

## Developing Problem Solving Skill in Secondary Students

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### Abstract

*The need for developing leadership skills amongst students has been felt for a long time. The study's objective was to develop and implement a Student Leadership Program (SLP) and study its effectiveness for developing the leadership skill of problem-solving among secondary school students. The research design was quasi-experimental in nature and convenient sampling technique was used. The sample included two secondary schools of Vadodara city, one being the experimental and the other the control group. The SLP was developed and implemented. The data were collected using the Leadership Knowledge Test and Intended Behavioural Scale. Mean, SD, and Mann-Whitney U-test was used for data analysis. The results showed that the Student Leadership Program (SLP) was effective as the experimental group students had significantly higher conceptual knowledge and intended behavior in problem-solving skill.*

**Key Words:** Leadership skills, Problem-solving skill, Student leadership program

### Introduction

It is necessary to note that leadership roles and responsibilities go much beyond participating in public and organizational meetings. There are numerous challenges in life that leadership faces. In such a scenario problem-solving is an important skill for leaders to carry on when it comes to the successful management of difficult circumstances. Problem-solving is identifying a problem, developing potential paths of the solution, and taking the required course of action. An individual with this skill has an opportunity to make a significant difference. A leader cannot solve challenges effectively from the mundane to the critical without using problem-solving skill. The students at the secondary level need to have leadership skills, be calm under pressure, develop the ability to analyse any situation, consider what will happen, and how their choice will affect the problem and derive its solution. This skill must be honed and mastered, like any other talent, to be effective. It is a significant part of the students' curriculum for life. The skilled student takes responsibility for their learning, takes personal action to solve problems, settle disagreements, consider

alternatives, and reflect on thought as an integral element of the curriculum. This skill development will provide students with opportunities for practical, real-life experiences that help them work at higher thought levels. Problem-solving is a critical skill to be learnt in schools to help the child learn to solve their problems and work efficiently in crisis conditions. Rossman (1993) indicates that the student's role shifts from a passive receiver of knowledge to a participant in understanding when students use problem-solving skill. Moreover, all these aspects develop a vital concern to focus on developing efficient problem-solving among the students.

### **Problem-solving skill at Secondary School Level: Importance**

Problem-solving ability is a multi-faceted competence that utilizes other abilities, including strategic thought, coordination, and creativity. Leaders with problem-solving skill can build the capacity to evaluate, diagnose and deal with problems in a satisfactory manner. A leader needs to be able to look at the concerns they have experienced in the past and to be able to use those experiences to channelize the things of their present predicament.

Problem-solving skill involves the thought of knowing the problem and being patient, the study and use of analytical methods, making decision, and getting a solution. On the point of leadership, Mulford (2006) claimed that solving problems is crucial for leadership success. For leaders, the secret to success is their calmness under pressure, their ability to analyse any situation, know what will occur, and how their decision will impact the situation. A good leader learns from their failures, and to fix potential challenges; they use specific experiences. The students of today are the leaders of tomorrow must be prepared by schools in acquiring the skill of problem-solving. It is always considered that any learning method must ideally prepare students to face the challenges of life. When faced with challenges or situations that are new to them, students need to build the capacity to apply problem-solving skill. For students, problem-solving abilities are very crucial in their day-to-day school life and other areas of their existence. It was well put by Keen (2011) that if problem-solving skills are a cognitive practice, education could be the most beneficial step to develop problem-solving skill. The development of problem-solving helps student's works and decides how to explore the problem independently. Problem-solving as an ability is a life skill and essential for each student irrespective of their academic achievement. NCERT (2000) presented the necessary core skills needed for the overall development of an individual, and it is found that the essential problem-solving ability falls under that category. For the efficient development of problem-solving skill, "it is important to recognize that students need to be familiar with new approaches and methods that make them efficient in solving problems" (Posamentier and Krulik, 1998).

An essential purpose of education is to help students learn how to think more productively by integrating creative thinking (to produce ideas) and critical thinking when solving problems (to evaluate ideas). It is required to consider that "Students in 21st Century schools are expected to learn in new ways by using an inquiry and problem-solving approach in all subject areas" (Wagner, 2018). Problem-solving abilities are essential for academic and social performance.

The development of problem-solving skill allows students to use newly gained knowledge practically, integrating it with the previous experience for the purpose of imparting this

knowledge in real-life activities. Students with good problem-solving skill will be able to use their initiatives and weigh up actions and consequences throughout the school day to guide their decisions. There are various ways for the development of leadership skills in students with a focus on inculcating problem-solving skill. One way is to develop and implement a student leadership program.

### **Student Leadership Program**

We cannot deny that school learning has a phenomenal effect on students' comprehension and progress in either academic or co-curricular life. By designing and implementing the Student Leadership Program, the leadership skills can be developed and strengthened, as it allows the learner to get well acquainted with the varied circumstances and conscious learning takes place.

People may be born with highly analytical mind that helps them analyse circumstances and decide the best course of action easily, but that ability may fade away without the experience of using it under different conditions. It must be honed and mastered, like any talent, to make it work properly. It is observed that Leadership Development Training/Program has great significance in today's world as leaders are regarded as developed rather than innate/born" (Bhaskar, 2009). It is needed that a deliberate effort be provided for skill development. Such efforts could come in the form of the student leadership program. Student leadership includes participating in the school assembly, helping the higher authorities make vital decisions, upholding order in the school premises, and expressing their expectations of the school's success. Students will work together within a leadership program framework to inform, empower, and encourage them to achieve goals. Hitt's (1992) research shows that it is possible to improve critical competencies such as communication, team building, and problem-solving with the program's help. Developing such a program would help students realize the significance of their better lives by becoming aware of different skills, strengths, and succession planning. In short, in such a program, we would assume that the learner can engage in acquiring the abilities they will use in their every-day lives.

According to Allington and Gabriel (2012), "leadership skills can be encouraged and developed through a wide range of school programs and activities, where implementation of the Student Leadership Program could be one step." The planning and implementation of a student leadership program at the high school level are essential for skill development. Such programs create leadership opportunities that contribute positively to each student and create a positive and ethical culture of moral school where students can take the challenges rather than the pressure as a healthy state of mind.

The current study aims to develop and implement a student leadership program (SLP) to develop leadership skills of problem-solving in secondary school students. Its further studies the effectiveness of the Student Leadership Program in terms of students' conceptual knowledge and intended behavior in the above skill.

Null hypotheses were formulated and tested at a 0.01 level of significance. Therefore, we hypothesized that there would be no significant difference between the mean post-test scores of students of the control and experimental group of class IX in the conceptual knowledge and intended behavior of the leadership skill of problem-solving.

**Method**

A quasi-experimental research design was used, and the Pre-test-Post-test- Non-Equivalent-Control Group Design was followed in the study. A convenient sampling technique was used to draw the sample. Two schools in the city of Vadodara were selected, and one section of standard IX of one school constituted the experimental group, and another section of standard IX of the second school formed the control group. As the design is Non-Equivalent in nature, it becomes essential to match the experimental and control groups. It was done by administering the Raven's Matrices (Raven's Progressive Matrices) pre-test. The participants who finally participated were (n=30) in both groups.

**Material****Intelligence**

Raven's Progressive Matrices (1998 edition, updated 2003) Intelligence Test with a reliability score of 0.96 was administered to the experimental and control group as a pre-test only with the purpose to match the groups. The Intelligence test was chosen to ensure that the group was matched. In several studies on the relationship between intelligence and learning ability (Vaci et. al., 2019; Diamond et. al., 2007), the intelligence test (such as an IQ test) and learning ability/skill growth show very little difference. Furthermore, it suggests a strong connection between the ability to learn skills and intelligence ability.

**Conceptual Knowledge**

Leadership Knowledge Test was designed for students to study their conceptual knowledge in problem-solving skill. The Leadership Knowledge Test for problem-solving skill comprised of 16 items that were of a total of 20 marks. There were open-ended and close-ended items related to the meaning, definition, and characteristics of problem-solving. The different items consisted of multiple-choice questions, one-sentence answers, fill in the blanks, and true/false questions. The Leadership Knowledge Test had a reliability coefficient of 0.79 when tested for test-retest reliability.

**Intended Behaviour**

The Intended Leadership Behaviour Scale was designed to study students' intended behavior towards problem-solving skill. The marks allocated were 40. The scale consisted of eight situations for the taken skill. There were five close-ended alternatives to each situation wherein the students had to choose one appropriate alternative. The five alternatives had strongly positive polarity, positive polarity, neutral polarity, negative polarity, strongly negative polarity, and the alternative scores ranged from 1 to 5, 1 for strongly negative polarity and 5 for strongly positive polarity. When tested for test-retest reliability, the intended leadership behavior scale showed a reliability coefficient of 0.76.

**Procedure**

Development of Student Leadership Program (SLP)

The Student Leadership Program was developed for the secondary students of standard IX to develop leadership skill of problem-solving. A total of thirteen interactive session plans with aims, knowledge, and activity inputs were developed. Each session consisted of conceptual knowledge about the topic and sub-topics of the skills taken, keeping the student's level in

mind. The program had features of a stress-free, fun-filled environment for student participation. Every session consisted of 40 minutes in which the theoretical inputs were of 15 minutes duration and the activities were conducted for 25 minutes focusing on the theoretical inputs imparted. The theoretical inputs for each session were introduced with general objectives, instructional objectives, and content on different subtopics. It was followed by indoor and outdoor activities, self-reporting exercises, role plays, assignments, video clips, documentary movies, daily to-do tasks and case- studies that could help students relate to real-world scenarios were a part of the program. At the end there was an engaging de-briefing/discussion session with the students. The Discussion Method was used.

The research was carried out in four phases. In the first phase, the Student Leadership Program (SLP) was developed. Raven’s Progressive Matrices Intelligence Test was administered to the control and experimental group with the sole purpose of matching the groups in the second phase. In the third phase, the Student Leadership Program (SLP) was implemented for the experimental group. The experiment included 13 sessions, where the students of the experimental group were taught the skill of problem solving during one school academic year. One session consisted of 40 minutes which was taken during three days of the school week. The sessions were conducted for nine hours. Indoor and outdoor games, tasks, written exercises, short documentary films, video clips, role plays, and a debriefing exercise at the end of each task were among the activities included in the sessions. The definition, features, elements, and importance of problem-solving skill in students' daily lives were discussed during the discussion of conceptual inputs. In the control group, however, normal curricular and co-curricular activities were carried out without the implementation of the Student Leadership program (SLP). Normal assembly activities such as reading the news, prayer, and school updates were among the different inputs in the control group. In the fourth phase, the Leadership Knowledge Test and the Intended Leadership Behaviour Scale were administered as a post-test to both the control and experimental groups.

The data collected was analysed quantitatively using non-parametric statistics as a non-probability sampling technique was used. Mean, SD, and Mann-Whitney- U-test was used to analyse the data. The Mann-Whitney U -Test was considered appropriate as it is one of the most potent and robust non-parametric tests taking care of a small sample size. The mean post-test scores of the experimental and control group were taken for analysis in accordance with the experimental design.

## Result and Discussion

**TABLE-1**

Summary of Mann-Whitney U-Test for the Conceptual Knowledge of Problem-solving Skill

Students	N	Mean of Ranks	Sum of Ranks	U-Value	Z- Value	Probability (p)
Control Group	30	15.50	465.00	0.000	-6.697	0.000
Experimental Group	30	45.50	1365.00			

The analysis shows that the experimental group ( $M = 12.100$ ,  $SD = 1.18$ ) differed from the control group ( $M = 1.83$ ,  $SD = 1.17$ ). The higher mean score of the experimental group in the

conceptual knowledge of problem-solving skill in comparison to the control group may be attributed to Student Leadership Program implemented for developing problem-solving skill. To find whether the difference in the mean was significant or by chance and to test the null hypothesis, the Mann-Whitney U test was used as the sample was taken by convenience sampling technique.

Table 1 presents the results of the Mann-Whitney U test. Referring to the Table for normal probability (Table A of Siegel, 1956) under the null hypothesis ( $H_0$ ) of  $z$ , for  $z \leq -5.490$ , the two-tailed probability was found to be 0.00, which was lesser than our decided  $\alpha = 0.01$ . Hence the null hypothesis was rejected. The findings suggest that the experimental and control group students differed significantly in the conceptual knowledge of problem-solving skill. It can be concluded that the conceptual knowledge of the problem-solving skill of the students in the experimental group was stochastically higher than the students in the control group, which was due to the use of the Student Leadership Program in developing problem-solving skill.

**TABLE-2**

Summary of Mann-Whitney U-Test for the Intended Behaviour of Problem-solving Skill

Students	N	Mean of Ranks	Sum of Ranks	U-Value	Z- Value	Probability (p)
Control Group	30	16.10	483.00	18.000	-6.413	0.000
Experimental Group	30	44.90	1347.00			

The analysis shows that the experimental group ( $M = 34.1$ ,  $SD = 0.53$ ) differed from the control group ( $M = 24.0$ ,  $SD = 0.67$ ). The higher mean score of the experimental group in the intended behaviour of problem-solving skill in comparison to the control group may be attributed to Student Leadership Program implemented for developing problem-solving skill. To find whether the difference in the mean was significant or by chance and to test the null hypothesis, the Mann-Whitney U test was used as the sample was taken by convenience sampling technique.

Table 2 presents the results of the Mann-Whitney U test. Referring to the Table for normal probability (Table A of Siegel, 1956) under the null hypothesis ( $H_0$ ) of  $z$ , for  $z \leq -5.490$ , the two-tailed probability was found to be 0.00, which was lesser than our decided  $\alpha = 0.01$ . Hence the null hypothesis was rejected. The findings suggest that the experimental and control group students differed significantly in the intended behaviour of problem-solving skill. It can be concluded that the intended behaviour of the problem-solving skill of the students in the experimental group was stochastically higher than the students in the control group, which was due to the use of the Student Leadership Program in developing problem-solving skill.

## Discussion

The results showed that the Student Leadership Program (SLP) developed to inculcate problem-solving skill among secondary school students was effective. It was found that the conceptual knowledge and intended behavior in leadership skill of problem-solving for Class IX students of the experimental group was higher due to the implementation

of the Student Leadership Program (SLP). The control group was given curricular and co-curricular inputs as scheduled in their regular school program where-in the focus on the skill of problem-solving may have been lacking.

Problem-solving is a mental process. The students who can solve problems effectively could become individuals who can succeed in any sphere of life, a classroom, or society. The investigator had planned sessions to develop problem-solving skill among the students by exposing them directly to discussions and activities. It goes in line with the study of Picus et. al., (1983) where the researcher had conducted a literature study about problem-solving skill and their inculcation in the curriculum and found that students can learn to be better solvers through exposure to focused instruction and directed teaching. It also validated that problem-solving competence requires adequate knowledge in the content area. In the study, the skill development began with various activities that again go in line with this research where it was claimed that transfer and use of problem-solving strategies appear more likely when problems used in instruction are like those that will be routinely encountered.

The investigator had developed the theoretical inputs for each session that helped understand various vital concepts to learn the skill more effectively. It can be substantiated by the study of Bransford et. al., (2006) where it was concluded that the programs designed to teach problem-solving could be strengthened by focusing more explicitly on domain knowledge. The investigator also used various activities for each session that helped the students understand the importance of multiple components in amore practical way. The study of Bransford et. al., (2006) is also in this path in regards that different learning methods can affect their abilities to solve relevant problems in a significant way.

In various sessions, the investigator had used group activities. It was found that it enhances the learning among the students that can be supported by Henry's (2005) research where the effectiveness of cooperative learning techniques was observed quite significant in terms of the development of problem-solving skill.

The investigator had prepared a specific student leadership program (not integrated into the curriculum) for the development of problem-solving skill, and it can go in line with Calsikan et. al., (2009), where the results reflected that the specific program was influential in developing the skill among the students as well as it also enhances their conceptual knowledge on various themes of skill development.

The various inputs of the SLP were imparted in a deliberate manner and this conscious effort for skill development had a positive impact on student learning. It goes in line with Gamze et. al., (2010), where traditional teaching was combined with strategic teaching, and it gave significant results in the performance of the students towards skill development.

It is imperative to provide proper exposure of conceptual knowledge during adolescent age with clarifications of concept. In this program, the investigator provided the theoretical inputs for each sub-theme with practical examples. There was a significant increase in the knowledge level of students. In the study of Parvathy and Pillai (2015), it was found that the knowledge level of the experimental group is more due to proper inputs of concepts in the program.

Adolescent students need to work on all the domains of knowledge. The developed program had various forms of activities that impact their cognitive environment, and it has also shown a positive impact on their learning. This is consistent with the study of Klegeris et. al.,

(2013), where the results depicted that cognitive domain development significantly impacted their skill development. The use of different techniques and approaches in an effective way shows the positive impact on learning among students. The investigator had utilized the sessions giving due weightage to theoretical inputs and skill-oriented activities. This has made a significant impact on the learning of the experimental group students. It is in line with Yulindar et. al., (2018) findings where the enhancement of problem-solving ability was observed due to the applicability of model-specific problem-solving skill development.

### Conclusion

The Student Leadership Program (SLP) effectively developed problem-solving skill in terms of conceptual knowledge and intended behaviour in secondary students. However, the transaction of the school curriculum at the secondary level often lacks focus on this skill.

When the students are faced with unique challenges, it has been observed that they may lack the ability to analyse different options/alternatives to solve problems. However, every child has a unique ability to solve the problem on their own. What they need is several reliable inputs in the form of intelligent problem-solving methods and techniques. A systematic and concrete approach for skill development with the help of Student Leadership program could be a useful step in developing problem-solving skill. The findings of the study have implications for school principals who could encourage the development and use of such leadership programs, making it a part of their school curriculum. The school teachers can be encouraged to give theoretical and activity inputs to develop leadership skills. The text-book designers can focus on leadership skills in their school text.

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