

# A STUDY OF PROBLEM-SOLVING ABILITY IN PHYSICS AMONG INTERMEDIATE LEVEL STUDENTS

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This study attempts to assess the problem-solving ability in physics among intermediate level students in relation to their sex, locality and type of school. To execute the present study, 500 students studying physics in Class XII from 30 schools of Rohilkhand region were selected on basis of multi stage random sampling technique. The present study was conducted through survey method. The data were analysed by mean, S.D. and 't' test. The findings indicate that sex and type of school both influenced the physics problem-solving ability of the students. Students of privately-managed and girl students have better physics problem-solving ability than their respective counterparts. However, locality does not reflect the significance effect over physics problem-solving ability of the students.

With the advancement in science and technological fields, the life of the individual is becoming more and more complex confronted with a variety of problem each and everyday. In order to lead a comfortable life, a person must have the capability to solve these problems in his/her own unique manner keeping in view his/her personal life settings and style. This capability is much more acquired rather than being by innate. So, it is the responsibility of education system to develop problem-solving ability in the students so that they may solve their problems independently for better adjustment. Discipline of science presents a better scope for this purpose.

Science should not be seen as a sterile academic discipline but should be taught at all stages in a way, which emphasises practical, investigative and problem-solving approach. At present, basic science is taught as a part of environmental studies at primary level. From upper primary level to secondary level, it is taught as a part of general science. In the hierarchy of types of learning, problem-solving learning is at the top. So, it is quite necessary that in the schools, subjects should be taught in the way that ensures highest level of learning. In physics, it becomes much more important because problem-solving ability in this subject is directly linked with our social progress.

Development of this ability is also associated with stages of cognitive development. According to Piaget, after the expiry of formal operation stage (about 15 years), the child may reach full intellectual potential to discover problems through mental manipulation of symbols by adopting a logical and systematic procedure. It implies that students at senior secondary level are matured enough to display problem-solving ability.

At senior secondary level, science is an optional subject. The students who opt for physics at this level are very different in their problem-solving ability. Some students are quick and efficient problem-solvers, while some students fail to solve even simple problems. This raises the question as why some students are poor problem-solvers and others are efficient, when the learning experiences provided to them are almost the same? The difference obviously lies within the problem-solver. Therefore, it would be interesting to understand the nature of difference between the successful and unsuccessful problem-solvers.

Review of the evidence in this aspect shows that very few researchers have tried to explore the impact of various individual characteristics of learners on their problem-solving ability, specially in physics subject. The studies conducted by Ajwani (1979) and Naga Lakshmi (1996) showed that there was no significant sex differences in relation to problem-solving ability. Mishra (1986) found in his study that public school students performed on the combinatorial grouping problem irrespective of school, place and sex. Kazemi (1996) also found that boys and girls did not differ significantly on achievement in solving mathematical word problems. However, Kiran (1983), Dharchingpui (1989) and Anthony (1991)

found in their studies that significant sex difference in problem-solving ability existed. Mealings (1961), Anthony (1991) and Roberts (2006) found in their studies that age of the child did not significantly affect problem-solving ability. But Ajwani (1979) and Shrestha (1982) found that problem-solving ability of the subjects increased with an increase in age. Studies conducted by Sumathy (1994) and Naga Lakshmi (1996) found that rural and urban students differ significantly to each other in problem-solving ability in physical science and mathematics respectively. Thus, findings in this area are quite contradictory and necessitate for further studies. With this view point, present study has been undertaken.

## Objective

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To assess the problem-solving ability in physics among intermediate level students in relation to their sex, locality and type of school.

## Hypotheses

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Following hypotheses have been framed to fulfil the objective of the study–

- (1) There is no significant difference between boy and girl students in respect to their problem-solving ability in physics.
- (2) Urban and rural students do not differ significantly in their problem-solving ability in physics.
- (3) No significant difference exists between the students of privately-managed and government-managed schools in respect to their problem-solving ability in physics.

## Methodology

Study has been carried out through survey method.

## Sample

A sample of 500 students studying physics in Class XII was selected on the basis of multistage random sampling technique taking into consideration proper representation to both the sexes (Boys and Girls), locality (Urban and Rural) and type of schools (Privately-managed and Government-managed). At the first stage, four districts were selected randomly out of eight districts of Rohilkhand region. Then, out of various senior secondary schools located in these districts, thirty senior secondary schools in which science was offered at XII level were selected randomly giving proper representation to locality.

## Tool

A test for measuring problem-solving ability in physics was developed by the investigators. The test was validated and revised at three stages— individual testing, small group testing and field testing. The initial draft of the test consisted of 150 problem-solving items. The final form of test consisted of 74 items. The reliability of the test was calculated by test-retest method and was found to be 0.73. It was validated for its content only.

## Statistical Techniques

't' test has been used for analysing the data. Table 1 shows the performance of boys, girls as

well as total students on physics problem-solving ability. The mean score of total students is 42.25. The maximum possible score on Physics Problem-solving Ability Test is 74. This shows that the average performance of intermediate level students is approximately 60 per cent on the constructed test. The value of standard deviation (13.09) indicates that scores of students are within the normal range of deviations.

## Results and Discussions

Table1 : Difference in the Mean Scores in Physics Problem Solving Ability of Boy and Girl Students

Groups	N	M	S.D.	't'
Boys	300	41.23	12.82	2.14*
Girls	200	43.78	13.38	
Total	500	42.25	13.09	

\*Significant at 0.05 level

Table 1 also reveals that there is a significant difference in physics problem-solving ability of boy and girl students at 0.05 level of significance ( $t=2.14$ ). Thus, sex of the students affects the physics problem-solving ability. Mean score on physics problem-solving ability of girls ( $M=43.78$ ) is higher as compared to the mean score of boys ( $M=41.23$ ), meaning thereby that girls are better in physics problem-solving ability than boys.

Similar findings were found by Kiran (1983), Dharchingpui (1989) and Anthony (1991). They explored that students have significant difference on problem-solving ability in relation to sex. But this finding is somewhat contradictory to some of the previously reported ones. Ajwani (1979) observed no

significant sex difference in subject ability to solve problems. Naga Lakshmi (1996) observed in her study that there was no significant difference between the performance of boys and girls regarding problem-solving ability in mathematics.

Finding of the present study is quite interesting and contradicts the general viewpoint that mathematics and physics are the subjects in which boys can do better than the girls. The reason for the obtained difference in physics problem-solving ability of girls and boys may be that girls are more serious in their studies, to see the things more critically and to devote more time in understanding each and every thing as compared to boys who are probably not so serious.

It is also possible that at this stage of age, cognitive development of girls is faster than the boys resulting in better development of problem-solving ability.

Table 2 : Difference in the Mean scores in Physics Problem-solving Ability of Rural and Urban Students

Groups	N	M	S.D.	't'
Rural	100	40.17	11.97	1.78
Urban	400	42.77	13.32	

Table 2 shows that 't' value among students of rural and urban areas for differences in physics problem-solving ability is not found significant at any level of confidence. Thus, this table indicates that both groups are similar on physics problem-solving ability. The mean scores of rural and urban students are 40.17 and 42.77, respectively. The result is contradictory to the study conducted in India by Sumathy (1994) who found significant difference on problem-solving ability in physical

sciences between the rural and urban students. Urban students were at a higher level than rural students on problem-solving ability. Naga Lakshmi (1996) also found in her study a significant difference in the problem-solving ability in mathematics students of rural and urban areas in favour of the latter groups. The present study infers that locality does not effect the problem-solving ability among intermediate level students showing that students of rural locality have come at par to urban students in this respect.

Table 3 : Difference in the Mean scores in Physics Problem-solving Ability of Students belonging to Privately-managed and Government-managed Schools

Groups	N	M	S.D.	't'
Privately-managed	400	43.26	13.47	3.48**
Government-managed	100	38.22	10.58	

\*\*Significant at 0.01 level

The close scrutiny of Table 3 indicates that the students studying in privately-managed and government-managed schools have a significant difference at 0.01 level of confidence in respect to physics problem-solving ability. The mean value of physics problem-solving ability of privately-managed schools students (M=43.26) is higher than the mean value of government-managed schools students (M=38.22). So, it may be concluded that students of privately-managed schools are better in physics problem-solving ability than those of government-managed schools. This is perhaps due to the reason that the privately-managed schools are more equipped in many aspects than government-managed schools. The buildings, the libraries, the

laboratories, the teaching staff, the educational atmosphere, the competitive spirit among the students, the amenities provided to students to pursue education, the opportunities of exposure through science fairs, exhibitions, workshops, debates, symposium, etc., the student participation in teaching-learning process, use of audio-visual aids etc., are better in privately-managed schools than in government-managed schools. Probably these factors contribute in the development of problem-solving ability among the students.

There may be one more reason behind this finding. The quality of teaching is better in private schools. The teachers have to show more sincerity and more interest in teaching in private schools because of the fear of losing their job or immediately being questioned by the management about the quality of their teaching. Thus, the standard of teaching is better in privately-managed schools than government-managed schools, which might play a role in the development of problem-solving ability in physics among the students.

Thus, it can be concluded on the basis of the present work that type of school effects physics problem-solving ability of the students and environment of private schools is more suitable in this respect than that of government schools.

## **Conclusions and Suggestions**

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The conclusions and respective suggestions based on the findings are as follows:

1. Sexwise, there are differences in problem-solving ability in physics of intermediate

level students. Girls are better in physics problem-solving ability than the boys. So, this study suggests that boys are required to show more seriousness in their studies, to see the things more critically and to devote more time in understanding each and every concept. Parents and teachers are suggested to take this finding in cognizance and facilitate the boys in developing problem-solving ability through providing proper home/school environment.

2. Locality does not affect the problem-solving ability in physics among intermediate level students showing that rural students are at par to urban students in this respect.
3. On problem-solving ability in physics type of school is a determining factor for students. Students studying in privately-managed schools are superior in problem-solving ability in physics than the students studying in government-managed schools. In view of this finding of present study, teachers serving in government schools are suggested to do more sincere efforts in this direction. It is desirable for them to make changes in their planning suitably so that more activities like brain-storming, group discussions, project methods, debates, symposium, etc., may be organised for the development of problem-solving ability among their students.

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