# Is Problem solving skill of girl students in Government schools up to the mark? An investigation through a realistic mathematics approach on Polynomials in Algebra

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**Abstract**

This study aims to describe the problem-solving skills of students in two Government Girls schools by using a realistic mathematics approach on the topic polynomials in Algebra. This study was conducted qualitative descriptive research. The research question of the study is "what are the levels of eight grade girl students' problem solving skills?" The aim of this study was to investigate the problem solving skill levels of secondary school students. The study was carried out with a total of 80 students of standard eight grade in the academic year 2018-2019 from two Government Girls Schools at Kanchipuram which is the one of the District headquarters in Tamil Nadu, India. The instrument of data collection in this study was conducted by problem-solving skills test which included four indicators consisting of comprehending the problem, making plans, implementing the plans, and re-checking the results obtained. The polynomial test material consists of (1) The recognizing and comparing polynomials; (2) the addition and subtraction of polynomials; and (3) the multiplication and division of polynomials. The results of the study state that the average overall problem-solving skills of girl students in polynomials in Algebra is moderate.

**Keywords:** *Problem solving skill, realistic mathematics approach, comprehending problems*

## Introduction

Mathematics has been an inseparable part of school curriculum ever since the beginning of formal education and it continues to be so. Mathematics curriculum has undergone various changes from time to time in accordance with the changing needs of the society. Realizing its social relevance the Kothari education commission (1964-66) recommended that mathematics should be taught as a compulsory subject of general education up to class X. Problem solving can be related with many cognitive abilities also, ranging from logic, analysis, mathematics, and science (Aslan, 2002). Hence, problem solving can simply be defined as offering a solution, an idea to a problematic situation. Problem solving abilities are important skills for educational area because a healthy society or a healthy nation can only maintain its existence through adopting themselves into new conditions by problem solving abilities. Solving a problem requires establishing a link between inputs and anticipated outcomes. Reading assigns meaning to a text by determining a suitable goal and method. No problem or text is self-expressive (Akyol, 2005). Therefore, an individual's eagerness, their interest, setting a goal and use of strategy are of great importance for problem solving and reading comprehension skills. Problems, including the comprehension of a text, bring about many difficulties for elementary school students due to the complexity of problem solving processes. Problems stated within the context of a story seem to be more complex and difficult for students than problems not embedded in a text (Mayer, Lewis & Hegarty, 1992; Nathan, Long & Alibali, 2002). Similar research findings have shown that the problems experienced by students regarding narration problems are related to an accurate comprehension of the text, rather than numbers or operations (Gökkurt & Soylu, 2013). The problematic characteristics examined in these studies are the number of words

in the text of the problem, the existence of statements pointing out the operations to be followed in the solution of the problem, as well as the magnitude of the numbers used in the problem (Briars & Larkin, 1984). The second course of research primarily focuses on the cognitive processes required for the solution of the problem (Dellarosa, 1986; Kintsch & Greeno, 1985).

Finding the correct solution to a problem does not necessarily mean that the student has the necessary problem solving skills. Though some students may have found the correct answers, they may have followed the wrong approach to a solution; other students might develop the correct solution strategies but nonetheless reach the wrong solution due to simple calculation errors (Soylu & Soylu, 2006). Each learning approach is different from each other. This is distinguished according to the characteristics, functions, and objectives of each approach. The implementation of the learning process requires a good learning approach, which is related to students' mathematical concepts and in accordance with the objectives of the learning curriculum oriented to contextual problems as a means of problem-solving(E Zakaria and M Syamaun 2017). Therefore, one of the learning approaches oriented to contextual problems especially in the field of mathematics is a realistic mathematical approach or realistic mathematics education (RME). The goal of RME is to change mathematics learning to be more fun and meaningful for students through contextual problems. The RME step begins with taking a problem that is relevant to students' experience and knowledge. Then the teacher facilitates students in helping to solve contextual problems (Laurens T, Batlolona, F A, Batlolona J R and Leasa M 2018). There are several steps to learning with realistic mathematical approaches, namely (1) presenting contextual problems; (2) resolve contextual problems; (3) discuss the completion of contextual problems; and (4) concluding learning material (Jazuli, A La Ode, M Anggo, Rahim, U and Sahidin, L 2017).

The formulation of the problem in this study is how to analyze the achievement of students' mathematical problem-solving abilities by applying learning realistic mathematical approaches. Problem-solving skills will be analyzed based on 4 indicators of problem-solving steps, namely (1) comprehending the problem; (2) making plans; (3) implementing plans; and (4) rechecking the results.

**Research Methods**

This type of study was qualitative descriptive research. This study used descriptive methods because through this research, students described the skills to solve problems based on four indicators of problem-solving skills, namely (1) comprehend the problem; (2) make plans; (3) implement the plans; and (4) re-check the results. The sample of this study was class eight students of Government Girls Higher Secondary School, Big Kanchipuram and BMS Government Girls Higher Secondary school, Little Kanchipuram in the Academic Year 2018/2019. For the test instruments used previously, has been validation by based content and format by the validator, namely the teacher and lecturer. Giving the test is done three times. There are three polynomial sub-topics given to students along with the number of test items presented in the table1:

**Table1 Subtopics of polynomials and number of items**

| S.No | Name of the Subtopics | No. of items |
|---|---|---|
| 1 | Recognizing and comparing different types of polynomials | 4 |
| 2 | Addition and subtraction of two or more polynomials | 6 |
| 3 | Multiplication and Division of two polynomials | 6 |

Before the analysis of students' problem-solving skills was carried out, all instruments were validated with the experts in Mathematics and Mathematics Education. Based on their opinions, modification have been carried out. The validated instrument was problem-solving skill test and then proceeded with applying to learn with realistic mathematical approaches to the topic of polynomials in Algebra. After completing the learning process

for each subtopic, students were given a problem-solving skill test. Test results were analysed based on 4 indicators of problem-solving skills mentioned above.

**Result and Discussion**

*1.Comprehending Problems*

The indicators assessed from the skills to comprehend the problem were: score 0 if there is no answer at all; score 1 if incorrectly written data is known; score 2 if only write a little data that is known correctly; score 3 if writing part of the data correctly known; score 4 if writing data that is known correctly but not complete; score 5 if writing data is known correctly and completely. Based on the test results obtained data that more students are skill to understand the problem in the material recognize and compare integers than the other two subtopics. This can be seen in the following figure 1:

**Figure 1 Percentage of problem solving skills of girl students based on comprehending the problems**

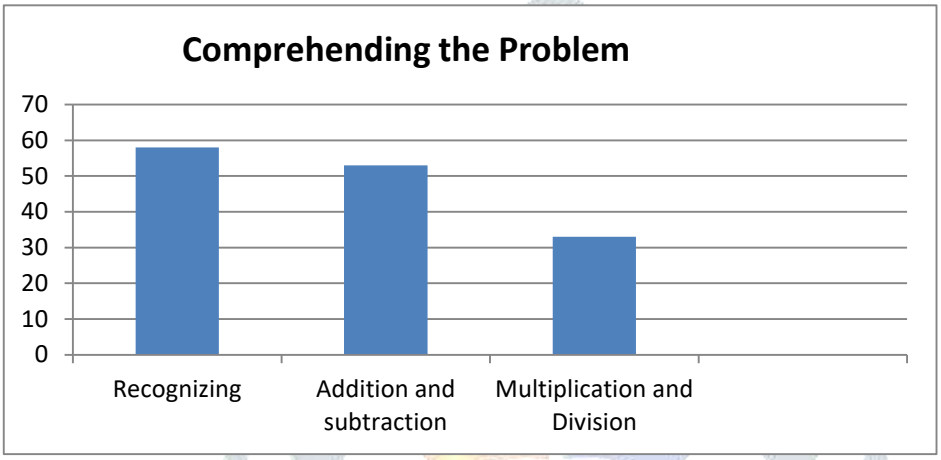


Figure 1 shows that the average percentage of girl students' ability to comprehending the problems on the subtopics of recognizing and compare polynomials were 58.15; addition and subtraction of polynomials were 53.12, and multiplication and division of division were 33.83. Based on these data, it can be concluded that the ability to comprehending the problems on the subtopics of recognizing and comparing polynomials along with of addition and subtraction was better than Multiplication and division of polynomials. However, the problem solving skills with regard to comprehending the problems were below moderate level.

*2.Making Plans to solve problems*

The indicators assessed from the skills to make plans are: score 0 if there is no answer at all; score 1 if writing a wrong settlement strategy; score 2 if only writing a few settlement strategies correctly; score 3 if writing part of the resolution strategy correctly; score 4 if writing a settlement strategy correctly but not complete; score 5 if writing a settlement strategy correctly and completely. Based on the test results obtained data that more students are skill to plan for multiplication and integer division compared to the other two subtopics. This can be seen in the following figure 2:

**Figure 2: Percentage of problem solving skills of girl students based on making plans to solve the problems**

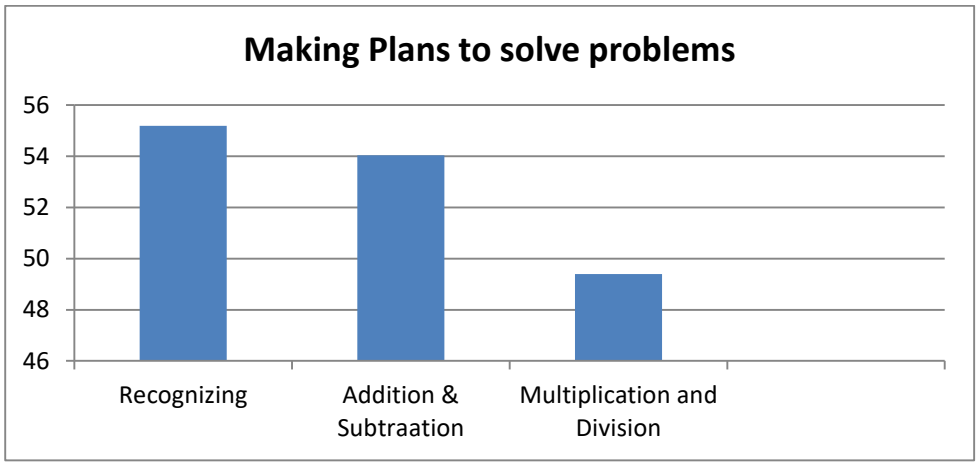


Figure 2 shows that the moderate percentage of girl students' ability to make plans on subtopics of recognizing and compares integers were 55.19; addition and subtraction of polynomials were 54.04, and multiplication and division of polynomials were 49.40. Based on these data, it can be concluded that the ability to making plans to solve the problems on the subtopics of recognizing and comparing polynomials along with of addition and subtraction was better than Multiplication and division of polynomials. However, the problem solving skills with regard to making plans to solve problems were only moderate level.

*3.Implementing plans to solve problems*

The indicators assessed from the skills to implement solutions are: score 0 if there is no completion at all; score 1 if the settlement is not in accordance with the planning and wrong results; score 2 if the completion is slightly in accordance with the plan but the result is wrong; score 3 if the completion is slightly in accordance with the plan but the result is correct; score 4 if the settlement is in accordance with the plan but the results are correct; score 5 if the settlement is in accordance with the plan and the results are correct.

**Figure 3: Percentage of problem solving skills of girl students based on implementing plans to solve the problems**

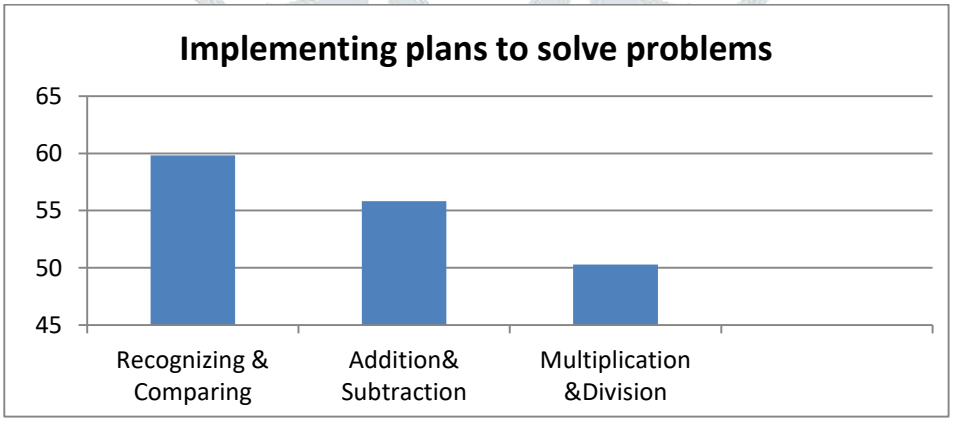


Figure 3 shows that the average percentage of students' ability to implement planning on the subtopic of recognize and compare polynomials were 59.82; addition and subtraction of polynomials were 55.83, and multiplication and division of polynomials were 50.28. Based on these data, it can be concluded that the ability to implementing plans to solve the problems on the subtopics of recognizing and comparing polynomials along with of addition and subtraction was better than Multiplication and division of polynomials. However, the problem solving skills with regard to implementing plans to solve problems were only moderate level.

*4.Re-checking the Results*

The indicators assessed from the skills to re-check are: a score of 0 if there is no information; score 1 if doing a wrong check; score 2 if checking is as correct as possible; score 3 if the examination is close to true; score 4 if doing a correct check but not complete; and a score of 5 if doing a correct and complete examination.

**Figure 4: Percentage of problem solving skills of girl students based on rechecking the results of the problems**

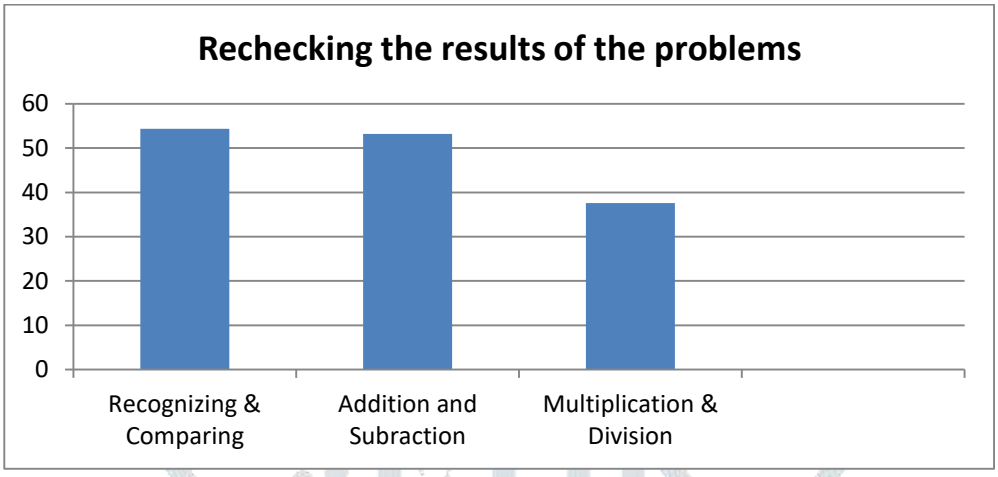


Figure 4 shows that the average percentage of girl students' ability to rechecking the result on the subtopic of recognizing and compare integers was 54.37; addition and subtraction of integers were 53.22, and multiplication and division of integers were 37.60. . Based on these data, it can be concluded that the ability to rechecking the results of the problems on the subtopics of recognizing and comparing polynomials along with of addition and subtraction was better than Multiplication and division of polynomials. However, the problem solving skills with regard to rechecking the results of the problems were only moderate level.

Overall, the percentage of problem-solving skills girl students based on four indicators

**Table2. Percentage of problem-solving skills of girl students based on four indicators**

| | Subtopics in Polynomials | Comprehending problems | Making Plans | Implementing Plans | Rechecking results | Overall scores |
|---|---|---|---|---|---|---|
| 1 | Recognizing and Comparing | 58.15 | 55.19 | 59.82 | 54.37 | 56.81 |
| 2 | Addition and subtraction | 53.12 | 54.04 | 55.83 | 53.22 | 54.10 |
| 3 | Multiplication and Division | 33.83 | 49.40 | 50.28 | 37.60 | 42.69 |

Table 2 shows that aspects of problem-solving skills in subtopics 1, the percentage of students understanding the problem is better than the other two aspects other than implementing plans Whereas in subtopic 2, the aspect of understanding the problem is almost to similar percentage to other aspects. In subtopic 3, the percentage of plan implementation is better than the other three aspects. Of the three subtopics, the average score of problem-solving ability in subtopic 3 is better than the other 2 subtopics.

**Recommendations for the Practitioners**

Problem solving requires reading, reading comprehension and the use of mathematical knowledge, as well as the use of mathematical operations (Bender, 2012). Students who experienced difficulties reading a problem were unable to provide correct answers. In addition, correct vocalization of the problem may not be enough for finding the correct solution to a problem, because the mathematical language involved in the problem must also

be understood. There is also a need for students to develop strategies besides understanding the language of the problem and the mathematical language involved in the problem. In addition to the development of strategies, how to administer these strategies to new situations must be mastered. Strengthening teacher-student and student-student relationships is of great importance for the understanding of problems (Mercer & Sams, 2008). Therefore, reading level and the problem solving skills of students should be handled together and instructional activities should focus on the concurrent teaching of these two skills

As the overall problem solving skills of eighth grade girl students of government schools were found moderate in Mathematics, the students may be oriented towards realistic mathematical approach so as to enhance their problem solving skills in Mathematics. The students must be trained to have their preparedness and monitoring while solving problems in mathematics as suggested below:

- What is given and required in the problem?
- Can you briefly explain the problem?
- Can she use visuals to explain the problem?
- What operations will you perform while solving the problem and why?
- Can you predict the result of the problem?
- Can you tell the result of the problem?
- Can you solve the problem in a different way?
- If she solved the problem incorrectly, were they able to explain the reason for doing so?
- Can you construct a problem similar to this one?

Heller et al., (2010) states that there are five stages to be scored in order to assess the problem-solving abilities. The five stages are as follows:

1. Focusing the problem, can be developed through the form of images or words that can help students.
2. Describe the problem into the physics concept, students can simplify the problem by doing by linking the problem with the concept of physics in terms of principles and physical symbols.
3. Planning a problem-solving solution (student the solution), students create a framework of equations based on the relationships that have been proposed in the previous stage.
4. Implementing execute the plan, students can manipulate equations, enter known numbers and solve algebraic problems.
5. Evaluating the solution (evaluate the solution), the student must evaluate the answer and make sure that the answer is satisfactory.

**Conclusion**

The ability of problem solving in this research means the ability of students to use knowledge based on experience that has been learned to solve various problems in daily life. To sum up, as the results of the analysis of problems in Mathematics are investigated, girl students are more prone to solve correctly problems that they are accustomed to. Even though they can differentiate and understand problems moderately, they could not use what they have properly. In problem solution phases, students may be trained by the teachers with right approach like realistic Mathematics approach but they have sometimes difficulties in applying them correctly. Hence, it can be said that if students encounter with those kind of problem types, they can easily solve those types of problems. The students whose reading level was at the teaching level were able to vocalize problems correctly and summarize what was given and required; however, they could not determine the operations required for solving the problem. During the solution process, they made errors and did not apply strategies. The students whose reading level was at the free level were observed to use strategies during reading and problem solving in order to recognize their mistakes and correct them, to be sure of their answers and to be able to try different ways of solving the problem. Furthermore, regardless of reading level, students at times made errors in some problems. This was because the use of knowledge about operations and how students perceived them varied according to individual differences.

**References**

Akyol, H. (2005). *Turkce ilk okuma yazma ogretimi* (4th Ed.). Ankara: Pegem

Aslan, E. A. (Ed.). (2002). *Orgutte kisisel gelisim*. Ankara: Nobel Yayıncilik.

Briars, D.L., & Larkin, J.H. (1984). An integrated model of skill in solving elementary word problems. *Cognition and Instruction*, 1, 245-296.

Dellarosa, D. (1986). A computer simulation of children's arithmetic word-problem solving, *Behavior Research Methods, Instruments, & Computers*, 18 (2), 147-154.

Gokkurt, B., & Soylu, Y. (2013). Ogrencilerin problem cozme surecinde anlam bilgisini kullanma duzeyleri, *Kastamonu Egitim Dergisi*, 21(2), 469-488.

Jazuli, A La Ode, M Anggo, Rahim U and Sahidin L (2017). The Application of Scientific Plus Learning to Improve Mathematics Learning Achievement of Junior High School Students Grade VII, *Int. Electron. J. Math. Educ*. 12 (9), 837–844

Laurens,T Batlolona, F A Batlolona J R and Leasa M (2018). How does realistic mathematics education (RME) improve students' mathematics cognitive achievement? *Eurasia J. Math. Sci. Technol. Educ*. 14 (2),569–578.

Mayer, R. E., Lewis, A. B., & Hegarty, M. (1992). Mathematical misunderstandings: Qualitative reasoning about quantitative problems. In J. I. D. Campbell (Ed.), *The nature and origins of mathematical skills* (pp.137–154). Amsterdam: Elsevier.

Nathan, M. J., Long, S. D., & Alibali, M. W. (2002). The symbolic precedence view of mathematical development: A corpus analysis of the rhetorical structure of textbooks, *Discourse Processes*, 33, 1–21.

Soylu, Y., & Soylu, C. (2006). Matematik derslerinde başarıya giden yolda problem cozmenin rolu, *Dicle Universitesi Ziya Gokalp Egitim Fakultesi Dergisi*, 7(11), 97-111.

Zakaria H and Syamaun M (2017). The Effect of Realistic Mathematics Education Approach on Students' Achievement and Attitudes towards Mathematics. *Mathematics Education Trends and Research*, 1, 32–40.