	100

Table 10. The distribution of the children's answers based on the problem presentation method according to the problem structure

			Incorrect	First reading	Second reading	"You-language"	"Show-language"	
Main category	Sub-category	Symbolic model	f	f	f	f	f	Total
Join	Result unknown	1+3=? 4+2=? 4+5=? 3+6=?	20	24	6	7	7	64
	Initial unknown	?+3=4 ?+3=7	23	3	3	3	0	32
	Change unknown	2+?=5 3+?=8	20	5	3	0	4	32
Separate	Initial unknown	?-1=4 ?-3=5	16	7	3	6	0	32
	Change unknown	4-?=1 7-? =2	14	7	4	3	4	32
Part-part-whole	Whole unknown	2+3=? 3+5=?	11	11	3	3	4	32
	Part unknown	1+?=4 3+?=8	19	3	0	2	8	32
Compare	Difference unknown	3-2=? 6-3=?	23	3	5	0	1	32

separate problems (68 correct out of 128 answers) were low, we could infer that nearly half of these answers were given by means of "you-language" and "show-language".

DISCUSSION AND CONCLUSION

This study investigates 60-78-month-old preschool children's word mathematical problem-solving skills. In the study, it was found that in a general sense, children's achievement related to word mathematical problem-solving skills was at a medium level. In a study by Carpenter et al. (1993), it was observed that preschool children were considerably good at problem solving.

In addition, in the current study it was found that the children gave more correct answers for each category as they grew older. Olkun and Toluk (2002) conducted a similar study with primary school children and found that the students' achievement improved with their grade level. It can be concluded that achievement in problem solving is linked to age.

In this study, no relationship was observed between gender and children's problem-solving success. From this perspective, the results of this study support the findings of parallel studies in the field (Hyde et al., 1990; Lachance and Mazzocco, 2006; Unutkan, 2007).

As for the problem categories, the children were in general good at joint, separated, and part-part-whole problems but were low-achieving with comparism problems. In solving comparism problems, most of the children were able to show two quantities through counting blocks but were not capable of indicating which quantity was greater or less than the other. On that point, we can conclude that the problems given to children in that age group should be limited to which quantity is more or less. The results of this study are in line with the findings in the related literature. (Altun et al., 2001; Mamede and Soutinho, 2012; Nesher et al., 1982). Mamede and Soutinho (2012) in their similar study with 4-6 months old children found that the children had difficulties in solving compare problems.

With respect to the sub-categories of the problems, it was observed that the children made more mistakes with initial-unknown problems than with result-unknown problems. They tried to solve the problems through direct modelling, using counting objects or trial and error. The reason for the children's failure with initial-unknown problems may be that they could not determine how many counting objects they needed to use initially (Wan de Well, 2001, p.148). Olkun and Toluk (2002) conducted a similar study with primary school students. They concluded that the book that they analysed in their study included initial-unknown problems based on addition, suggesting that using these types of problems can be one of the reasons for receiving more correct answers. Wan de Well (2001, p.148) noted that in most books, there was simply more emphasis on join and separate problems with result-unknown structure. One of the reasons why the children failed in the other problem categories may derive from their lack of frequent exposure to these other problems.

In terms of the numbers in problem statements in each category, the children demonstrated high achievement with the problems including small numbers. This result also indicates that not only the structure of the problem but also the numbers used in the problem can influence its difficulty level. Therefore, it is recommended that numbers in problems be compatible with children's cognitive development regarding numbers. Hamann and Ashcraft (1986; cited Clements and Sarama, 2014, p. 337) stated that some problems are more challenging owing to the larger numbers they include. They also stated that, such difficulties are often greater than they should be because they are not exposed to larger single-digit numbers.

When the content of the problems is formulated considering the children's surroundings, children better understand the structure of the problems and see the relationships between the given pieces in the problem, which helps them overcome any difficulty (Outhred and Sardelich, 2005; Monroe and Panchyshyn, 2005).

The results of this study indicate that the method of presenting problems ("you-language"-"show-language") was helpful in guiding the children to the right answers. Similarly, Pape (2003) stated that the language used for solving mathematical word problems of the children is effective on problem-solving success, and Reusser and Stebler (1997) stated that the changing on presentation structure of problem; in other words, changing words used while expressing the problems affect the difficulty of the problem. It is possible that the children related the problems to their own lives when they were addressed with "you-language". In the same way, the "show-language" may have helped the children make complex problems more concrete so that they understood and solved the problems successfully.

As a result, it was concluded that the academic attainment of children 60-78 months old was medium level in solving word mathematical problems based on addition and subtraction. They were better at result-unknown problems, whereas they had difficulty with initial-unknown problems. The children experienced the greatest difficulty with comparing problems. Gender was found to have no effect on the children's problem-solving levels; however, age appeared influential. As the children grew older, their achievement increased. The method of presenting the problems was also found to affect the correctness of the children's answers. Although the children were not good at giving correct answers in part-part-whole and separate problems, half of their correct answers were given when the questions were asked through "you-language" and "show-language".

In this context, it is highly recommended to include not only result-unknown problems but also different examples from other categories in class and to consider children's cognitive developmental readiness when choosing actual numbers in problem statements. Additionally, teachers can be advised to use different methods of presenting problems to their students. For further studies, we suggest focusing on the effects of different methods on children's problem-solving achievement. The effects of different problem presentation methods can also be analysed with a larger sample. Finally, in this study different content of formulation of problems, the presentation by diagrams, the use of material, etc. are not examined. The follow-up studies can concentrate on these aspects. However, the study was carried out for Turkish children, the results can not be generalized to other countries.

Conflict of Interests

The author has not declared any conflicts of interest.

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Appendix. Problem Test

Problem 1 (Join-result unknown-(1+3=?)). Eren had 1 balloon. Sara gave him 3 more. How many balloons does Eren altogether?

Problem 2 (Join-initial unknown-small numbers-(?+3=4)). Eren had some marbles. Sara gave him 3 more. Now Eren has 4 marbles. How many marbles did Eren have to begin with?

Problem 3 (Join-result unknown-(1+3=?)). Eren had 4 balloons. Sara gave him 2 more. How many balloons does Eren altogether?

Problem 4 (Join-initial unknown-large numbers-(?+3=4)). Eren had some marbles. Sara gave him 3 more. Now Eren has 7 marbles. How many marbles did Eren have to begin with?

Problem 5 (Separate-initial unknown-small numbers-(?-1=4)). Eren had some marbles. He gave 1 to Sara. Now Eren has 4 marbles. How many marbles did Eren have to begin with?

Problem 6 (Separate-initial unknown-large numbers-(?-3=5)). Eren had some marbles. He gave 3 to Sara. Now Eren has 5 marbles. How many marbles did Eren have to begin with?

Problem 7 (Join-result unknown-small numbers-(2+3=?)). Eren had 2 balloon. Sara gave him 3 more. How many balloons does Eren altogether?

Problem 8 (Separate-change unknown-small numbers-(4-?=1)). Eren has 4 balloons. He gave some to Sara. Now he has 1 balloon. How many balloons does Eren have now?

Problem 9 (Join-result unknown-large numbers-(5+3=?)). Eren had 5 balloon. Sara gave him 3 more. How many balloons does Eren altogether?

Problem 10 (Separate-change unknown-large numbers-(7-?=2)). Eren has 7 balloons. He gave some to Sara. Now he has 2 balloons. How many balloons does Eren have now?

Problem 11 (Join-result unknown-large numbers-(4+5=?)). Cookie Monster had 4 cookies. Then it bought more 5 cookies. How many cookies does Cookie Monster have now.

Problem 12 (Part part whole -whole unknown-small numbers-(2+3=?)). Sara has 2 apples and 3 oranges.. How many fruits does she have ?

Problem 13 (Join-result unknown-large numbers-(4+5=?)). Cookie Monster had 3 cookies. Then it bought more 6 cookies. How many cookies does Cookie Monster have now.

Problem 14 (Part part whole -part unknown-small numbers-(1+?=4)). Sara has 4 fruits. One of her fruits is an apple, and the rest are oranges. How many oranges does Sara have?

Problem 15 (Join-change unkown-small numbers-(2+?=5)) Eren had 2 liras. Sara gave him some more. Now Eren has 5 liras. How many did Sara give him?

Problem 16 (Part part whole -part unknown-large numbers-(3+?=8)). Sara has 8 fruits. Three of her fruits are apple, and the rest are orenges. How many yellow orenges does Sara have?

Problem 17 (Part part whole -part unknown-large numbers-(3+5=?)). Tarkan has 3 yellow marbles and 4 blue marbles. How many marbles does Tarkan have?

Problem 18 (Join-change unkown-large numbers-(3+?=8)). Eren had 3 liras. Sara gave him some more. Now Eren has 8 liras. How many did Sara give him?

Problem 19 (Compare-difference unknown-small numbers-(3-2=?)) Eren has 3 liras and Sara has 2 liras. How many more liras does Sara have than Eren?

Problem 20 (Compare-difference unknown-large numbers-(6-2=?)) Eren has 6 liras and Sara has 3 liras. How many more liras does Eren have than Sara?

Problem 21 (Compare-larger unknown-small numbers-(?-1=2)) Sara has 2 more liras than Eren. Eren has 1 liras. How many liras does Sara have ?

Problem 22 (Compare-Smaller unknown-small numbers-(?-1=2)) Eren has 3 more liras than Sara. Eren has 5 liras. How many liras does Sara have ?

Problem 23 (Compare-Smaller unknown-large numbers-(?-1=2)) Eren has 4 more liras than Sara. Eren has 7 liras. How many liras does Sara have ?

Problem 24 (Compare-Larger unknown-large numbers-(?-2=3)) Eren has 3 more liras than Sara. Sara has 2 liras. How many liras does Eren have ?