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The role of students' age, problem type and situational context in solving mathematical word problems

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The aim of this research is to test the hypotheses regarding the importance of understanding situation in mathematical word problems that follow from Reusser's Situation Problem Solver (SPS) model by exploring efficiency in children's mathematical word problems solving as a function of age, problem type and situational context of the problem. Children of three age groups participated in the study: preschool kindergarten group (*N*=67), first grade (*N*=79) and second grade students (*N*=85). Testing was conducted by 20 specially trained senior psychology students. Two categories of word problems were used: *change problems* and *compare problems*. Every child was tested twice, one time with neutral context problems, and the other time with familiar context problems. Repeated measures analysis of variance was performed with age, situational context and problem type as independent variables and children's performance as a dependent variable. All main effects were significant, as well as the interaction of age and problem type. The results indicate that older children are more successful than younger children in solving mathematical word problems and that the children's performance on the change problems is better than performance on compare problems. Results also showed that children's performance on the problems with familiar context was better than performance on the problems with neutral context. In both problem types performance of school children was better than performance of kindergarten children. These results confirm Reusser's essential hypothesis that including additional sense to the problem text would facilitate designing the situational model of the problem.

Keywords: mathematical word problems, age, context

Even the preschool children can solve some mathematical word problems (Riley, Greeno & Heller, 1983; Riley & Greeno, 1988), but word problems are generally considered difficult for all school children regardless their grade level. Numerous difficulties that children face when trying to solve word problems may seem unexpected and confusing because intuitively we would expect word problems to be the bridge between real life and mathematics, to motivate children and to make mathematics easier to study. Some authors (Boulton-Lewis & Tait, 1994; Verschaffel, De Corte, Lasure, Van Vaerenbergh, Bogaerts, & Ratincky, 1999) suppose that the cause of difficulties in word problem solving is inadequate mathematics teaching in schools, which is abundant in abstract and procedural knowledge. Children learn to deal with numbers mechanically, not paying attention to the structure of a problem and, thus, they cannot distinguish illogical parts of their problem solution. Inadequate teaching is certainly one source of children's difficulties, but there are also some other important factors regarding characteristics of mathematical word problems.

The task in solving word problems is linked to the creation of an appropriate problem model or schema that is considered crucial to the selection and application of mathematical operations (De Corte & Vershaffel, 1985; Kintsch & Greeno, 1985; Nathan, Kintsch, & Young, 1992; Vershaffel et al., 1999). Research has shown that students who have schemata for meaningful problem types, evidenced by ability to classify problems on the basis of their semantic structures, are better problem solvers than students who do not have knowledge of problem types (Bovenmayer Lewis, 1989; Morales, Shute, & Pellegrino, 1985). Furthermore, studies have indicated that the majority of students' errors on word problems are due to misrepresentation of problem structure rather than computational errors (Anand & Ross, 1987; Bovenmayer Lewis, 1989; Cummins, 1991).

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Classification of addition and subtraction word problems introduced by Heller and Greeno (1978; cited in De Corte, Verschaffel, & De Win, 1985) and revised by Riley and Greeno (1988) is nowadays accepted as a standard. As the first criterion of classification, they single out semantic relation used for describing situation in word problems. These semantic relationships are: combining, increase, decrease and comparison of set of objects. Based on this criterion we can differentiate three general categories of problems: combine, change and compare problems. Second classification criterion is the position of the unknown set, which results in six different problem types for each of the three aforementioned problem categories. Examples for all 18 types of word problems are shown in Table 1. (Vlahović-Štetić, 1999).

Previous research showed that compare problems can be generally considered as the most difficult word problems. Some studies show that change and combine problems are equally difficult (Carpenter, Hiebert, & Moser,

Table 1

Mathematical addition and subtraction word problems

Problem type	Illustration of problem	Unknown quantity	Direction of change
Combine			
1	Joe has 3 marbles. Tom has 5 marbles. How many marbles do they have altogether?	superset	-
2	Joe and Tom have some marbles. Joe has 3 marbles. Tom has 5 marbles. How many marbles do they have altogether?	superset	-
3	Joe has 3 marbles. Tom has some marbles. They have 8 marbles altogether. How many marbles does Tom have?	subset	-
4	Joe has some marbles. Tom has 5 marbles. They have 8 marbles altogether. How many marbles does Joe have?	subset	-
5	Joe and Tom have 8 marbles altogether. Joe has 3 marbles. How many marbles does Tom have?	subset	-
6	Joe and Tom have 8 marbles altogether. Joe has some marbles. Tom has 5 marbles. How many marbles does Joe have?	subset	-
Change			
1	Joe had 3 marbles. Then Tom gave him 5 marbles. How many marbles does Joe have now?	result set	increase
2	Joe had 8 marbles. Then he gave 5 marbles to Tom. How many marbles does Joe have now?	result set	decrease
3	Joe had 3 marbles. Then Tom gave him some marbles. Now Joe has 8 marbles. How many marbles did Tom give him?	change set	increase
4	Joe had 8 marbles. Then he gave some marbles to Tom. Now Joe has 3 marbles. How many marbles did he give to Tom?	change set	decrease
5	Joe had some marbles. Then Tom gave him 5 marbles. Now Joe has 8 marbles. How many marbles did Joe have in the beginning?	start set	increase
6	Joe had some marbles. Then he gave 5 marbles to Tom. Now Joe has 3 marbles. How many marbles did Joe have in the beginning?	start set	decrease
Compare			
1	Joe has 3 marbles. Tom has 5 marbles. How many marbles does Tom have more than Joe?	difference set	more
2	Joe has 8 marbles. Tom has 5 marbles. How many marbles does Tom have less than Joe?	difference set	less
3	Joe has 3 marbles. Tom has 5 marbles more than Joe. How many marbles does Tom have?	compared set	more
4	Joe has 8 marbles. Tom has 5 marbles less than Joe. How many marbles does Tom have?	compared set	less
5	Joe has 8 marbles. He has 5 marbles more than Tom. How many marbles does Tom have?	reference set	more
6	Joe has 3 marbles. He has 5 marbles less than Tom. How many marbles does Tom have?	reference set	less

1981; Riley & Greeno, 1988), although there are some studies which found that combine problems were more difficult than change problems to the kindergarten and first grade children (Nesher & Katriel, 1978; Vergnaud, 1982). In their research Riley and Greeno (1988) had four age groups (kindergarten children and grade 1-3 students) and they used all 18 types of problems. Their results showed an increase in proportion of correctly solved problems with age, but relative difficulty of the problems remained constant.

To explain the ways how children solve mathematical word problems, different models have been designed. Basic differences between these models originate from underlining hypothesis of what is the most important for successful solving of word problems. While some authors presume conceptual knowledge to be the most important and develop *logico-mathematical* models (Briars & Larkin, 1984; Riley et al, 1983), some others suppose language comprehension of problems to be the most important, which resulted in large number of different linguistic models (De Corte & Verschaffel, 1985; Kintsch & Greeno, 1985; Lee, Ng, Ng, & Lim, 2004; Nathan, Kintsch, & Young, 1992; Reusser, 1989).

One of the most popular linguistic models was developed by Reusser (1989). He believes that there are at least four causes of difficulties that children face in mathematical word problems: incomprehensible verbal formulation of problem text, situational context that is unclear to children (events and relationship between characters), children's lack of logico-mathematical knowledge about relations between sets and undeveloped arithmetical skills needed for counting or solving equations.

In his Situation Problem Solver (SPS) model, Reusser (1989) emphasizes the importance of understanding situation in problem, postulating that it requires the interaction of linguistic knowledge, familiarity with the real world situations and mathematical knowledge. He presumes that solving word problems is a process that goes from text understanding to situation and then to computing process. Based on his research results, Reusser (1989) concludes that situation understanding in the problem is decisive for efficient problem solving.

According to Reusser (1989) it is easier for children to create a meaningful story and situational model of problem if the characters are in some relation. In problems with related characters, the main character has the name, and the other characters are defined by their relation to the main character (grandmother, mother, brother, etc.) and have no name. So it is easier for children to identify character with the name as the most relevant and to examine the story from his point of view.

A series of studies support the importance of the situational context for solving word problems (Anand & Ross, 1987; Davis-Dorsey, Ross, & Morrison, 1991; Moreau & Coquin-Viennot, 2003; Reusser, 1989; Stern & Lehrndorfer, 1992).

In her study, Vlahović-Štetić (1996) tested 56 first grade students. Students were presented with all three categories of word problems (combine, change and compare). Two kinds of situational contexts were used. In neutral situational context both characters had their own name. In familiar situational context, the main character was named, and the other characters were defined by their relationship to the main character.

Results didn't yield the significant main effect of the context, but the interaction between context and problem type was significant. Vlahović-Štetić (1996) explains these results as a result of the problem difficulty. As combine and change problems are easy to children, there is no need for further processing. Compare problems are more difficult and the situation in the neutral context is not so understandable, so difficulties in forming situational model emerge. Consistently with the hypotheses of Reusser's model, forming the situational model of problem is facilitated by familiar context, which improves the efficacy of problem solving.

The aim of this research is to test the hypotheses regarding the importance of understanding situation in mathematical word problems that follow from Reusser's SPS model and to explore the efficiency of children's solving of mathematical problems as a function of age, problem type and situational context of the problem.

Consistently with results of previous research (Hudson, 1983; Riley & Greeno, 1988), we started from hypothesis that the performance of older children would be better than performance of younger children. More specific, we expected second grade students to be more successful than the first grade students, and first grade students to be more successful then kindergarten children in solving mathematical word problems.

Our second hypothesis was that children's performance on change problems would be better than on compare problems. This hypothesis is based on empirical results of previous research (Riley et al, 1983; Riley & Greeno, 1988).

Third hypothesis was that children would be more efficient in solving problems with familiar context. This hypothesis is based on Reusser's SPS model, according to which familiar context facilitates forming the situational model of problem and is also congruent with the results of his research (Reusser, 1989; Reusser, 1990).

Interaction of the aforementioned variables will also be tested. On the basis of the previous research findings (Vlahović-Štetić, 1996), we can expect interaction of situational context and problem type i.e. we can expect that familiar context will facilitate performance on compare problems, while performance on change problems will be unaffected by using different contexts.

METHOD

Variables

In our study independent variables were children's age, type of problem and situational context in a problem. Two categories of word problems were used: change problems and compare problems. Numerous studies show that combine problem are easiest to children, and that school children solve them with almost 100% efficacy. Since our research procedure was fairly complex concerning the number of problems (16) that children solved, we decided to omit combine problems form our research. Eight problems of each category were created. For change problems, there were four Change 3 problems and four Change 6 problems, and for compare problems there were four Compare 3 problems and four Compare 5 problems.

Two situational contexts were used, neutral and familiar. In the problems with neutral context two characters are named, and there is an action involving both of them or, alternatively, they are compared in some way. Problems with familiar context start with the line that gives situational framework to the problem (e.g. Ivan collects picture cards). One character is named, and the other is defined by his relationship to the main character (e.g. his mother, grandfather, best friend, etc.). The action in the problem and the construction of the sentences are identical in neutral and familiar context.

Dependent variable in the study was children's performance on mathematical word problems. For each correct answer child was given 1 point, and for each incorrect answer 0 points. Therefore, every child could have maximum of 8 correctly solved change problems and 8 correctly solved compare problems during each testing.

Participants

Children of three age groups from two kindergartens and two elementary schools in Zagreb participated in the study: preschool kindergarten group, first grade and second grade students. Preschool kindergarten group consisted of students who will be enrolled in first grade next school year. The final sample was formed of 67 kindergarten children (M = 6 years and 3 months), 79 first grade students (M = 7 years and 1 month) and 85 second grade students (M = 8 and 1 month). The data from some additional participants were discarded because the testing was interrupted and/or they have not been tested two times, i.e. with both situational contexts.

Materials

Lists with problems, answering sheets and dictaphones were used in the testing. Lists with problems contained 16 different word problems (8 change problems and 8 compare problems) and one example. As an example, Combine 1 problem was used. The problems were formed so to require addition and subtraction of numbers from 2 through 9, and the result was also within that interval. The number that was correct answer in no case was used in the problem text (e.g. combination $8 - 4 = 4$ was impossible).

To avoid the possibility that computation difficulty influences the efficacy of solving the problem, there were two versions of each problem, A and B. Problems in these two forms were different only by number size, but the texts were identical.

Since the order of presenting problems could influence their difficulty, three different sequences of problems were formed. Each sequence was formed by choosing problems in random order.

All problems had two different forms: neutral and familiar. When neutral context was used two characters were named, and sets of objects and relationships between them were defined. In familiar form an introduction line which gives situational information (e.g., "Mother bought some apples at the market") was included. The second difference between these two forms was the way of defining second character. In familiar context this character was defined by his relationship to the main character instead of naming him (e.g., "Boris has four apples. His sister has three apples."). So, a problem in neutral context would be: "Boris has four apples. Mira has three apples. How many apples do they have altogether?", and in the familiar: "Mother bought some apples at the market. Boris has four apples. His sister has three apples. How many apples do they have altogether?". Combining the two versions of problems (A and B), three different problem sequences and two contexts, 12 different problem lists were formed.

Procedure

The study was conducted near the end of school year, in April and May 2004, with permission of parents and school authorities. Children were tested during their stay at school or in the kindergarten by 20 specially trained senior psychology students. Testing was conducted individually with each student in a quiet room. The procedure lasted 10 to 20 minutes, depending on a child's rate.

Every child was tested twice, one time with neutral context problems, and the other time with familiar context problem. The interval between two testing was at least two weeks. To avoid the possible influence of repeated testing on the results, half of the children in each age group were first tested with the neutral context problems, and then with familiar context, while the other half was tested in the opposite order.

During the first testing experimenters alternately used A and B versions of the problems with each subsequent child. During the second testing, experimenters had a list with assigned version (A or B) and situational context used in the first testing for each child. During the second testing experimenter used the other situational context, but the same version of the problems. So, a child who solved version A neutral context problems in the first testing, was presented in the second testing with the familiar context problems, but also version A.

There were three experimenters at each of four locations during every day of testing. Each of them had lists with one of three possible problem sequences, so it was assured that children at each location could get every possible sequence.

During this procedure each child was tested with total of 32 word problems – 16 with neutral context and 16 with familiar context. The children's answers were recorded in the answering sheets, and their explanations were recorded to be able to analyse the strategies they used. Analyses of their explanations were not used in this study.

RESULTS AND DISCUSSION

Previous research (Delgado & Prieto, 2004; Hyde, Fennema, & Lamon, 1990) found no differences in performance on mathematical word problems between boys and girls aged between 5 and 10. Based on these results we didn't expect sex differences in performance, however, we tested

Table 2

Means and standard deviations of children's performance on each change and compare problem for both situational contexts (neutral and familiar) for kindergarten children and first and second grade students

		Kindergarten (*N*=67)		First grade (*N*=79)		Second grade (*N*=85)	
Problem		Neutral context	Familiar context	Neutral context	Familiar context	Neutral context	Familiar context
Change 3 -	*M*	.34	.34	.68	.80	.80	.82
Problem 1	*SD*	.48	.48	.47	.40	.40	.38
Change 3 -	*M*	.28	.24	.68	.75	.80	.81
Problem 2	*SD*	.45	.43	.47	.44	.40	.39
Change 3 -	*M*	.28	.27	.73	.76	.84	.89
Problem 3	*SD*	.45	.45	.44	.43	.37	.31
Change 3 -	*M*	.22	.27	.70	.71	.76	.85
Problem 4	*SD*	.42	.45	.46	.46	.43	.36
Change 6 -	*M*	.18	.13	.51	.65	.68	.66
Problem 1	*SD*	.39	.34	.50	.48	.47	.48
Change 6 -	*M*	.30	.24	.66	.70	.69	.76
Problem 2	*SD*	.46	.43	.48	.46	.46	.43
Change 6 -	*M*	.21	.21	.53	.51	.55	.65
Problem 3	*SD*	.41	.41	.50	.50	.50	.48
Change 6 -	*M*	.22	.19	.59	.59	.71	.68
Problem 4	*SD*	.42	.40	.49	.49	.46	.47
Compare 3 -	*M*	.22	.27	.70	.76	.86	.81
Problem 1	*SD*	.42	.45	.46	.43	.35	.39
Compare 3 -	*M*	.25	.19	.66	.77	.87	.84
Problem 2	*SD*	.44	.40	.48	.42	.34	.37
Compare 3 -	*M*	.19	.25	.70	.76	.87	.84
Problem 3	*SD*	.40	.44	.46	.43	.34	.37
Compare 3 -	*M*	.24	.24	.63	.72	.80	.85
Problem 4	*SD*	.43	.43	.49	.45	.40	.36
Compare 5 -	*M*	.21	.16	.33	.38	.38	.47
Problem 1	*SD*	.41	.37	.47	.49	.49	.50
Compare 5 -	*M*	.15	.22	.39	.42	.39	.52
Problem 2	*SD*	.36	.42	.49	.50	.49	.50
Compare 5 -	*M*	.22	.21	.39	.39	.45	.47
Problem 3	*SD*	.42	.41	.49	.49	.50	.50
Compare 5 -	*M*	.16	.18	.25	.28	.36	.42
Problem 4	*SD*	.37	.39	.44	.45	.48	.50

this hypothesis to justify the joint analysis of boys' (N = 129) and girls' (N = 102) results. Repeated measures ANOVA confirmed that boys and girls did not significantly differ in the word problems performance (F (1,229) = .160; p = .69). The means and standard deviations for change and compare problem in both situational contexts (neutral and familiar) for all three age groups are presented in Table 2.

Results presented in Table 2 show the trend of better performance of older children. We can also notice that proportions of correct answers are almost equal in the group of kindergarten children in both contexts, while they are quite different in the other two groups. Performance of kindergarten children is poor; proportions of correct answers vary from 0.14 for Change 6 – Problem 1 in familiar context to 0.30 for Change 1 – Problem 1 in both contexts. Proportions of correct answers of first grade students vary from 0.25 for Compare 5 – Problem 4 in neutral context to 0.80 for Change 3 – Problem 1 in familiar context. Second grade students have the worst performance for the Compare 5 – Problem 4 in neutral context with the proportion of correct answers of 0.36, and the best performance on Change 3 – Problem 3 in familiar context with the proportion of 0.89.

Results of kindergarten group in our study are mainly similar to the results of other authors (Riley et al., 1983; Riley & Greeno, 1988). For first grade students our results are somewhat higher than their results (e.g. for Change 6 problem proportion of correct answers in our study was 0.51-0.66 compared with 0.39 in their study), but not as high as the results of the first grade students in the study of Vlahović-Štetić (1996). Proportions of correct answers in her study for change and compare problems vary from 0.39 to 0.95 in neutral context and from 0.41 to 0.98 in familiar situational context. In this study proportions vary from 0.25 to 0.73 for neutral context, and from 0.28 to 0.80 for familiar context. Differences between our results and results of Vlahović-Štetić (1996) most likely come from use of different research methods. In that study students could also, while listening to experimenter, follow the text of the problem on the paper, which could have facilitated their memory and computational process.

In our study the performance of three age groups on two types of word problems was recorded. Children were tested two times, once with the problems with neutral context, and the other time with familiar situational context. Experimental design is therefore 3 × 2 × 2 (3 age groups x 2 word problems types × 2 situational contexts). Means and standard deviations for each group in two different problem types are presented in Table 3. The average performance of all participants in neutral context was M = 8.18 (SD = 5.06), and in familiar context M = 8.62 (SD = 5.15).

Results of the repeated measures ANOVA are presented in Table 4. The main effects of age, situational context and problem type were significant, as well as the interaction of age and problem type.

All three main effects were found to be significant. According to Scheffé post-hoc test, for the effect of age there were differences between all three age groups. The performance of first grade students was better than the performance of kindergarten children (p<.01), and second grade students had better results than first grade students (p<.05). Total results for children's performance in all problems show us that the difference between kindergarten children and first grade students is almost 12 more correctly solved problems by first grade students. Difference between first and second grade students is also significant, but not so large, resulting in 3 more correctly solved word problems by second graders. These results are consistent with the results of other studies on the developmental changes in children's performance on mathematical problems (De

Table 3

Means and standard deviations of children's performance on the sets of change and compare problems for two situational contexts (neutral and familiar) for three age groups and total results for each problem type and age

Problem type		Kindergarten (N = 67)		First grade (N = 79)		Second grade (N = 85)		Total
Problem		Neutral context	Familiar context	Neutral context	Familiar context	Neutral context	Familiar context	
Change	M	2.04	1.90	5.09	5.46	5.84	6.13	9.15
	SD	2.29	1.82	2.38	2.32	2.38	2.06	5.31
Compare	M	1.66	1.73	4.05	4.48	4.98	5.21	7.65
	SD	1.67	2.08	2.40	2.41	2.41	2.50	5.07
Total	M	7.33		19.08		22.15		
	SD	6.57		8.13		7.98		

Table 4

Results of repeated measures ANOVA for 3 x 2 x 2 experimental design (age x situational context x problem type)

	F	*df*	*p*
Age	75.647	2/228	**.001**
Problem type	44.031	1/228	**.001**
Age × Context	1.865	2/228	.157
Age × Problem type	4.019	2/228	**.019**
Context × Problem type	.292	1/228	.589
Age × Context × Problem type	.330	2/228	.719

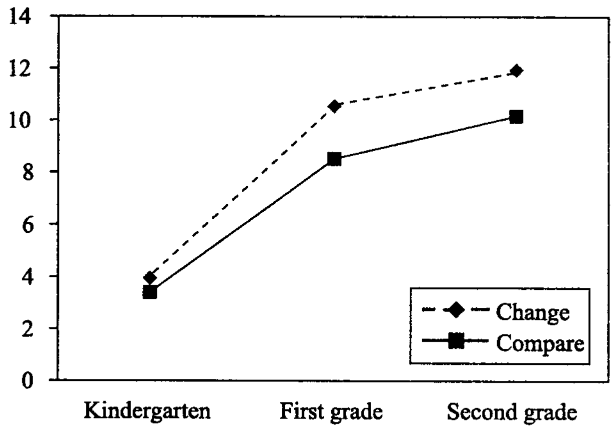

Figure 1. Average performance on compare and change problems for kindergarten ($N = 67$), first grade ($N = 79$) and second grade ($N = 85$) children

Corte et al., 1985; Hudson, 1983; Riley et al, 1983; Riley & Greeno, 1988), and can also be logically interpreted in accordance with Reusser's model. We can presume that there are also differences in linguistic knowledge among different age groups, i.e. that they differ in the ability to comprehend certain text or situation. According to Reusser's model, understanding of the situation in problem is the most important for good performance. So, if children show good understanding, their performance will also be better.

The significant main effect of the problem type indicates that performance on the change problems was significantly better then the performance on compare problems. This result is consistent with the findings of other studies (Riley et al, 1983; Riley & Greeno, 1988; Vlahović-Štetić, Kišak, & Vizek Vidović, 2000), which showed that compare problems can be considered as the most difficult word problem type.

Main effect of the context was also found to be significant. Performance on problems with familiar context was statistically better than the performance on problems with neutral context. According to Reusser's model (1989), embedding mathematical problem in familiar and meaningful context facilitates forming situational model of problem in the phase of situation understanding and therefore gives the higher possibility of good performance. In this research, this is achieved by adding the introductory line that describes action in the wider framework, and by exchanging the name of one character with his relation to the main character (e.g. brother, sister, friend, etc.). Better understanding of the situation, which was facilitated by the enriched problem text, proved to be relevant for children's performance. This finding is also consistent with the results of other research trying to find out how adding meaningful context to the problem text influences children's performance (Anand & Ross, 1987; Davis-Dorsey et al., 1991; Reusser, 1989;). Other possible explanation for this finding is that children can use the introduction line for focusing attention on the problem, which can lead to better performance on word problems.

However, it has to be noticed that difference in performance in different contexts is relatively small. As can be seen in Table 2, familiar context improves performance on most of the problems for first and second grade children but not for kindergarten children.

If we look at the results of each age group, we can notice a trend that older children gain more from giving additional meaning to the context. This trend, although small in absolute values, is notable for both first and second grade students. For kindergarten children there are no differences in performance in different situational contexts. But these differences were too small to show significant interaction of age and context. The only significant interaction in this study was the one between age and problem type (see Figure 1).

The one-way ANOVA's (age × problem type) also showed significant main effects of age for both change (F (2, 228) = 78.57; p<.001), and compare problems (F (2, 228) = 51.09; p<.001). In both problem types performance of kindergarten children was lower than performance of first and second grade students, while there were no significant differences between first and second grade students. According to Sheffé post-hoc test, performance of kindergarten children in change problems was significantly lower than performance of the first grade students (p<.01) and second grade students (p <.01), and the same results were found for compare problems. For kindergarten children, there were no differences in compare and change problems

(F (1, 66) = 1.79; p =.19), but first and second grade students were more successful in solving change problems than compare problems (F (1, 78) = 29.54; p < .001; F (1, 84) = 25.53; p<.001).

According to the results from previous studies (Riley et al., 1983; Riley & Greeno, 1988) compare problems were the most difficult for all age groups. Despite the fact that performance is getting better with age, relative difficulty of these two problem types remains constant. Therefore, in every age group we can expect better performance on change problems than on compare problems. Our results confirmed this hypothesis for first and second grade students, but not for kindergarten children. To kindergarten children change and compare problems are equally difficult. We suppose that this is due to the specific problems we used. It is possible that the change problems used in our study were too difficult for the children of preschool age to be possible to show a difference between their performance on change and on compare problems. In the case of using some other easier change problems, we assume that the interaction of age and problem type would not be significant.

It would be interesting to analyse which kinds of errors children made, because in that way we could get some extra information about possible causes of their failures in solving word problems. In that case, errors in computation would imply the lack of arithmetical skills, and the use of incorrect operation would imply misunderstanding of the situation in problem.

Based on our results we can conclude that older children are more successful than younger children and that the children's performance is better on the change problems than on compare problems. Our results also showed that children's performance on the problems with familiar context was better than performance on the problems with neutral context. We can say that these results confirm Reusser's essential hypothesis that adding additional sense to the problem text would facilitate designing the situational model of the problem. In our study, adding additional sense was accomplished by making slight variations to the classical problem text, and in spite of that it significantly facilitated problem solving. These results reveal the possibility of more adequate teaching of word problem solving. Using the problems with familiar situational context during the teaching process, teachers can make easier for children to understand the problem, and therefore to solve it. Also, adding the introduction line to word problems could be used for attracting children's attention necessary for accomplishing complex cognitive activity. We believe that only after mastering solving problems with familiar context, transfer to reduced situational context can be achieved. As the explanations and strategies of problem solving were recorded as a part of a larger study, we hope that these data will give us additional explanations and implications for teaching process.

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