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Problem Solving Ability of High School Students in Relation to Their Gender, Area and Type of School

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Abstract: *Every person is unique in his thinking, reasoning and responding to a particular situation and attitude towards things. The application of thinking and reasoning is very well seen in problem solving. As a matter of fact, the modern education attaches utmost importance to the development of the ability of problem solving. Problem solving is the frame-work or pattern within which creative thinking and reasoning take place. It is the ability to think and reason out for the given levels of complexity. People who learned effective problem solving techniques are able to solve problems at higher of complexity than more intelligent people who have not such trainings. The problem solving is process of overcoming difficulties that appears to interfere with the attainment of a goal. Simple problems can be solved by instinctive and habitual behaviors. The more difficult problems require a series of solutions attempts until the successful solution is reached i.e., the problems which are more difficult require a degree of understanding, a perception of the relationships and the significant factors of a problem.*

Keywords: Problem, Ability, Intelligent, Students, Complexity, understanding.

I. INTRODUCTION

It has been found that persons having higher intelligence and reasoning ability can solve the complex problems quickly. Therefore, it is necessary that on one hand we try to develop intelligence and reasoning ability and similarly on the other hand we should also develop the problem solving ability through proper education and training of our young boys and girls. Problem solving ability is the important aspect of an individual. A broad review of related literature shows that a lot of studies have been conducted on problem solving ability by keeping in view the various factors such as intelligence, personality, achievement, motivation, scientific creativity, self concept and mathematical interest. But a negligible amount of research has been done on a study of problem solving ability among 10^{th} class students. Thus, the investigator feels to select the topic, "A Study of Problem Solving Ability of High School Students in Relation to Their Gender Area and Type of School" Education is a process of all round development of an individual i.e., physical, intellectual, emotional, social, moral and spiritual. The teacher is expected to function not only as a facilitator for acquisition of knowledge but also as an inculcator of values and transformer of inner being. In the modern times, the education has become mere acquisition of information in cognitive learning areas with the sole purpose of passing examination and getting degrees. This is resulting in the emergence of lopsided personalities. Education is a process of all round development of an individual physical, intellectual, emotional, social, moral and spiritual. The teacher is expected to function not only as a facilitator for acquisition of knowledge but also as an inculcator of values and transformer of inner being. In the modern times education is becoming a mere acquisition of information in cognitive learning with the sole purpose of passing examinations and getting degrees. This results in the emergence of lopsided personalities. Problem solving is the frame-work or pattern within which creative thinking and reasoning takes place. It is the ability to think and reason on given levels of complexity. People who have learnt effective problem solving techniques are able to solve problems at higher levels of complexity than more intelligent people who have not such training.

In general, the state of tension is created in mind when an individual faces a problem. He exercises his greatest efforts and uses all his abilities, intelligence, thinking, imaginations, observations etc. Some individual are able to solve problems sooner than others. It indicates there are levels of problem solving ability-ranging from average ability to

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highest ability depending upon the difficulty level of the problem. A simple problem can be solved by the person having average problem solving ability, while high level of ability is required to solve complex problems. The problem solving is a process of overcoming difficulties that appear to interfere with the attainment of a goal. Simple problems can be well solved by instinctive and habitual behavior. More difficult problems require a series of solution attempts, until the successful solution is reached to solve the problem and a more difficult require a degree of understanding, a perception of the relationships between the significant factors of a problem.

It has been found that persons having higher intelligence and reasoning ability can solve the complex problem quickly. Therefore, it is necessary that on one hand we try to develop intelligence and reasoning ability and on the other hand we should also develop the problem solving ability through proper education and training of our young boys and girls (Dubey, 1971).

Problem solving is a mental process which is the concluding part of the large problem process that includes problem finding and problem solving where problem is defined as state of desire, for the reaching of a definite goal from a present conditions that citizen directly moving towards the goal, is far from it or needs more complex logic finding a missing description of conditions or steps towards the goal. Problem solving has special important in the study of mathematics. A primary goal of mathematics teaching and learning is to develop the ability to solve a wide variety of complex mathematical problems. Mathematic is essential in the modern world. In the present era of computers memorization of fact and principles is sufficient. Teaching and learning of mathematics play a different role in the present century of automation and cybernetics marked the beginning of new scientific and industrial revolution. National Policy on Education (NPE, 1986) has envisaged that, “Mathematics should be visualized as the vehicle of communication to train a child to think, to reason, to articulate and to analyses logically. It should be treated as a concomitant to any subject involving analysis and synthesis.

We need people who can solve not only the mathematical problems but also the problems of other fields by applying the approaches that are used in solving mathematical problems, principles and standards for school mathematics. According to the National Council of Teachers of Mathematics (NCTM, 2000), states that, “the instructional programme from kindergarten through grade 12 should enable all students to:

- Build new mathematical knowledge through problem solving.
- Solve problems that arise in mathematics and in other context.
- Apply and adopt a variety of appropriate strategies to solve problems.
- Monitor and reflect on the process of mathematical problems solving”.

These sentences reinforce the need for students to develop the problem-solving skills to solve a wide variety of complex problems. These different types of problem solving are critical to the discussion of problem solving and student achievement because of the potentially different impact on student achievement.

II. What Is Problem?

A problem exists when a problem solver has a goal but does not know how to accomplish it? Specifically, a problem occurs when a situation is in a given state, a problem solver wants the situation to be in a goal state and the problem solver is not aware of an obvious way to transform the situation from the given state to the goal state. In the Gestalt psychologist Karl Dunker's classic monograph (1945) based on Problem Solving, defined a problem as: A problem arises when a living creature has a goal but does not know how this goal is to be reached. Whenever, one cannot go from the given situation to the desired situation simply by action, then there has to be recourse to thinking. Such thinking has the task of devising some action, which may mediate between the existing and desired situations (https://www.lorainccc.edu/Counselling/Problem+Solving.htm on dated 17/06/2020).

1.1 Defining the Problem

The key to a good problem definition is ensuring that you deal with the real problem–not its symptoms. For example, if performance in your department is substandard, you might think the problem is with the individuals submitting work.

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However, if you look a bit deeper, the real problem might be a lack of training, or an unreasonable workload (https://www.lorainccc.edu/.Counselling/Problem+Solving.htm on dated 18/06/2020).

III. Concept of Problem Solving Ability

Problem solving has special importance in the study of mathematics. A primary goal of mathematics teaching and learning is to develop the ability to solve a wide variety of complex mathematical problem. Mathematics is essential in the modern world. In the present era of computers, memorization of facts and principles is not sufficient. Teachings and learning of mathematics plays a different role in the present century of automation, and cybernetics marked the beginning of new scientific and industrial revolution. NPE, 1986 has envisaged that "mathematics should be visualized as the vehicles of communication to train a child to think, to reason, to articulate and to analysis logically. It should be treated as a concomitant to any subject involving analysis and synthesis.

Problem solving ability is one kind of test of the student's intelligence. In day to day life, a person faces many problems and tries to solve them. It can be done only be right thinking and proper reasoning which depend upon the level of intelligence of the peers. Problem solving ability is a mental process and is part of large problem that includes problem finding and problem shaping. Considered most complex of all intellectual functions Problem solving has been defined as higher order cognitive process that requires the modulation and control of more routine or fundamental skills. With the advancement in the socio-economic & technological field the life of individual is becoming more and more complex fraught with a member of problems which the individual and the society have to face in near future. The responsibility of school becomes increasingly important to develop scientific attitude the future complex society. Problem solving is the highest level of learning in the hierarchy proposed by Gagne which depends on the mastery of next lower types of learning. It involves the application of principles and facts to explain and solve new phenomenon or predict consequences from conditions. The task of problem solving requires predictions, analysis of facts and principles to develop cause effect relationship in physical phenomenon of the environment. The term 'problem solving' is used in many ways. The term scientific method, method of science, scientific thinking, scientific enquiry and problem solving method refer to the same process. The major responsibility of school is to develop scientific attitude among students. So that they may solve their problem independently for better adjustment is future complex society. One of the major responsibilities of education is to develop the ability of problem solving and creativity. The success efficiency and happiness in life to a large extent depend upon their abilities.

3.1 The Development of Problem Solving Abilities and Strategies

Problem solving has special importance in the study of mathematics, primary goal mathematics teaching and learning is to develop the ability to solve a wide variety of complex mathematics problems. During mathematics problem solving, one goal is to find a solution for a given problem. Other goals` may be to generate new problems, generate alternative solutions, interpret a result or generalize. The curriculum and evaluation standards for school mathematics published by the NCTM, 1989 advocates that a primary goal for students is, "they become mathematical problem solvers". Stannic and Kilpatrick (1988) noted that 'the sets of word problem have long been a part of the mathematics curriculum'.

For many of mathematically literate peoples, mathematics is synonymous with solving problems, word problems, creating patterns, interpreting figures, developing geometric constructions, proving theorems and so forth. On the other hand, the persons who have not been enthralled with mathematics have described any of the mathematical activity as 'problem solving'. The basis for most of the mathematics problem-solving researches for secondary school students since from 1960 have been found in the writings of G. Polya in the field of cognitive psychology and validate theories of human learning.

3.2 Study of Complex Problem-Solving in Real Life Problems

The most important aim of education would be to prepare pupils for life, for the unknown, for work and for real-life problems. The pre-requisite of this is that school-related knowledge of pupils should not be fragmented into subjects

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and restricted to school context but it should be a uniform and systematized knowledge, applicable and transferable to novel situations, where not only the quality matters, but the quantity too. There are however, a several national and international surveys indicating that a considerable number of pupils are not effective enough in independent mathematical knowledge and its acquisition in the application of this acquired knowledge to a new everyday situation. The mental representation of acquired knowledge is not sufficient, new knowledge is not connected to the existing system of knowledge. So the transfer and application of acquired knowledge is problematic. The various research results showed that the knowledge transfer is generally not automatic and only proper education can ensure its broader applicability.

3.3 Definitions of Problem Solving Ability

According to Mayer and Witt rock, 'problem solving' is, “a cognitive process directed at achieving a goal when no solution method is obvious to the problem solver”. This definition consists of four parts as shown below:

1. Problem solving is cognitive, i.e., problem solving occurs within the problem solver's cognitive system and can only be inferred from the problem solver's behavior.
2. Problem solving is a process, i.e., problem solving involves applying cognitive processes to cognitive representations in the problem solver's cognitive system.

3.4 Problem Faced by the Students

Students all over the world face a number of problems which dishearten them. It leads to sheer desperation among the students’ community giving rise to student’s unrest. Student’s life has probably become more difficult than at any time before. There are so many issues they have to deal with study, time, money, relationships, jobs, hopes and more. Parents’ previous experience and education do not always equip them in dealing with such pressures.

1. Many students will not admit their affects to their future prospects and over a period of time and these can be badly hamper a student’s psyche. Usually, students face general symptoms of emotional imbalances as part of growing up as adolescents and these become more pronounced because of the hectic student’s life. All such negativeness can be effectively controlled with the aid of participation right from the parents to education ministers.
2. New-admits or transferred students think about how they will handle the school environment with other students and teachers. They are more concerned with such issues instead of studying which hampers their performance.
3. Today the students are burdened with a load of study. The curriculum has become more extensive and complex than ever before. They not only carry ever increasing weight of study material on their shoulders but they also carry the burden of intensive study even after they have left the classroom.
4. Some students come from weaker section of the society and financial situation in their house is not good enough. If a student is not finically equipped, it may obstruct his/her study especially if hunger is craving their stomach.
5. Sometimes, many students face the problems of illness of their parents; it will also affect the performance of the students in the class.
6. Another major problem faced by junior students is bullying by seniors and other students i.e., seniors have the habits of dominating a new comers or someone they don’t like. Such behaviours leave strong mental scars on the mind of the students.
7. Lack of quality education also affects many students’ performance. It provides lack of knowledge to students to establish themselves in the world.

3.5 Possible Solutions

Education is regarded as an effective tool and it helps the students as well as the teachers in such a way: (1) the students can balance their time and work and handle social pressures (ii) the teachers can freely talk to the students of

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bad habits like: alcohol and drugs (iii) the teachers can counsel them on sex related matter (iv) the teachers can educate them through various mediums like: audio-visual aids and special help lines also curb the dangers of pregnancy and diseases. For example: if exams are really making the student ill, worried or depressed than the teacher can motivate the students by saying 'don't hide your feelings'. Talk to someone about it. In some cultures, people think it's wrong to share their feelings and worries with others (v) special laws and regulations need to be enforced to make sure that all section of society is getting quality education and (vi) concessions and other benefits need to be provided for the weaker sections of the society.

IV. Objectives of The Study

The study has the following objectives:

1. To study the level of problem solving ability of 10^{th} class students.
2. To study the problem solving ability of 10^{th} class male and female students.
3. To study the problem solving ability of 10th class students of government and private schools.

4.1 Hypotheses of The Study

The following hypotheses have been formulated by the researcher in the present study:

1. 10^{th} class students have significant level of problem solving ability.
2. There is no significant difference between male and female 10^{th} class students for problem solving ability.
3. There is no significant difference between government and private schools of 10^{th} class students for problem solving ability.

4.2 Delimitations of The Study

For the convenience of the researcher, the study is delimited in terms of the following perspectives:

1. The study is delimited to the Rait block of Kangra District only.
2. The study is restricted to 10^{th} class students of Rait block of Kangra District only.
3. The study is delimited to 100 students of government and private schools only.

- **Problem: -** It is a relation between human will and realities do not coincide. The resolution of this gap between reality and the human will is the solution of the problem. A problem implies a desired outcome coupled with an apparent deficiency, doubt or inconsistency that prevents the outcome from talking place.
- **Ability: -** It can be defined as a power of capacity or act physically, mentally, legally, morally and financially. Ability is a talent, special skill aptitude; denotes power or capacity to do something. Ability is the general word for a natural or acquired capacity to do things; it implies doing well. For an example: A leader of great ability and an ability of a person in solving mathematical problems.
- **Problem Solving Ability: -** Problem solving is the frame-work or pattern within which creative thinking and reasoning take place. It is the ability to think and reason on given levels of complexity. People who have learned effective problem solving techniques are able to solve problems at higher of complexity than more intelligent people who have not such training.
- **10^{th} class students: -** 10^{th} class students refer to the boys and girls studying in 10^{th} class in Rait block of district Kangra of Himachal Pradesh.

4.3 Type of Schools

In the present study the type of schools means government & private school functioning in Himachal Pradesh.

1. **Government Schools-** Government schools refer to those schools which are under the management of government officials are included in government schools.
2. **Non-Government Schools-** Non-government schools are managed by the private organization or person either partially or totally are included in non-government schools.

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Hooda ,(2018) he purpose of the present study is to investigate the mathematics achievement of secondary school students in relation to problem solving ability and gender. Descriptive survey method was used. Problem Solving Ability and Gender were treated as independent variables whereas Mathematics Achievement was treated as dependent variable. A sample of 400 secondary school students was selected through multi-stage random sampling technique. Problem Solving Ability Test for school students (PSA) by Dubey (2011) [5] was used to assess the problem solving ability of the students. Mathematics Achievement Test (MAT) developed by Singh and Jaidka (2015) [18] was used to assess the mathematics achievement of secondary school students. The obtained data was analyzed using Two Way ANOVA with 3x2 factorial design. Levene's Test of Homogeneity of Variance was also applied to test the assumption of homogeneity of variance for ANOVA. The findings of the study revealed that problem solving ability and gender has significant main effect on the mathematics achievement of the secondary school students. However, no significant double interaction effect of problem solving ability and gender on mathematics achievement of the secondary school students was found. Thus, efforts should be made to help the students to improve their problem solving ability which will help them in improving their mathematics achievement. Workshops and seminars should also be organized in all educational institution to guide the students about the various techniques to enhance the mathematics achievement. The findings of the present study has an implication for teachers that they should use the appropriate classroom techniques, methods and tools so that better problem solving ability can be accomplished.

Nain Singh1, & Yudh Veer (2019) This study was conducted on 600 Scheduled Castes Senior Secondary School Students of Kullu and Mandi Districts of Himachal Pradesh to find out the differences in the problem solving ability of these students in relation to their gender and district they belong to. The results of the study revealed that neither the gender nor the district of the senior secondary scheduled caste school students have any effect on problem solving ability of these students..

Madhumathi and Ahmed (2020) conducted a study on 'assessing problem- solving abilities based on Polya's approach Osmania (Hyderabaad) university'. The study revealed that almost 80% of the students are below average in their problem solving abilities. It has been also found that in almost all the problem solving abilities, the performance of girl students was found to be relatively better than boys. A sample is a small portion of a population selected for observation and analysis. It is a collection consisting of a part of subset of the objects or individuals of population which is selected to express the purpose of representing the population. By observing the characteristics of the sample, one can make certain inferences about the characteristic of the population from which it is drawn.

In the present study, the sample of 200 students of government and private schools has been taken between the age group of 12 to 17 years from block Rait of the Kangra District of Himachal Pradesh, by using convenient random sampling. In random sampling, each unit of the population is given an equal chance of being selected. The selection of the unit from the population is done in such a manner that every unit in the population has an equal chance to being chosen and the selection of any one unit is in way tied to the selection.

The main purpose of the study is to study the problem solving ability of 10^{th} class students. It is well known that the most acceptable criterion for the selection of the sample is the degree to which it may be regarded as representative of the universe under study. In the present study, a convenient random sampling technique is used for selection of sample. Due to shortage of time, it is not feasible for the researcher to visit all the schools of Rait block. So for convenience, the researcher selected total ten governments and private schools in which there were five governments and five private schools consisting of rural and urban 10^{th} class school students in block Rait of District Kangra.

Hypothesis: - 1. There is no significant difference between government and private schools of 10^{th} class students for problem solving ability.

As the problem solving ability helps in bringing the desirable modification in the behaviours of the student. It is evident from the table no. 1 that approximately 0.5% of the sample has a very high problem solving ability, 1% of the sample has a high problem solving ability, 1 % of the sample has an average problem solving ability, 6 % of the sample has a low problem solving ability and 91.5% of the sample has a very low problem solving ability. The figure no.1 shows the frequency distribution with the help of column diagramme among (a) very high ability, (b) average and (c) very low problem solving ability of 10^{th} class students ranging the age group between 14 to 17 yrs given below in

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Table no. 1

Classifications → / Ability ↓	14-15 yrs Age Group of Boys and Girls	No. of Students in the Age group of 14-15 yrs	16-17 Age Group of Boys and Girls	No. of Students in the Age group of 16-17 yrs	Total No. of Students in the Age group of 14-17 yrs	Percentage (%)
Very High Ability Marks →	16 & Above	1	16 & Above	-	1	0.5
High Ability Marks →	13-15	1	14-16	1	2	1
Average Ability Marks →	11-13	1	12-14	1	2	1
Low Ability Marks →	9-11	5	10-12	7	12	6
Very Low Ability Marks →	9 & below	76	10 & below	107	183	91.5

HYPOTHESES-2 "There is no significant difference between male and female 10th class students for problem solving ability".

In order to test the above said hypothesis, the investigator calculated the Mean (M), Standard Deviation (S.D), Standard Error of Deviation ($S.E_{D.}$), Degree of Freedom (df), t- value and the level of significance of male and female 10th class students. The calculated values have been shown in table no.2 as given:

Table No. 2

Showing the Statistical Differential on Problem Solving Ability of Male & Female 10th Class Students

Gender	Number(N)	Mean(M)	S.D	$S.E_{D.}$	Degree of Freedom (df)	't-'value	Significant Level
Female	100	6.02	3.14	0.4	198	1.85	Not Significant at 0.05 level
Male	100	6.76	2.48				

Source: Primary Probe

It is evident from the table no.2 that the calculated S. $E_{D,}$ df and t- value are 0.4, 198 and 1.85. As the calculated't'-value is 1.85, which is less than the table value of 1.97 at 0.05 level. Thus, theresult indicates that there is no significant difference between male and female 10th class students. Hence, the hypothesis-II is accepted. It means both male and female students do not play an important role in making difference. The reasons for the above said results may be emotional imbalances as a part of growing up as adolescents and these become more pronounced because of the hectic student's life, new-admits or transferred students think about how they will handle the school environment with other students and teachers and lack of quality education.

The figure no .2 shows the frequency distribution with the help of column diagramme among (a) mean, (b) S.D and (c) S. $E_{D.}$ of 10th class students ranging the age group between 14 to 17 yrs as give.

Hypothesis No 3: "There is no significant difference between government and private schools of 10th class students for problem solving ability".

In order to test the above said hypothesis, the investigator calculated the M, S.D, $S.E_{D.,}$ df, t- value and the level of significance of government and private 10th class students. The calculated values have been shown in table no.3 as given:

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Table No. 3

Showing the Statistical Differential on Problem Solving Ability of Types of School

Groups	N	M	S.D	S. E_D	df	't'value	Significant Level
Government	100	5.82	2.10	0.38	198	1.05	Not Significant at 0.05
Private	100	6.87	3.36				

Source: Primary Probe

It is evident from the table no. 3 that the calculated S. E_D, df and t- value are 0.38, 198 and 1.05. As the calculated 't'-value is 1.05, which is less than the table value of 1.97 at 0.05 level. Thus, the result indicates that there is no significant difference between government and private 10^{th} class students. Hence, the hypothesis-III is accepted. It means either government or private does not play an important role in making differences. The reasons for the above said results may be the students all over the world face a number of problems which dishearten them. It leads to sheer desperation among the students' community giving rise to student's unrest. There are so many issues they have to deal with study, time, money, relationships, jobs, hopes and more. Parents' previous experience and education do not always equip them in dealing with such pressures. The figure no.3 shows the frequency distribution with the help of column diagramme among (a) mean, (b) S.D and (c) S. E_D of 10^{th} class students ranging the age group between 14 to 17 yrs.

V. CONCLUSION

Mathematics is an essential subject in the present era of computers memorization of fact and principles. Problem solving has special importance in the study of mathematics. A primary goal of mathematics teaching and learning is to develop the ability to solve a wide variety of complex mathematical problems. Teaching and learning of mathematics play a different role in the present century of automation and cybernetics, marked the beginning of new scientific and industrial revolution. National Policy on Education (NPE, 1986) has envisaged that, "Mathematics should be visualized as the vehicle of communication to train a child to think, to reason, to articulate and to analyse logically. It should be treated as a concomitant to any subject involving analysis and synthesis.We need people who can solve not only the mathematical problems but also the problems of other fields by applying the approaches that are used in solving mathematical problems, principles and standards for school mathematics. According to the National Council of Teachers of Mathematics (NCTM, 2000), states that, "the instructional programme from kindergarten through grade 12 should enable all students to:-

- Build new mathematical knowledge through problem solving.
- Solve problems that arise in mathematics and in other context.
- Apply and adopt a variety of appropriate strategies to solve problems.
- Monitor and reflect on the process of mathematical problems solving".

These sentences reinforce the need for students to develop the problem-solving skills to solve a wide variety of complex problems.

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