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Assessing Problem-Solving Ability of Secondary School Students in Balasore, Odisha: A Comparative Analysis by Gender, Locality and School Type

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Abstract

Problem-solving skill is a core cognitive ability that equips students to confront difficulties, make decisions and act with resolve in uncertain situations. This study set out to examine the problem-solving ability of secondary school students in Balasore District, Odisha, giving particular attention to overall ability and to group differences by gender, locality, and school type. Adopting a descriptive survey design, the researchers drew a stratified random sample of 380 Grade 9 students from Government and Private Schools located in Rural and Urban areas. Respondents completed the Problem-Solving Ability Test, and the responses were analysed through percentage, mean, standard deviation, and t-test. Based on the results obtained, it is evident that most of the respondents had a moderate level of problem-solving ability (39.74%). There was no significant difference between the problem-solving ability of both genders. However, there is a significant difference between the problem-solving abilities of Urban and Rural students. Urban students excelled over their Rural counterparts, and similarly, students in Private Schools outperformed those in Government Schools. From the results, one can conclude that the problem-solving ability varies with the location and the type of institution but not with gender. The study recommends that schools can play a significant role in enhancing students' problem-solving abilities if they implement new methods in teaching. The results also emphasize the need to develop students' problem-solving abilities and address the disparities between Government and Private Institutions.

Keywords: *Problem-solving ability; secondary school student; gender; locality; school type.*

1. Introduction

Problem-solving is among the most vital abilities that students need in today's world. The skill extends beyond academic learning and influences how a person handles difficulties in personal and social life. Unlike the simple memorization of information, it draws on critical thinking, imagination, reasoning, and judgement, enabling students to evaluate a situation and arrive at the most suitable solution (OECD, 2017). As present-day tasks grow more complex, schools need to move toward building students' capacity to deal with the many challenges awaiting them in future (NCERT, 2005).

The value of problem-solving skills is not confined to the classroom. In a knowledge-based society, where technology and information change quickly, problem-solving abilities are central to innovation, employability, and lifelong learning (Trilling & Fadel, 2009). When students are encouraged to think independently and to face challenges critically, they become better prepared to adjust to a world that keeps changing. Consequently, strengthening students' problem-solving capabilities has emerged as a major priority in educational policies and curricular reforms, both globally and in India (Ministry of Education, 2020).

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Although the need to enhance one's ability to solve problems is not in question, students differ in their capacity to cope with challenges, and gender, school type, and locality factors may explain this phenomenon. For instance, boys and girls are expected to adopt different cognitive approaches and learning orientations (Halpern, 2012), and rural and urban students are likely to encounter disparities stemming from their diversified backgrounds (Singh & Gera, 2015). Differences between government and private schools in terms of teaching and administrative practices, on the same note, may influence students' learning behaviors and critical thinking and, consequently, their problem-solving capacities (Mishra & Nayak, 2019).

Research that looks at differences in the problem-solving abilities of secondary school students in Odisha is limited. This study therefore tries to fill the gap, taking the Balasore district as its focus. Balasore includes both urban and rural areas, which makes it a fair representative of the state as a whole. What the study finds can enrich the literature on students' problem-solving skills and give educators and policy-makers pointers for nurturing the competencies that are critical for students' overall development (Pradhan & Mohanty, 2021).

Problem solving ability is the capacity to recognise complex issues or challenges, produce several possible solutions, judge how feasible and effective each one is, and carry out suitable strategies to reach a satisfactory resolution. For the purpose of this study, problem solving ability means the students' capacity to understand and analyse problems on the basis of Intelligence, Reasoning Ability and Mathematical Ability, and to apply scientific knowledge and methods to solve them.

Secondary school students are those enrolled in grades 9 and 10. In this study, the term secondary school students refers specifically to grade 9 students of the secondary schools of Balasore.

2. Rationale of the Study

Success depends on problem solving, which has long been seen as the most important dimension of human behavior. Education seeks, among other aims, to build the capacity for better performance. Problem-solving behavior exists to foster the thinking ability that helps in discovering the solution to a problem, and it chiefly aims to examine the physical, psychological, social, and environmental factors that obstruct an individual's progress toward particular goals. Problem Based Education is an approach designed to help students acquire skills in self-directed learning, independent study, questioning, and problem solving, so that they can research on their own and keep learning whenever comparable situations occur later in life. Real situations are shaped into problem situations and scenarios for this purpose. Guided and managed by the teacher, learners discover, analyze, and solve the problem and together gather the data needed to learn, individually as well as in groups (Hooda & Devi, 2014). Another aim of teaching through problem solving is that students gradually refine and extend their own processes, since accumulating experience lets them set some ideas aside and notice further possibilities.

Secondary education is the link that joins elementary education to higher education. As a critical stage in the educational hierarchy, it readies students for higher studies and also for the world of work. Because the secondary and higher secondary stages are rigorous, Indian students are able to compete successfully worldwide for education and for jobs. Strengthening this stage, by widening access and by raising quality significantly, is thus absolutely essential (Mohalik & Behera, 2016).

Many studies in India and abroad have examined students' problem-solving ability with respect to a variety of variables. Researchers such as Kumar & Vasimalairaja (2022), Son et al. (2020), Simamora et al. (2019), Nursyahidah et al. (2018), Hendriana et al. (2018), Suarsana et al. (2019), Widada et al. (2018), Daniel (2016), and Aurah et al. (2014) took problem-solving ability as the variable and concluded that problem-based learning improves students' mathematical problem-solving ability along with their self-efficacy. Their work also shows that, to maximize students' achievement in mathematics, it is important to incorporate local culture into mathematics learning. Mathematics teachers are accordingly expected to make learning materials accessible to students and to integrate local culture into mathematics lessons at school. Another set of researchers, Castro (2023), Keles (2022), Kumar (2020), Karthika & Vasimalairaja (2019), Priya (2017), and Sonnleitner et al. (2013), studied problem solving ability and creativity among higher secondary school students and found their problem-solving ability to be on the higher side. The same studies suggest that higher secondary students of government, government aided, and self-financing institutions show no significant difference in problem-solving ability in mathematics. Gupta et al. (2016), Mahalakshmi & Pugalenthy (2015), and Gupta (2013) took variables such as problem-solving ability and the academic achievement of secondary school students in relation to gender, caste, locality and the like, and reported that Sex and Caste had a significant impact on students' problem-solving ability.

A felt need for this study therefore exists, all the more because research in this area on secondary school students of Odisha is lacking. On the basis of the formulated objectives, certain judgments also have to be made, and these will clarify the existing status of Problem-Solving Ability among Secondary school students of Odisha.

3. Objectives of the Study

1. To examine the level of problem-solving ability of secondary school students.
2. To study the problem-solving ability of secondary school students in relation to their gender, Locality and School type.

4. Hypotheses of the Study

1. H_{01}: Boys and girls do not differ significantly in their problem-solving ability (μ boys = μ girls).
2. H_{02}: Rural and urban students do not differ significantly in their problem-solving ability (μ rural = μ urban).
3. H_{03}: Government and private secondary school students do not differ significantly in their problem-solving ability (μ government = μ private).

5. Methodology

5.1 Method of the Study

This study followed the descriptive survey method within the quantitative research approach. Its aim was to describe and analyze the prevailing level of problem-solving abilities of secondary school students without manipulating the environment.

5.2 Population

The target population of the research consists of 9th grade students from secondary schools in Balasore district. Both government and private institutions are included so that every category of school in the district is covered. The students' age may range from 14 to 16 years.

The selected schools cover both urban and rural areas of the district, which allows the results to be generalized to the whole student population at the secondary level.

5.3 Sample

Stratified non-proportionate random sampling was used to draw 380 students from the sample frame. Gender, area and school type served as strata, with equal groups in each: 190 boys and 190 girl students, 190 rural and 190 urban students, and 190 government and 190 private school students.

5.4 Tool Used

The researcher measured students' capacity to solve problems with the Problem-Solving Ability Test (PSAT), a standardized psychological instrument that L.N. Dubey (2006) developed to assess the "problem-solving ability" of adolescents.

The PSAT contains 20 multiple-choice questions, designed to capture the basic components of students' problem-solving ability. Each correct answer earns the respondent one point, so the maximum possible score is 20 points.

5.5 Statistical Technique Used

The present study made use of the following statistical techniques, namely descriptive statistics along with inferential statistics.

For the first objective, the data obtained from the PSAT were analyzed through simple percentage analysis. This method is well suited to descriptive research because it makes it easy to compare and interpret the proportion of students in the various ability categories. The percentages gave a clear picture of how problem-solving abilities are distributed across the different groups.

For the second, third and fourth objectives, the t-test was applied to examine differences by gender, locality and school type respectively.

6. Results

6.1 Level of Problem- Solving Ability of Secondary school Students

Students' problem-solving ability was grouped into seven levels, from "Extremely High" to "Extremely Low." The data collected are shown in Table 1.

Table 1: Level of Problem-Solving Ability of Secondary School Students by Gender

Sl. No.	Level of Problem-solving ability	No. of students (percentage)		Total no. of students (percentage)
		Boys (N = 190)	Girls (N = 190)	
1	Extremely High	2 (1.05%)	5 (2.63%)	7 (1.84%)
2	High	5 (2.63%)	19 (10.00%)	24 (6.32%)
3	Above average	47 (24.74%)	43 (22.63%)	90 (23.68%)
4	Average	85 (44.74%)	66 (34.74%)	151 (39.74%)
5	Below average	14 (7.37%)	14 (7.37%)	28 (7.37%)
6	Low	23 (12.11%)	24 (12.63%)	47 (12.37%)
7	Extremely low	14 (7.37%)	19 (10.00%)	33 (8.68%)
	Total	190 (100%)	190 (100%)	380 (100%)

Note. Cell entries are the number of students, with the percentage of the group in brackets. Percentages are calculated within each gender group (boys, n = 190; girls, n = 190) and, in the last column, for all 380 students.

Figure 1: Percentage of Boys and Girls at Each Level of Problem-Solving Ability

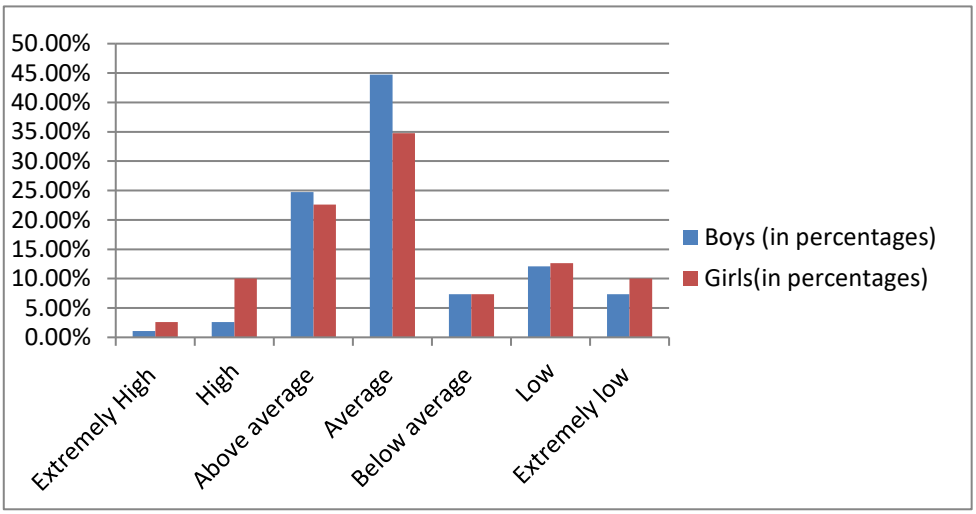


Table 1 and Figure 1 reveal that the biggest share of students (151 students, 39.74%) belong to the "Average" category, which indicates that most students have a moderate level of problem-solving ability. A notable proportion (90 students, 23.68%) is placed in the "Above Average" category, meaning that nearly one-fourth of the students possess good problem-solving skills. In contrast, only 7 students (1.84%) are classified as "Extremely High" in problem-solving ability, which shows that very few students have exceptional cognitive skills. In addition, a considerable number of students (47 students, 12.37%) come under the "Low" category, and a further 33 students (8.68%) are categorized as "Extremely Low." These two levels together comprise 80 students (21.05%), which underlines the need for intervention to strengthen their problem-solving capabilities.

When boys and girls were compared, the "Average" category held the largest proportion of boys (44.74%), with "Above Average" next (24.74%); for girls too the largest proportion (34.74%) was in "Average", and "Above Average" came next (22.63%). In the "High" (10.00%) and "Extremely High" (2.63%) categories, girls recorded relatively higher percentages than boys (2.63% and 1.05% respectively), and taking the two highest levels together, 12.63% of girls against only 3.68% of boys are placed there. Toward the lower end, boys and girls have the same proportion of "Below Average" students (7.37%) and nearly

the same proportion of "Low" students (12.11% of boys and 12.63% of girls); however, a higher share of girls (10.00%) than boys (7.37%) falls in the "Extremely Low" category. Girls thus appear more prominently at both extremes of the distribution, and boys cluster in the middle levels.

6.2 Problem-solving ability of secondary school students with reference to their gender.

The objective was to find out whether the problem-solving ability of secondary school boys and girls differs significantly, using an independent samples design. The data were analyzed using the t-test. The descriptive statistics and results are given below:

Table 2: Mean, Standard Deviation, and t-Value of Problem-Solving Ability Scores by Gender

Gender	N	Mean	SD	df	t-value	Remarks
Boys	190	11.575	3.714	378		
Girls	190	11.7	4.539	378	0.29	Not Significant at 0.05 level

Note. N = number of students; SD = standard deviation; df = degrees of freedom. Scores are PSAT raw scores (maximum = 20).

According to Table 2, secondary school boys and girls obtained mean problem-solving ability scores of 11.575 and 11.7, and their standard deviations are 3.714 and 4.539 respectively. The t-value computed for the two groups is 0.29, and since it is lower than the critical value of 1.96 at the 0.05 level of significance, the null hypothesis is not rejected. It can therefore be interpreted that secondary school boys and girls do not differ significantly in Problem-solving ability.

6.3 Problem-solving ability of secondary school students with reference to their locality

The objective was to compare the mean problem-solving ability scores of rural and urban secondary school students for an independent sample. Locality was of two types, namely rural and urban. The t-test was used for data analysis, and the results are given below:

Table 3: Mean, Standard Deviation, and t-Value of Problem-Solving Ability Scores by Locality

Locality of School	N	Mean	SD	df	t-value	Remarks
Rural	190	10.3	4.160	378		
Urban	190	12.975	3.677	378	6.64	Significant at 0.05 level

Note. N = number of students; SD = standard deviation; df = degrees of freedom. Scores are PSAT raw scores (maximum = 20).

According to Table 3, rural and urban Secondary school students obtained mean problem-solving ability scores of 10.3 and 12.975, and their standard deviations are 4.160 and 3.677 respectively. The t-value computed for the two groups is 6.64, and since it exceeds the critical value of 1.96 at the 0.05 level of significance, the null hypothesis is rejected. It can therefore be interpreted that secondary school students from urban areas of Balasore show greater problem-solving ability than students from rural areas.

6.4 Problem-solving ability of Secondary School Students of Balasore district with reference to their type of schools

The purpose was to determine whether the problem-solving ability of government and private secondary school students differs significantly, for which an independent sample was used. The t-test was employed to analyze the data. The descriptive statistics and t-test results are as follows:

Table 4: Mean, Standard Deviation, and t-Value of Problem-Solving Ability Scores by School Type

Type of School	N	Mean	SD	df	t-value	Remarks
Government	190	9.975	4.315	378		
Private	190	13.3	3.203	378	8.58	Significant at 0.05 level

Note. N = number of students; SD = standard deviation; df = degrees of freedom. Scores are PSAT raw scores (maximum = 20).

According to Table 4, government and private Secondary school students obtained mean problem-solving ability scores of 9.975 and 13.3, and their standard deviations are 4.315 and 3.203 respectively. The t-value computed for the two groups is 8.58, and since it exceeds the critical value of 1.96 at the 0.05 level of significance, the null hypothesis is rejected. It can therefore be interpreted that secondary school students from private schools of Balasore show greater problem-solving ability than students from government schools.

7. Discussion of the Results

7.1 Level of problem-solving ability

Taken overall, Grade 9 students in Balasore district display problem-solving ability that is mostly moderate. The average level accounted for 151 (39.74%) of the 380 students and the above average level for 90 (23.68%), whereas only 7 (1.84%) reached the extremely high level. The low and extremely low levels, by contrast, held 80 students (21.05%). A mean raw score of about 11.6 out of 20, or roughly 58 per cent, for the whole sample supports this reading. Kumar (2020) likewise observed a considerable but uneven extent of problem-solving ability among higher secondary students, and Karthika and Vasimalairaja (2019) found that just a minority of rural higher secondary students (24.5%) had a high level of ability in understanding problems, and still fewer (14.8%) in forming equations.

These scores can also be set beside studies in which students were taught through problem-based approaches. After problem-based learning, Grade 9 students in the study of Treepob et al. (2023) reached a mean of 15.28 out of 20 (76.4%), well above the mean of the present sample. The tests are not the same, so this comparison is only indicative; even so, it hints that students in regular classrooms can still grow considerably. The point agrees with Hendriana et al. (2018) and Simamora et al. (2019), whose results showed that problem-based and guided discovery learning improved students' problem-solving ability.

7.2 Gender and problem-solving ability

The problem-solving ability of boys and girls was not significantly different (means of 11.58 and 11.70; $t = 0.29$; Cohen's $d \approx 0.03$); consequently, the first null hypothesis was not rejected. Jaisawal and Naaz (2023) similarly obtained a slightly higher mean for boys that failed to reach statistical significance, and Keles (2022) likewise detected no gender difference in the creative problem-solving attributes of 435 high school students. A gender effect has, though, been reported elsewhere: Priya (2017) and Suman, Kamatchi and Stanly (2021) found boys ahead, and Gupta (2013) reported a significant effect of sex. The literature as a whole is thus mixed, and this suggests that gender differences are not universal; their direction and size seem to vary with the test used, the subject area (mathematics-specific or general reasoning), the age group and the region. Since the PSAT used here taps general reasoning and decision-making rather than school mathematics alone, and since boys and girls studying in the same schools have the same curriculum and classroom conditions, the lack of a difference in averages becomes easier to understand.

The equal means should not, however, be taken to imply identical distributions. A larger share of girls than boys appeared at both extremes: 12.63% of girls compared with 3.68% of boys were in the High and Extremely High levels, while 10.00% of girls compared with 7.37% of boys were Extremely Low. This is consistent with the greater standard deviation of girls (4.539) relative to boys (3.714). Girls therefore seem to be a more varied group, some performing very well and some being left behind. The observation rests on a descriptive comparison alone and should be tested in future research, for instance through a test of equality of variances.

7.3 Locality and problem-solving ability

With a mean of 12.98, urban students scored significantly higher than rural students, whose mean was 10.30 ($t = 6.64$; Cohen's $d \approx 0.68$); the second null hypothesis was thus rejected. A difference of roughly 2.7 marks on a 20-mark test can be described as medium-to-large. Singh and Gera (2015), who highlight rural–urban disparities in exposure, resources and opportunities, support this result, as do Gupta, Kavita and Pasrija (2016), who noted significant differences between urban and rural Grade 10 students in a study that connected problem-solving ability with academic achievement. Kamatchi and Stanly (2021), however, reached a different result, finding rural students ahead among higher secondary students in Puducherry. Sample size, the measure used and the local conditions of the districts studied may explain why these studies diverge.

Why might urban students in Balasore do better? Several features of urban schooling could be responsible: libraries, laboratories and digital resources are easier to reach, qualified teachers are more plentiful, children meet more varied problem situations outside the classroom, and extra academic support is more readily available. Teaching in rural classrooms, in comparison, may lean more on textbooks and memorization. These explanations are plausible, but the present study did not test them. A further point is that urban students are more likely to attend private schools, so the locality difference cannot be fully separated from the school-type difference reported below.

7.4 School type and problem-solving ability

Private school students (mean = 13.30) scored above government school students (mean = 9.98) ($t = 8.58$; Cohen's $d \approx 0.88$), which led to rejection of the third null hypothesis; of the three differences examined, this one was the largest. Jaisawal and Naaz (2023) reached the same conclusion, finding private school students ahead and arguing that school type and available resources play a substantial role. Better performance by private school students was also reported by Suman and Sharma (2025) and Kamatchi and Stanly (2021), and Singh and Kaur (2014) found heads of private schools to have greater problem-solving ability than heads of government schools. The result also lends support to the concern Mishra and Nayak (2019) expressed about institutional differences between government and private schools in Odisha. Priya (2017), in contrast, found no significant difference among government, government-aided and self-financing higher secondary schools, and Keles (2022) found no school-type difference in creative problem-solving. Such contrasts suggest that the school-type effect varies from one setting to another.

Private schools may owe their lead to smaller classes, closer supervision of teaching and learning, more regular academic activities, and a more favourable home background among their students; Priya (2017) observed higher problem-solving ability in students from higher socio-economic backgrounds. None of these factors was measured in this study. Government school students also had a larger standard deviation (4.315) than private school students (3.203). Government school classrooms thus contain a wider mix of very weak and very strong performers, a variety that teaching strategies must take into account.

7.5 Overall interpretation and educational implications

Taken as a whole, the findings indicate that the place where a student studies matters much more than the student's own identity. Compared with the effect size for gender ($d \approx 0.03$), those for locality ($d \approx 0.68$) and school type ($d \approx 0.88$) are large. Rural students are mostly found in government schools, and urban students more often in private schools; the two gaps probably therefore share a common underlying disadvantage in access to resources and to good teaching, and are unlikely to be two independent causes.

Several implications follow from this. First, problem-based and activity-based learning ought to become part of daily classroom teaching, as studies by Hendriana et al. (2018), Treepob et al. (2023), Simamora et al. (2019) and Suarsana et al. (2019) demonstrate that such approaches improve problem-solving ability; the National Curriculum Framework (NCERT, 2005) and the National Education Policy (Ministry of Education, 2020), which stress critical thinking and competency-based learning, point the same way. Second, government and rural schools should be given priority over others in in-service training and resources centred on problem-posing and inquiry. Third, the 21.05% of students at the low and extremely low levels require remedial support, while the small number at the topmost level require enrichment exercises. Fourth, teachers should plan for the greater range of abilities represented by girls and by government schools, instead of relying on the class mean.

Certain limitations apply. Only one district and one grade, i.e. grade 9, were covered, a single achievement test of 20 items was used, and the design is cross-sectional. Socio-economic status, parents' education, medium of instruction and teacher related variables were not examined; gender, locality and school type were analyzed one at a time through t tests, so their joint influences could not be assessed. In future, studies could cover more districts and classes, apply analysis of variance or regression to explore combined effects, and look into the reasons behind the differences through interviews or observations.

8. Conclusion

The present study was carried out to assess the level of problem-solving ability among secondary school students, and it highlights how significant it is to develop students' problem-solving abilities for academic success and daily functioning. Present-day education places emphasis on creative problem-solving skills so that students can face the challenges

of a dynamic society. With this in view, a survey based on a standardized problem-solving ability test was conducted to ascertain the problem-solving abilities of grade 9 students. Most students were found to have an average level of problem-solving skills; a few had a high and exceptional level, and a considerable number had below-average problem-solving ability. Gender was found not to be a significant factor in determining students' problem-solving ability. Students of urban areas and of private schools, though, showed a higher level of problem-solving ability than students of rural areas and government schools. The findings indicate that students' problem-solving skills need to be developed so that they can meet the contemporary demands of life. Appropriate measures, such as a co-ed environment and academic support, should be taken by educators and administrators to help students cope with the challenges of academics and life in general.

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