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PROBLEM-SOLVING ABILITY IN MATHEMATICS AMONG SECONDARY SCHOOL STUDENTS: A STUDY

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Azam HUSSAIN[1], Viquar UNNISA[2], Mousuf RAZA[3]
[1]Research Scholar, Department of Education and Training, Maulana Azad National Urdu University, Hyderabad, India
[2]Department of Education and Training, Maulana Azad National Urdu University, Hyderabad, India
[3]Assistant Professor, Maulana Azad National Urdu University, Darbhanga, India
Corresponding author: Azam Hussain
E-mail: mdazamhussain32@gmail.com

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Abstract:
This study explores the problem-solving capability in mathematics among secondary school students. The study aimed to investigate the problem-solving capabilities in mathematics among students, taking into account school, level, and gender. A descriptive survey method was used in this study. Secondary schools in the Samastipur district were included in the population, and one hundred students from class IX of two Government and two private schools in Shahpur Patory were selected as the sample. A convenience sample was adopted as the sampling technique. Mean, percentage, standard deviation (SD), and t-test were used as the statistics in this study. Data obtained from secondary school students were analyzed using the Statistical Package for the Social Sciences (SPSS). The results indicate that the level of problem-solving capability in mathematics among secondary school students was 25% low level. 54% of the students were at the average level, while 21% of the students were at the high level. The conclusion reveals that there is no significant difference between males and females in solving mathematics problems among secondary school students and no significant difference in solving mathematics problems between students in private schools and those in public schools.

Keywords: Solving Ability, Mathematics, Secondary School Students.

INTRODUCTION

Education is the backbone of society, playing a crucial role in the social and economic development of a nation. It helps individuals transition from ignorance to knowledge, encourages social reform, and supports the country's development. Education aims to develop children holistically and prepare them for success. Today's world is more complex and competitive, and students now expect education to help them develop their skills, become more sensitive, and excel in their abilities. Education also helps people adapt and adjust to the demands of society. The National Education Policy (NEP) 2020 has redesigned the school curriculum into a 5+3+3+4 structure to meet better the needs and interests of students at different stages of learning. High school students face various challenges, and problem-solving is an important skill that helps them handle them effectively. Problem-solving requires intelligence and involves creating practical solutions to real-life issues. Mathematics, in particular, is important for both individuals and society because it builds logical thinking, abstract reasoning, and understanding. Mathematics has a special place in the school curriculum because it is a structured subject. While social problems often have multiple solutions, mathematical problems usually have one correct answer. Problem-solving in mathematics fosters creative thinking and reasoning skills, enabling students to approach challenges in a logical and structured manner.

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There are many definitions on Problem Solving:

- Polya (1981) defined problem solving as "Finding a way out of a difficulty, a way around
- Skinner's view (1986), "Problem-solving is the framework or pattern within which Creative thinking and reasoning take place."
- According to Oxford Dictionary, "Mathematics is the science of measurement, quantity and magnitude." According to Locke, "Mathematics is the way to settle in the mind of Children a habit of reasoning."

Problem Solving Ability. Every human being in the world is unique. There are differences in physical, mental, emotional, and other aspects. There is one special thing in the human body, and that is the brain. The brain is a very special part of our body. People like Newton, Stephen Hawking, and Ramanujan made their mark in the world by using their brains. Humans possess the ability to identify, discover, strategize, and solve the challenges that arise in their daily lives. Polya (1981) has defined problem-solving as "finding a way out of a difficulty, finding a way out." Mathematical problem-solving ability is a crucial skill that enables the solution of mathematical problems and prepares individuals for future challenges. As Albert Einstein once said, "If I had 60 minutes to solve a problem, I would spend 55 minutes defining it and 5 minutes solving it."

Mathematical Problem-Solving Ability. Mathematics is the most important subject, as it helps solve problems in daily life. The Secondary Education Commission, the Kothari Commission, the National Education Commission, and others have accepted its importance. Prof. Yashpal has advocated for mathematics as a core subject at the secondary school level in the National Curriculum Framework 2005. Developing problem-solving skills in mathematics is often one of the toughest challenges for students. These skills rely heavily on reasoning and thinking abilities, and mastering them requires practice. Many students become easily frustrated when they cannot find a solution quickly. The key for any problem solver is to stay patient, think critically, and not give up too soon. Trying different approaches can often lead to success. There are two major components of mathematical problem-solving abilities.

a) Understanding Problems. Everyone is trying to solve their problems. The most crucial step in solving any problem is understanding it. Understanding the problem is the foundation of solving a mathematical problem. In mathematics, students often encounter word problems, which can be difficult to understand. To solve these problems effectively, it is important to read the problem several times to fully understand what the problem is and what is being asked. It helps ensure a clear understanding before attempting to find a solution.
b) Problem-solving skills. Social problems often have multiple solutions, but in mathematics, there is usually only one correct answer. Solving mathematical problems requires specialized problem-solving abilities that develop over time through practice, empowering individuals to tackle mathematical challenges effectively.

Need and Significant of the Study. Educational institutions play a vital role in student achievement. Secondary schools help students develop problem-solving skills. The research is important in that it will reveal the reality of students' mathematical success and problem-solving abilities to teachers and school administrators in the educational society. It is often seen in secondary class students that when the level of mathematical proficiency of children is assessed, the results are disappointing because the children of class 10th are unable to solve even small and basic questions of mathematics, and due to their low ability to solve problems, they do not perform well in mathematics. For this, Mishra and Choudhury (2020) consider several reasons, including a lack of coordination with existing studies and a lack of ability. The NCF (2005) is an official Indian government document that emphasizes the need to develop mathematical competence at the

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secondary school level. It highlights the importance of connecting mathematical problem-solving to real-world applications and calls for a shift toward a deeper understanding, thereby fostering positive attitudes toward mathematics among both students and teachers. The researcher aims to investigate the relationship between mathematical problem-solving abilities in Class IX students from the Samastipur district, with a focus on the significance of mathematical problem-solving at the secondary level. The study will investigate the potential of innovative teaching strategies and explore how cooperative learning methods can enhance problem-solving abilities, ultimately leading to improved educational outcomes. The primary objective of this research is to enhance mathematics teaching and learning by fostering critical thinking and developing problem-solving skills. While there is extensive research and resources on mathematical proficiency abroad, India faces a significant gap in educational resources and information, which this study aims to address by bridging the gap in mathematical proficiency.

Literature Review. Gopikanta Suna (2023) "Effectiveness of Concept-mapping Strategy on Logical Thinking and Academic Achievement of Secondary School Students in Social Studies" Studied the researcher's goal of this Study to know the effect of geography on secondary school students through concept mapping. This study showed that 5E lesson planning with a concept mapping strategy is more effective than 5E lesson planning without a concept mapping strategy. The research found that using concept mapping in geography lessons at the secondary level enhances students' logical thinking and academic performance more effectively than traditional methods. The study revealed that concept mapping improves students' comprehension, reasoning, and idea generation. (Suna, 2023)

Singh (2023), "Mathematical Problem-solving Ability among Secondary School Students in Relation to Mathematical Aptitude and Mathematics Self-concept," studied the Researcher's goal was to examine the connection between mathematical problem-solving skills and mathematical aptitude among secondary school students. This study concluded that secondary students demonstrated an average level of mathematical aptitude. Female students showed higher mathematical aptitude than male students, and CBSE board students scored higher in mathematical aptitude compared to UP board students. In this study, the researcher suggests that a similar investigation could also be conducted on the mathematical problem-solving abilities of secondary-level teachers. (Singh, 2023)

J. vishwanatham (2021) ''A study on the problem-solving ability and anxiety in mathematics among secondary school students in relation to their academic performance.' The researcher's goal in this study was to investigate the relationship between mathematical anxiety and academic performance in secondary school students. The findings of this study revealed that the distribution of grade scores for mathematical anxiety among secondary school students was not normal, as indicated by the insignificant F value. Therefore, it can be concluded that mathematical anxiety does not impact the academic performance of these students. However, the average scores indicated a steady improvement in academic performance, from a grade C to an A+. It suggests that academic performance, reflected in scores and grades, had a notable influence on mathematical anxiety, with students who performed better academically also experiencing higher levels of anxiety. (J.Vishwanatham, Shodhganga, 2021)

Alharthi & Alsufyani (2020) "Constructivism as a learning theory applied to Thinking in Solving Physics Problems: An interpretive Study" Goal of this study. He studied. The researcher's objective in this paper was to investigate how students approach problem-solving during higher education. Many findings of this study revealed that the researcher conducted the study with these four points at the center: understanding the problem, preparing a plan, looking back, and carrying

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out a plan to facilitate the student's thinking while solving physics problems. For the data, both groups, as soon as the participants saw the questions related to physics problems, the student said, "I cannot answer such questions. It is the first time I have seen such questions. The student said that I did not understand the mechanic's problem. After this, the researcher asked the student, how did you get the idea of solving the problem? Moreover, the student did not provide an explanation. The student said, 'This is my first time encountering a physics problem.' I do not understand what it means, and I cannot even think about it. The lack of basic physics knowledge during school education has led to a negative impact on students, resulting in rote memory rather than critical thinking. (Majed Alharthi & Naif Alsufyani, 2020)

Murdiyah et. of (2020), "The effect of problem-based learning integrated with concept mapping technique on students' learning activities" studied this topic. In this study, the researchers focused on the three learning domains of Bloom's Taxonomy. This study aims to investigate the impact of integrating problem-based learning with concept mapping techniques on students' learning activities. The results of this study demonstrate that problem-based learning and concept mapping techniques have had a positive impact on students. This study is based on four domains of active learning, and both groups were included in it. The result was that a significant difference was found between the two groups. (Siti Murdiyah, 2020)

Karppagavalli. S (2018) ''Multiple intelligence and problem-solving ability among secondary student teachers" He studied this topic. This study aimed to investigate the connection between multiple intelligences and Problem-Solving Skills in Secondary Student Teachers. The researcher used the descriptive survey method. Conclusion: This study, although it has some limitations, clearly demonstrates a positive correlation between multiple intelligences and problem-solving abilities in secondary student teachers, suggesting that developing one can enhance the other. Efforts to boost multiple intelligences may help teachers address their challenges more effectively. (S, 2018)

Totappa (2016) "Effectiveness of Concept Mapping Strategy of Teaching Science on Problem Solving Ability and Achievement in Science of Secondary School Students" The main purpose of this study is to compare problem-solving ability in biology class ninth students through traditional teaching and concept mapping, the researcher has used a quasi-experimental research, The study concluded that the concept mapping teaching method was more effective than traditional lectures in enhancing problem-solving skills in biology for ninth-grade students. Both boys and girls demonstrated similar improvements in problem-solving abilities with this approach. (Totappa K. V., 2016)

Joshi (2021) "effect of connectivism based strategies on critical thinking ability, problem-solving ability and achievement in science among secondary school students" He studied. In this study, the researcher aimed to investigate the effect of gender and treatment on the problem-solving abilities of secondary school students. This study found that neither gender nor treatment has a significant interaction impact on the problem-solving ability of secondary school students.

Statement of the Problem. "Problem Solving Ability in Mathematics Among Secondary School Students: A study"

Objective of the Study.

1. To study the level of problem-solving ability in Mathematics of secondary school students.
2. To compare the problem-solving ability in Mathematics among male and female students in secondary school.
3. To compare the problem-solving ability in Mathematics among government and private secondary school students.

Hypotheses of the study.

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1. There will be no significant difference in problem-solving ability in Mathematics among male and female students in secondary school. (For objective-02)
2. There will be no significant difference in problem-solving ability in Mathematics among government and private secondary school students. (For objective-03)

METHODS

Research Design. Given the nature of the problem addressed in this study, the researcher employed a survey method, utilizing quantitative research to collect data.

Population. In this study, students from government and private secondary schools in Samastipur district were selected as the population.

Sample. In this study, one hundred students were selected from the secondary schools of Shahpur Patory in the Samastipur district; fifty students were selected from two government secondary schools, and fifty students were selected from two private secondary schools.

Sampling Technique. Convenience Sampling was used by the researcher in this study considering the conditions of COVID-19.

Statistical Techniques. The t-test, mean, percentage and standard deviation (SD) were used as statistical techniques in this study.

Delimitation.

- Data was collected from only 4 Secondary schools (2 government Schools and 2 Private Schools)
- Data was collected from class 9 students only.
- Data was drawn from the Samastipur district only.
- The sample used only 100 students.

Data Interpretation.

Objective-01: To study the level of problem-solving ability in Mathematics of secondary school students.

Table 1. Level Wise Classification Secondary School

Classification	Number	Percentage
Low	25	25%
Average	54	54%
High	21	21%

Interpretation. The above Table No. 1 illustrates the problem-solving ability in mathematics among secondary school students, indicating that 25% of students have low levels of ability and 54% of students have average levels of ability. While 21% of students possess advanced abilities, it is clear from the above data that the problem-solving capability of most students is average.

Objectives-02: To compare the problem-solving ability in Mathematics among male and female students in secondary school.

Hypothesis: 1. There will be no significant difference in problem-solving ability in Mathematics among male and female students in secondary school.

Table 2. Level Wise Classification Secondary School on the basis of gender

S.L	GENDER	No of Student	Mean	S.D	D.F	T Value	Table value	Remarks
1	Male	50	8.56	4.49	98	0.919	1.98	NS

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2	Female	50	7.87	2.97	

*Note: NS at 0.05 level

Interpretation: In Table 2 above, the problem-solving ability of secondary school students in mathematics was observed on the basis of gender, which shows that the mean of male students is 8.56 and 4.49 standard deviation (SD), while the mean of female students is 7.87 and the SD is 2.97. Both t values are -0.919, and the table value is less than 1.98, which means it is not significant. So, from all the details mentioned above, the mean and SD of male students are slightly higher than the mean and SD of female students. It is why there is no significant difference at the 0.05 level on the DF-98- this is why the researcher hypothesized. There is no significant difference between males and females in problem-solving among secondary school students; therefore, the researcher accepts this null hypothesis.

Objectives-03: To compare the problem-solving ability in Mathematics among government and private secondary school students.

Hypothesis: 2. There will be no significant difference in problem-solving ability in Mathematics among government and private secondary school students.

Table 3. Level Wise Classification Secondary School

No of School	No of Student	Mean	S.D	D.F	T Value	Table value	Remarks
Government (Public) School	50	10.14	4.18	98	5.647	1.98	No Significant
Private School	50	6.34	2.25				

*NS at 0.05 level

Interpretation: In the above table, no. 4.3, It is observed that problem-solving of secondary school students in which government (Public) school students have a mean of 10.14 and SD 4.18 whereas private school students have a mean of 6.34 and SD 2.25 - t value of 5.647; it indicates that there is no significant difference between public and private schools-this hypothesis is accepted by the researcher.

RESULT AND DISCUSSION

The quantitative data collected in this study were analyzed using SPSS. The first objective of this study was to investigate the level of problem-solving ability in mathematics among secondary school students. The results showed that 25% of the students had a low level of problem-solving capability in mathematics, 54% had an average level, and 21% had a high level.

Therefore, based on the above details, it is clear that most students have an average level of problem-solving capability in mathematics. The findings of the present study are supported by Singh (2023) and Joshi (2021), who believe that school students have an average level of mathematical problem-solving capability. 1st null hypothesis of this study is that there will be no significant difference in the ability to solve problems in mathematics between males and females in secondary school. The mean of males is 8.56, and the standard deviation (SD) is 4.49, while the mean of females is 7.87, and the SD is 2.97. The t value is less than -0.91, and the tabulated value is 1.98. i.e., there is no difference. Therefore, from all the details, it is shown that the mean and SD of males and the mean and SD of females are slightly higher than the 0.05 level, which is not significant at DF -98. The hypothesis is that there is no significant difference in the ability to solve mathematics

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problems between males and females in secondary school based on gender. The null hypothesis is accepted. The findings of the present study are supported by Singh (2023), who believes that both females and males have approximately equal ability to solve mathematical problems. Mathematical problem-solving capability and the findings of the present study are supported by Joshi (2021), who believes that there is no significant effect of gender and treatment on the problem-solving capability of secondary school students. The second null hypothesis of this study is that there will be no significant difference in the ability to solve problems in mathematics between public and private secondary school students. On the basis of secondary school, the average of public secondary schools is 10.14, the SD is 4.18, the average of private secondary schools is 6.34, the SD is 2.25, and the t value is 5.647, which is an appropriate DF-98 at the 0.05 level, and the tabulated value is 1.98, i.e., no difference. Therefore, this indicates that there is no significant difference between private and public schools; the null hypothesis is accepted.

CONCLUSION

This study focuses on the ability to solve mathematical problems among secondary school students in Samastipur District. In this study, 25% of secondary school students have a low ability to solve problems in mathematics, while 54% have an average ability, and 21% of students have a high ability to solve problems in mathematics. On the basis of government schools and private schools, government secondary schools have a mean of 10.14 and a standard deviation of 4.18, while private secondary schools have a mean of 6.34 and a standard deviation of 2.25; there is no statistically significant difference. The results indicate that there is no significant difference between private and public schools. Based on the data for male and female students, the mean for male students is 8.56 with a standard deviation (SD) of 4.49, while the mean for female students is 7.87 with an SD of 2.97. There is no difference. From all the details, it is evident that the mean and SD of males and the mean and SD of females are slightly above the 0.05 level, which is not significant in DF-98. The hypothesis is that there is no significant difference in the capability to solve mathematical problems between males and females in secondary school based on gender.

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