Available online at www.sciencedirect.com

ScienceDirect

Procedia Social and Behavioral Sciences 15 (2011) 2500–2504

Procedia Social and Behavioral Sciences

WCES-2011

Analyzing extraneous problem solving performances of 6th grade primary students

Sare Şengül[a] *, Hande Gülbağcı[a] , Zeynep Yıldız[a]

[a]*Atatürk Education Faculty Elemantary Mathematics Teaching Department, Marmara University, Kadikoy, Istanbul 34722, Turkey*

Abstract

The purpose of this study is to analyze the 6th Grade primary students' solving word problem skills that require extraneous knowledge. With this purpose in mind, 109 6th grade primary students from a primary school in Istanbul attended this research. Two types of test were used in this research. In the first test, the students were asked five word problems but in the second test an unnecessary data which was not necessary to solve these problems were added. The scores which were taken from tests which were carried out a week apart were compared by using paired-sampling t-test. The results of the research reveal the fact which is supported by the literature that students cannot distinguish that the extraneous information is not necessary for solving the problem and as a result they became less successful in solving extraneous problems than normal problems.

Keywords: Problem solving; Real-life problems; Extraneous problems

1. Introduction

The aim of teaching mathematics is to teach mathematical concepts and to help students to gain skills such as problem solving, communicating, reasoning and relating (MEB, 2009). Problem solving helps students to cope with complicated and unknown situations that they will face in the future. One of the most important tools that help students to gain this skill is word problems.

Many people face with different problems in their daily lives. In the situations like these, there is information related to or unrelated to the solution of the problem. The person by reasoning the necessity of the information use the information required for solving the problem. From this point of view, reasoning the information whether it is relevant for the solution of the problem or not is also as important as the ability of problem solving. Helping students to gain the skill that we talked here, makes students better problem solvers.

For giving students these kinds of skills, that is deciding whether the information given in the problem will be used in solving the problem or not, various kinds of problems should be presented to students. These kinds of problems which will be presented to students are called extraneous problems (Muth, 1991). The problems with irrelevant information comprises more than the information and situation which is required for solving the problem. Cawley, Fitzmaurice-Hayes and Shaw (1998) suggested extraneous information as distracter and defined as "…information that if used will produce an incorrect response".

*Sare Şengül. Tel.:+0-216-345-4705; fax:+0-216-338-8060.
E-mail address: zsengul@marmara.edu.tr

1877–0428 © 2011 Published by Elsevier Ltd.
doi:10.1016/j.sbspro.2011.04.135

No extraneous information:

The painter is working for a payment per hour. This painter can paint half of the room in an hour. In how many hours can he paint three rooms with the same size in a house?

Extraneous information:

The painter works for 15 TL per hour. This painter can paint half of the room in an hour. In how many hours can he paint three rooms with the same size in a house?

As it is seen from the above example, it is not necessary to use the given number 15 while solving the problem. The student should realize that it is not necessary to use this number while solving the problem and should not use in the solution.

In our country students do not frequently experience with these kinds of problems. For example, when the textbook which is used in 6th grade primary classrooms analyzed, this kind of problem is not seen. In the other countries although the situation is similar to us, it is in better level. In the textbooks which are used in China, 15 problems have irrelevant information among 6.850 problems; while in America 264 problems in 13.286 problems have irrelevant information (Yan & Lianlghuo, 2006). The extraneous problems which are not used in textbooks generally presented to students by teachers. For sure, when students learn a principal for the first time, it is not advised to use these kinds of problems. However, when this principal was understood, teachers should use these kinds of problems in their classrooms (Muth, 1982).

Not encountering with extraneous problems frequently have concluded with the idea that "all the numbers given in the problem should be used in the solution" in the students (Muth, 1988) and it is caused using all the data whether relevant or not while problem solving. The researches showed us that the students are not successful in solving these kind of problems (Parmar, Cawley, & Fratzita, 1996; Low, Over, Doolan & Michell, 1994). Muth (1991) in his research determined that in problems which have irrelevant information, giving a clue like "Word problems can contain information which is not necessary for the right solution" increases solving problems correctly. If the misconception that the students have as "all the numbers given in the problem should be used" removed made us think that the students can solve these problems better.

In real life, people should gather information, analyze the information that they gathered and should pick the necessary information for solving the problem. In order for students to gain these skills, the problems with irrelevant information should be used in teaching programs and text books. In literature research, it is found that a research has not been carried out about this subject before in our country. Before using problems with irrelevant information in our education world, it is necessary to set the situation in our country. The purpose of this research is to analyze the 6th grade primary students' solving extraneous problems and contributing to field related to this subject.

2. Method

2.1. Participants

6th grade students in a primary school in Istanbul have attended to research. The primary school has 6 classrooms in 6th grades. Two classrooms have attended to the first pilot study. In the research four classrooms attended to the study. 62 students have attended to the pilot study. 29 of these students were girls and 33 of them were boys. The research started with 114 students, but 5 of these students left the research because of various excuses. 52 of 109 students are girls and 57 of them are boys. The ages of these students differ from 11 and 12.

2.2. The data collection instruments

In the research, two tests were used by researchers to gather data. There are five word problems in both tests. In the first test (Test A), all the information in word problems were used while solving the problem. In the second test (Test B), there was also some information which would not be used while solving the problem. That is, the problems in the second test were extraneous problems. In order not to create any differences in terms of difficulty, some questions were used in both tests. While test B was prepared, quantitative data which would not affect the solution of the problem in Test A, was added.

The problems in tests were created after a literature search and after taking the views of expert mathematics educators and the mathematics teacher of the school that research was carried out.

The 2nd question of Test A:
The sum of the ages of a mother and her 3 children is 72. What is the sum of the ages of the mother and her 3 children 5 years later?

The 2nd question of Test B:
The sum of the ages of a mother and her 3 children is 72. The oldest child is 21 years old. What is the sum of the ages of the mother and her 3 children 5 years later?

Figure 1. The sample questions which are in Test A and B

2.3. Procedure

The research was carried out in a three weeks period. First of all, for a pilot study, two types of tests were distributed to the students in two classrooms randomly. The students were asked to solve the test in a course time.

After the pilot study, in both tests necessary changes and corrections were made. For example, in order for students to analyze the data in problems better, the students were asked to write given and asked information.

After making the final version of the tests, students in the four classrooms made the Test A. The students were not informed about the correct answers during and after the study. After a week later, Test B was given to students. The students were asked to complete the test in course time. Semi- structured interviews were made with some of the students to have a better understanding about the students' ideas about these problems. But since there is limited space, the data gathered through these interviews were not mentioned here.

2.4. Data Analysis

The data was analyzed by grouping data as qualitative and quantitative. The quantitative data was the scores of the students which they got from Test A and B. These tests with open ended questions were scored by researchers. The scorers gave 1 point for using the correct way for solving the problem and gave 0 for using the incorrect way for solving the problem. Besides, whether the students made computation mistakes or not while solving the problem, was taken into consideration. Students who chose the correct way but had computation mistakes got 0.5 points. The maximum point that a student could get from the test was determined as 5 and the minimum point was determined as 0.

The quantitative analysis which was made by using the achievement scores of students was carried out by using SPSS 15 (Statistical Package for Social Sciences) computer program. Quantitative data was analyzed by using frequency distribution, mean, standard deviation and t-test for dependent samples. Qualitative data was collected from students' papers and content analysis was used to analyze this data.

3. Findings

Table 1 shows that analyses of students' Test A and B scores.

Table 1. Analyses of the students' Test A and B scores

Test	N	$\overline{X}$	S	Sd	t	p*
Test A	109	2.27	1.67	108	2.710	.008
Test B	109	1.99	1.69			

* p is significant at the 0.01 level.

As it is seen in the table, the average scores of students from Test A, in which only necessary information for solving the problem was given, was calculated as 2.27. In Test B, test with extraneous problems, the average score was 1.99. It is obvious that there is a difference between students' success in tests with extraneous problems and the other test. In order to see whether this difference is significant or not, paired sample t-test was used. After the

analysis a significant difference was found [$t_{(108)}$=2.710, p< .01]. This means that 6th grade primary students are less successful while solving extraneous problems than the problems without extraneous information.

After this analysis, the question about how the students in different levels of success evaluated the extraneous information has come to the mind of the researcher. For this reason two different success levels of students have determined. The students who got 3 and above accepted as successful and the students below this point accepted as unsuccessful. In the table below the scores of the students from these groups in Test A and B were compared.

Table 2. Analyses of the upper and lower group students' Test A and B scores

Group	Test	N	$\overline{X}$	S	Sd	t	p*
Upper Group	Test A	44	4.04	.74	43	3.750	.001
	Test B	44	3.43	1.21			
Lower Group	Test A	65	1.06	.84	64	.419	.676
	Test B	65	1.01	1.21			

* p is significant at the 0.01 level.

As it is seen table 2, the students in the upper group had 4.04 average score from Test A and 3.43 average score from Test B. When we look at the two average scores, .67 point decrease was seen in the average scores of the students. Paired sample t test was carried out in order to understand whether the difference was significant or not. After the test, it was seen that there was a significant difference between the average scores [$t_{(43)}$=3.750, p< .01]. This means that the students in the upper group could not realize the extraneous information in the world problems. A significant difference could not be found between the average scores of the students in the lower group. The analysis which was made to understand whether this difference was significant or not, did not show us a significant difference. In conclusion, it could be said that having an extraneous information in the problem or not was not important for the students in lower group.

When the test papers were analyzed, different data was gathered related to students. The students are asked to write given and asked information in the problem in order for students to have a better analyze the data given in the problems. When we looked at the answers of the students, students who were successful in solving problems were also successful in this subject. The students who could not be successful in problem solving wrote the questions again to the answer and some wrote the numbers given in the problem as an answer. Some students did not give any answers to this section. When these students compared with students who are more successful than them, they fell behind when analyzing the function of the data give in the problem.

When we looked at the problem solutions of the students, students who were using modeling were seen. In order to look at the effects of modeling on problem solving, the students' answers to questions 1 and 4 were analyzed. In the first problem, 19 students from 109 students used modeling while solving problems. 14 of the answers were correct and 5 of them were in correct. In the answers given for the fourth question, 7 students used modeling and 6 of them were correct. One of the correct answers of the students could be seen in Figure 2.

Question: The painter is working for a payment per hour. This painter can paint half of the room in an hour. In how many hours can he paint three rooms with the same size in a house?

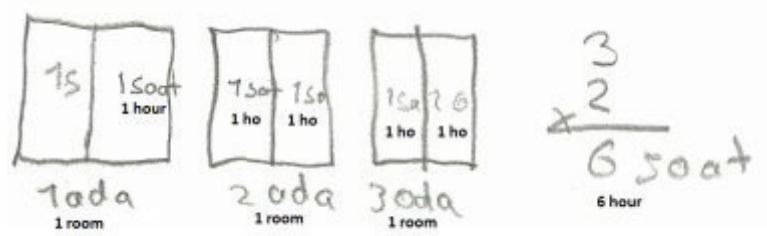

Figure 2. A sample correct answer

4. Conclusions

This research investigates the performance of the 6th grade primary school students on solving extraneous problems. It is shown that the success rate of solving extraneous problems is lower than the success rate of solving normal problems. When the students' achievements are considered and their performances are compared, some differences are realized between the students. While significant differences are found between A and B test scores of the successful students, significant differences are not found between the test scores of the unsuccessful students being under the lower group. The students under the lower group failed on solving the problems of both tests. The importance of submitting extraneous problems to the students having of certain level on problem solving has emerged once again. As Muth (1982) stated, the students should not face with the extraneous problems at the beginning. The students, who have problems about problem solving skills, must work on the extraneous problems after reaching to a certain level only.

When the solutions of the problems solved by students are examined, it is realized that, the unsuccessful students are more unqualified than the successful students on the analysis of the things provided and requested in the problems. It is shown that, not being qualified on understanding the things provided and requested in the problems can be one of the reasons of failure on the students' problem solving. Also it is stated that the students use the modeling rarely. If they had used the modeling, they would find more correct answers. The researches concluded that, if modeling usage is taught to the students, their problem solving success rate will increase.

After this study which was carried out with 6th grade primary students, it could be useful to repeat this study with larger samples or with different level of students like 7th or 8th grades. When we evaluate the results of the study, giving students extraneous problems will help them to analyze the data given in the problems deeply and by using given and asked analysis they can find solutions more consciously. For this reason, this kind of questions should be used in course books and in workbooks. Besides, for determining data that is necessary for solving the problem by the students, it is accepted as useful to let students write problems related with the subject by themselves.

References

Cawley, J. F., Fitzmaurice-Hayes, A. M. & Shaw, R. A. (1988). *Mathematics for the mildly handicapped: A guide to curriculum and instruction*. Boston, MA: Allyn & Bacon.

Low, R. , Over, R. , Doolann, L. & Michell, S. (1994). Solution of algebraic word problems following training in identifying necessary and sufficient information within problems. *The American Journal of Psychology*, 107(3), 423-439.

Millî Eğitim Bakanlığı (MEB). (2008). *İlköğretim Matematik Dersi 6-8. Sınıflar Öğretim Program ve Kılavuzu*. M.E.B.: Ankara .

Muth, K. D. (1982). Cognitive Demands That Arithmetic Word Problems Impose on Children. Retrieved December, 02, 2010, from ERIC database.

Muth, K. D. (1984). Solving arithmetic word problems: Role of reading and computational skills. *Journal of Educational Psychology,* 76(2), 205–210.

Muth, K. D. (1991). Effects of cuing on middle-school students' performance on arithmetic word problems containing extraneous information. *Journal of Educational Psychology,* 83(1), 173-174.

Parmar, R. S., Cawley, J. F., & Frazita, R. R. (1996). World problem-solving by students with and without mild disabilities. *Exceptional Children,* 62(5), 415-429

Zhu, Y., & Fan, L. (2006). Focus on the representation of problem types in intended curriculum: A comparison of selected mathematics textbooks from Mainland China and the United States. *International Journal of Science and Mathematics Education, 4*(4), 609–626.