

## THE USE OF INQUIRY-BASED LEARNING STRATEGIES TO ENHANCE STUDENTS' LIFE SKILLS: THE CURRENT STATE OF SCIENCE EDUCATION IN SECONDARY SCHOOLS

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### Abstract

*Inquiry based science learning strategies are beneficial in developing higher order thinking skills in the students. The main goal of present study was to find out the current state of Science Teaching with a focus on the application of Inquiry-based Science Learning Strategies to improve secondary school students' life skills. Here, Life skills comprises of four thinking skills: critical thinking, creative thinking, decision making, and problem solving. The current study is a descriptive research study in which data from science teachers is gathered using survey Method. Data was collected from 52 science teachers from secondary schools of Pernem Taluka of North Goa district of State of Goa, of whom 32 were given a rating scale designed by the researcher and 20 teachers, 15 of whom were senior science teachers and 5 of whom were headmasters with science teaching expertise, were interviewed. According to the findings of the study, the majority of science teachers in Pernem Taluka rarely or sometime use inquiry-based strategies to teach science to secondary school students in order to improve life skills such as critical thinking, creative thinking, decision making, and problem solving.*

**Key words:** *Inquiry based learning, Life skill, critical thinking, creative thinking, decision making, and problem solving.*



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### 1. Introduction

Scientific inquiry refers to the diverse ways in which scientists study the natural world and propose explanations based on the evidence derived from their work. Inquiry also refers to the activities of students in which they develop knowledge and understanding of scientific ideas, as well as an understanding of how scientists study the natural world. National Science

Education Standards, p. 23. As pointed out in the National Science Education Standards (National Research Council, 1996). The inquiry method is a student-centered teaching and learning method. This method emphasizes knowledge related to “how” and not “about,” which means how knowledge is acquired and not about knowledge. (Shanmugavelu et al., 2020). Inquiry is a term used both within education and in daily life to refer to seeking explanations or information by asking questions. (Harlen, 2013).

Inquiry Based Learning is a teaching and learning technique that aligns teaching and learning with the student and the abilities required for future success (Marks, 2013). There have been numerous researches on the benefits of using IBL in the classroom. (Abdi, 2014) found that students who were taught using inquiry-based learning scored higher than those who were taught using traditional techniques in their study of the impact of inquiry-based learning on science students' academic achievement. (Tindangen, 2018) argued that inquiry-based learning model with the scientific report using an induction method in biology lesson in Public Secondary School has improved the quality of students' higher order thinking skills. (Yunistika & Juanengsih, 2018) research results show a significant increase of higher-order thinking skills towards student ability categories from both guided inquiry and free inquiry learning model.

Higher order thinking mostly includes student's ability to think Critical thinking, Creative thinking, decision making and Problem solving. There were many researchers conducted specifically to improve student's critical thinking, creative thinking, decision making and problem solving ability. (Muskita et al., 2020) found that application of three levels of inquiry based-worksheets in learning of plant morphology, plant ecology and plant physiology are significantly effective in improving the ability to think critically and creatively. (Oktavia et al., 2019) concluded from their study that implementation of guided inquiry-based learning model on Pteridophyte can improve the students' creativity thinking skill. According to the findings of the study conducted by (Eka et al., 2021) the guided inquiry model is capable of developing students' critical thinking skills, particularly on indicators of interpretation, analysis and evaluation. (Pursitasari et al., 2020) concluded that the science context-based inquiry learning (SCOIL) model can help junior high students improve their critical thinking skills. (Yuliati et al., 2018) studied Problem Solving Skills in Direct Current Electricity Using Inquiry Based Learning and PhET Simulations and concluded that approach used to solve the problem influences student problem solving skills.

From the above researchers we have seen that Inquiry based learning was very helpful enhancing thinking Skills such as Critical thinking, Creative thinking, Decision making and Problem solving.

Life skills are abilities for adaptive and positive behaviour that enable individuals to deal effectively with the demands and challenges of everyday life. (WHO (World Health Organization ), 1996). According to the World Health Organization (WHO), life skills are divided into three categories: thinking skills, social skills, and emotional skills. Self-awareness, critical thinking, creative thinking, decision making, and problem solving are examples of thinking skills; empathy, effective communication, and interpersonal relationships are examples of social skills; and coping with emotions and stress are examples of emotional skills. So in the present research Life skills considered are Thinking skills namely critical thinking, Creative thinking, Decision making and Problem solving.

### **1.1 Problem of Research**

Inquiry based learning strategies are gaining importance in science classroom and are widely use now in science discourse. Nevertheless, the results of the researches conducted with Inquiry based learning show a significant increase of higher-order thinking skills towards student ability categories from both guided inquiry and free inquiry learning model (Yunistika & Juanengsih, 2018). According to the findings of the study conducted by (Eka et al., 2021) the guided inquiry model is capable of developing students' critical thinking skills, particularly on indicators of interpretation , analysis and evaluation. (Pursitasari et al., 2020) concluded that the science context-based inquiry.

National Science Education Standards recommend that science instruction and learning should be well grounded in inquiry. In spite of these efforts, however, little has changed in the way science is taught. Teacher-talk and textbooks are still the primary providers of science information for students.(McBride et al., 2004). Teaching science as a process/inquiry and value system is recommended in India's National Curriculum Framework Policy (NCF) 2005. In scientific textbooks, it discusses maintaining cognitive validity, process validity, historical validity, environmental validity, and ethical validity. ((NCERT), 2005)Unfortunately, today's science textbooks rarely cover such problems. It portrays science as being devoid of epistemological, cognitive, or social values. As a result, the vast majority of students hold a naive view of science, and teachers continue to structure their science arguments in ways that are incompatible with how scientists conduct scientific activities,

deliberations, and unpack their investigations into natural phenomena in real-world situations. (Kumar & Singh, 2017)

Therefore, this research focuses on finding out status of science teaching with respect to application of Inquiry based science learning strategies on enhancing life skills of the students.

## **1.2 Research Focus**

This study will be critical in establishing the status of secondary school science teachers with regards to use inquiry-based learning strategies to develop secondary school students' life skills. Furthermore, the findings of the study will give researchers and instructors a new viewpoint on the usage of inquiry-based science learning methodologies, which are promising and will have a substantial impact on the quality of science education provided.

## **2. Method**

The current study is a descriptive research study in which data from science teachers is gathered using survey Method. The current state of science education was gathered using a rating scale and through semi structured interviews. Both sets of data were analyzed separately, with data from rating scale being studied by using frequencies and percentages and data gathered from interview being analyzed with thematic analysis of the responses.

### **2.1 Participants**

In the research data was collected from 52 science teachers from secondary schools of Pernem Taluka of North Goa district of State of Goa teachers, of whom 32 were given a rating scale designed by the researcher and 20 teachers, 15 of whom were senior science teachers and 5 of whom were headmasters with science teaching expertise, were interviewed.

### **2.2 Data collection tools**

The data gathering instruments in this study were a rating scale and a semi-structured interview form. Science teacher rating scale comprises of 25 statements about the teaching-learning process that are employed in scientific inquiry and life skills, such as Critical Thinking, Creative Thinking, Decision Making, and Problem Solving. The Science teacher rating scale consists of 25 statements on a 5-point scale enabling the respondent to select the proper response that best describes him or her, such as Never, Rarely, Sometimes, Frequently, Always. Semistructured interview form consisting of 6 questions was used to determine the senior science teachers opinions about application of inquiry based science learning strategies to enhance life skills in secondary school students. The semi-structured

interview form was applied to 20 teachers out of which 15 were senior science teacher and 5 Headmasters having experience of science teaching.

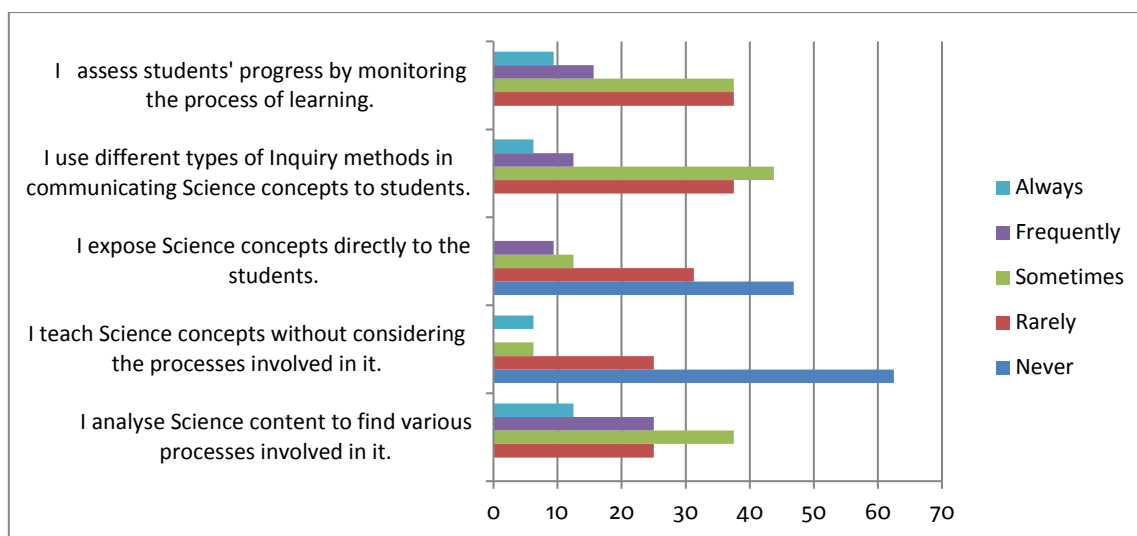
### 3. Data Analysis

Data gathered from science teachers rating scale was analyzed by using frequencies and percentages and data from semi structured interviews was analyzed by using thematic analysis of the responses.

**Table No 3.1.: Nature of Science and Inquiry based learning**

Sr. No	Items	Never	Rarely	Sometimes	Frequently	Always
1	I analyse Science content to find various processes involved in it.	0	25	37.5	25	12.5
2	I teach Science concepts without considering the processes involved in it.	62.5	25	6.25	0	6.25
3	I expose Science concepts directly to the students.	46.87	31.25	12.5	9.38	0
4	I use different types of Inquiry methods in communicating Science concepts to students. E.g., Open Inquiry, Guided Inquiry and Structured Inquiry.	0	37.5	43.75	12.5	6.25
5	I assess students' progress by monitoring the process of learning.	0	37.5	37.5	15.62	9.38

When table 3.1 was examined it was seen that 25% teachers rarely, 37.5 % sometimes, 25% frequently and 12.5% always analyse Science content to find various processes involved in it. 62.5 % teachers never, 25% rarely, 6.25% sometimes and 6.25% always teach Science concepts without considering the processes involved in it. 46.87% teachers never, 31.25% rarely, 12.5 % sometimes and 9.38% frequently expose Science concepts directly to the students. 37.5% teachers rarely, 43.75% sometimes, 12.5% frequently and 6.25% always use different types of Inquiry methods in communicating Science concepts to students. E.g., Open Inquiry, Guided Inquiry and Structured Inquiry. 37.5% teachers rarely, 37.5% sometimes. 15.62% frequently and 9.38% always assess students' progress by monitoring the process of learning. Fig no 3.1 shows the graphical representation of responses of science teacher on component Nature of science and Inquiry Based learning.



**Fig No 3.1: Graph of responses of Science teachers on component Nature of Science and Inquiry based learning**

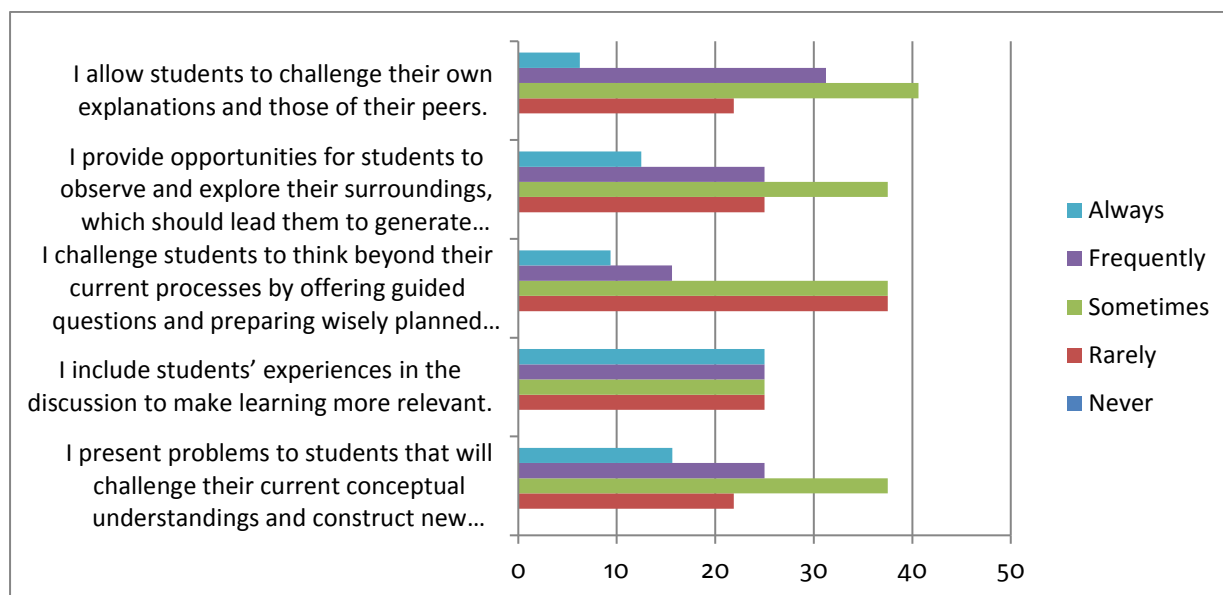
**Table No.3.2: Building Critical thinking through Inquiry bases learning**

Sr. No	Items	Never	Rarely	Someti mes	Freque ntly	Alway s
1	I present problems to students that will challenge their current conceptual understandings and construct new understandings.	0	21.87	37.5	25	15.63
2	I include students' experiences in the discussion to make learning more relevant.	0	25	25	25	25
3	I challenge students to think beyond their current processes by offering guided questions and preparing wisely planned scaffolds.	0	37.5	37.5	15.62	9.38
4	I provide opportunities for students to observe and explore their surroundings, which should lead them to generate questions about the natural world.	0	25	37.5	25	12.5
5	I allow students to challenge their own explanations and those of their peers.	0	21.87	40.62	31.25	6.26

When table 3.2 was examined, it was determined that 21.87% teachers rarely, 37.5% sometimes, 25% frequently and 15.63% always present problems to students that will challenge their current conceptual understandings and construct new understandings. 25% teachers rarely, 25% sometimes, 25% frequently and 25% always include students' experiences in the discussion to make learning more relevant. 37.5% teachers rarely, 37.5 % sometimes, 15.62% frequently and 9.38% always challenge students to think beyond their current processes by offering guided questions and preparing wisely planned scaffolds. 25% teachers rarely, 37.5 % sometimes, 25% frequently, 12.5% always provide opportunities for

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students to observe and explore their surroundings, which should lead them to generate questions about the natural world. 21.87% teachers rarely 40.62% sometimes, 31.25% frequently and 6.26% always allow students to challenge their own explanations and those of their peers.



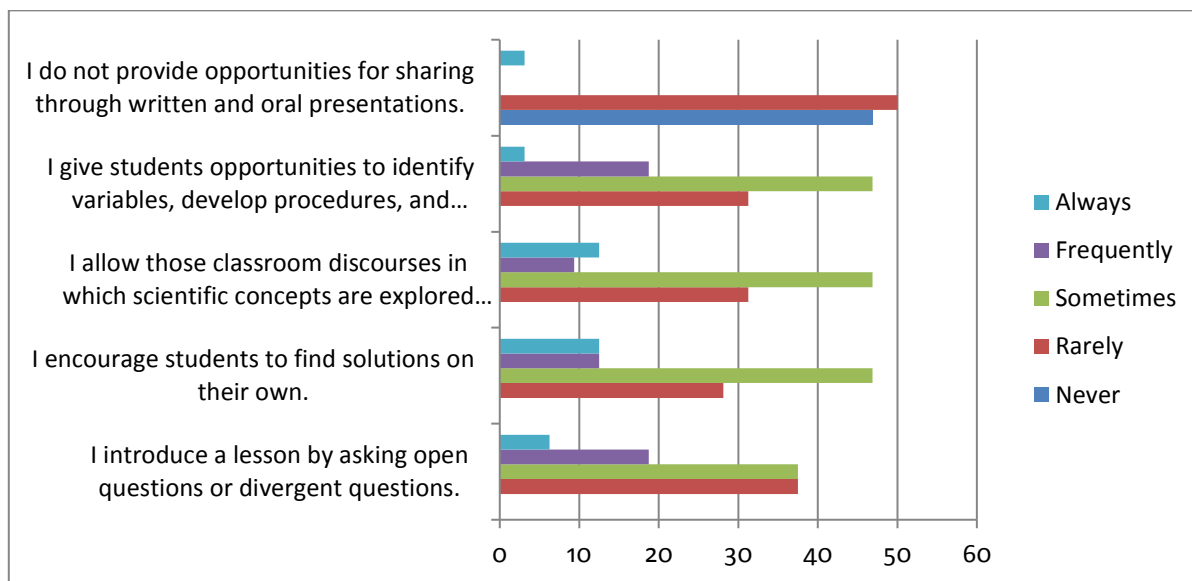
**Fig No 3.2: Graph of responses of Science teachers on component building Critical thinking skill through Inquiry Based Learning.**

**Table No.3.3: Building Creative thinking skill through Inquiry bases learning**

Sr. No	Items	Never	Rarely	Some times	Freque ntly	Alwa ys
1	I introduce a lesson by asking open questions or divergent questions.	0	37.5	37.5	18.75	6.25
2	I encourage students to find solutions on their own.	0	28.12	46.88	12.5	12.5
3	I allow those classroom discourses in which scientific concepts are explored from multiple perspectives.	0	31.25	46.88	9.37	12.5
4	I give students opportunities to identify variables, develop procedures, and devise strategies for collecting and presenting data.	0	31.25	46.88	18.75	3.12
5	I do not provide opportunities for sharing through written and oral presentations.	46.88	50	0	0	3.12

When table No. 3.3 was analysed it was seen that 37.5 % teachers rarely, 37.5% sometimes, 18.75% frequently and 6.25% always introduces a lesson by asking open questions or divergent questions. 28.12% teachers rarely, 46.88 % sometimes, 12.5 % frequently and 12.5% always encourage students to find solutions on their own. 31.25% teachers rarely,

46.88 sometimes, 9.37% frequently and 12.5% always allow those classroom discourses in which scientific concepts are explored from multiple perspectives. 31.25% teachers rarely, 46.88 sometimes, 18.75 % frequently and 3.12% always give students opportunities to identify variables, develop procedures, and devise strategies for collecting and presenting data and 46.88% teachers rarely, 50% sometimes and 3.12 % always do not provide opportunities for sharing through written and oral presentations.



**Fig No 3.3: Graph of responses of Science teachers on component building Creative thinking skill through Inquiry Based Learning**

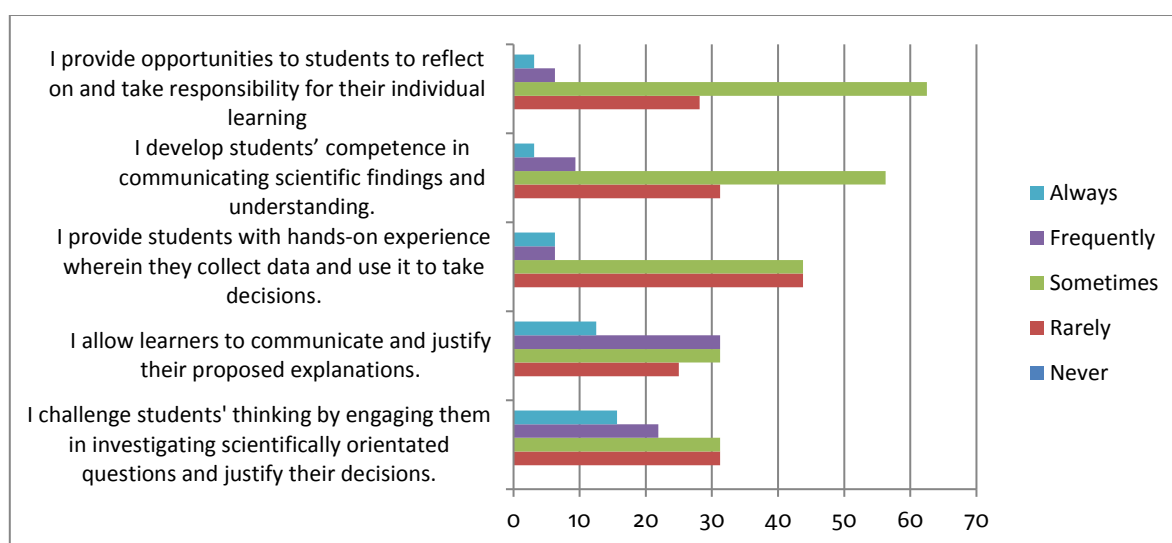
**Table No. 3.4: Building Decision Making Skill through Inquiry bases learning**

Sr. No	Items	Never	Rarely	Someti mes	Freque ntly	Alway s
1	I challenge students' thinking by engaging them in investigating scientifically orientated questions and justify their decisions.	0	31.25	31.25	21.87	15.63
2	I allow learners to communicate and justify their proposed explanations.	0	25	31.25	31.25	12.5
3	I provide students with hands-on experience wherein they collect data and use it to take decisions.	0	43.75	43.75	6.25	6.25
4	I develop students' competence in communicating scientific findings and understanding.	0	31.25	56.25	9.38	3.12
5	I provide opportunities to students to reflect on and take responsibility for their individual learning	0	28.13	62.5	6.25	3.12

Table No 3.4 indicates that 31.25 % teachers rarely, 31.25% sometimes, 21.87% % frequently and 15.63 % always challenge students' thinking by engaging them in



investigating scientifically orientated questions and justify their decisions. 25 % teachers rarely, 31.25% % sometimes, 31.25 % frequently and 12.5% always allow learners to communicate and justify their proposed explanations. 43.75% teachers rarely, 43.75% sometimes, 6.25% frequently and 6.25% always provide students with hands-on experience wherein they collect data and use it to take decisions. 31.25% teachers rarely, 56.25% sometimes, 8.38% frequently and 3.12% always develop students' competence in communicating scientific findings and understanding and 28.13% teachers rarely, 62.5% sometimes and 6.25% frequently and 3.12% always provide opportunities to students to reflect on and take responsibility for their individual learning.

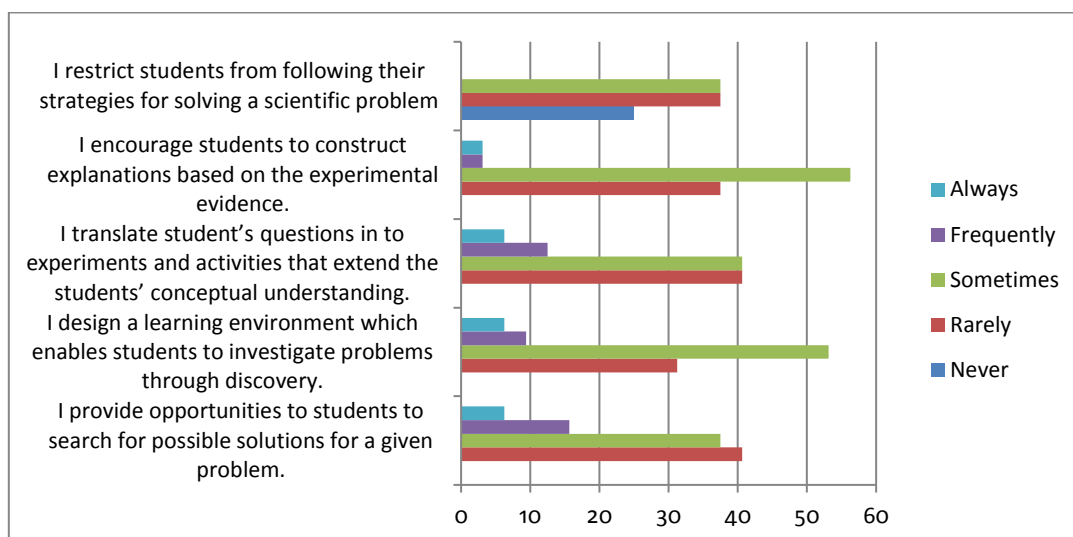


**Fig No 3.3: Graph of responses of Science teachers on component building Creative thinking skill through Inquiry Based Learning**

**Table No. 3.5: Building Problem Solving Skill through Inquiry bases learning**

Sr. No	Items	Never	Rarely	Someti mes	Freque ntly	Alway s
1	I provide opportunities to students to search for possible solutions for a given problem.	0	40.62	37.5	15.62	6.25
2	I design a learning environment which enables students to investigate problems through discovery.	0	31.25	53.12	9.37	6.25
3	I translate student's questions in to experiments and activities that extend the students' conceptual understanding.	0	40.62	40.63	12.5	6.25
4	I encourage students to construct explanations based on the experimental evidence.	0	37.5	56.25	3.12	3.12
5	I restrict students from following their strategies for solving a scientific problem	25	37.5	37.5	0	0

Table 3.5 indicates that 40.62% of teachers rarely, 37.5% sometimes, 15.62% frequently and 6.25% always provide opportunities to students to search for possible solutions for a given problem. 31.25% teachers rarely, 53.12% sometimes, 9.37% frequently and 6.25% always design a learning environment which enables students to investigate problems through discovery. 40.62% teachers rarely, 40.63% sometimes, 12.5% frequently and 6.25% always translate student’s questions in to experiments and activities that extend the students’ conceptual understanding. 37.5% teachers rarely, 56.25% sometimes, 3.12% frequently and 3.12% always encourage students to construct explanations based on the experimental evidence and 25% teachers never, 37.5% rarely and 37.5% sometimes restrict students from following their strategies for solving a scientific problem



**Fig No 3.5: Graph of responses of Science teachers on component building Problem Solving skill through Inquiry Based Learning**

### 3.6 Analysis of Interviews of 15 Science teachers and 5 headmasters having experience of Science Teaching

Attributes	Themes generated through Responses of the teachers	Frequency	Percentage
Meaning of Life Skill Education	Teaching students skills which will help them to life successfully.	8	40
	Training students on the topic of health and personal issues.	4	20
	Training student on health and sex education.	3	15
	Making students aware about issues related to adolescence and tackling such issues.	5	25

Importance of Life skill Education	To have well balance life. I.e. students who will be developed in cognitive aspect as well as emotional aspect.	11	55
	To take wise decisions in life without getting influence with peer pressure.	6	30
	To make student aware about issues related to adolescence and sex education.	3	15
Methods through which life skills are developed in students.	Role plays, discussions, talks by expert, storytelling, narrating incidences.	17	85
	Conducting workshops for students.	3	15
Methods through which Life Skills are integrated in Science teaching.	By telling students day today life incidences related to the topic.	14	70
	Do not integrate Life skills in Science teaching.	06	30
Meaning of Inquiry based learning	Making students to learn through activities and their experiences.	9	45
	Learning science through discovery	11	55
Methods to incorporate Inquiry in Science Teaching.	By giving them worksheets.	12	60
	Giving opportunities to ask questions on science topic and finding answer through activities with the help of teacher.	08	40

#### 4. Results

With this research, status of science teaching with focus on application of Inquiry based science learning strategies for building life skills was determined. Results are presented in two subtitles, result from rating scale provided to the teachers and result from semi structured interviews.

##### 4.1 Result from rating scale provided to the teachers

1. Although most teachers are aware of science process skills and inquiry-based learning, inquiry-based strategies are rarely used in science discourse.
2. The majority of Science teachers do not use inquiry-based strategies that encourage students to think critically by allowing them to investigate their environment, ask questions, integrate their experiences, and generate new understanding.
3. The majority of teachers rarely or sometimes use inquiry techniques such as asking open-ended questions, encouraging students find solution on their own, making students to explore scientific concept from multiple perspective, giving opportunities to devise strategies which develops creative thinking skills in the students. Many teachers do this by allowing pupils to share their ideas through written and oral presentations.

4. The majority of teachers rarely or never provide students with opportunities to develop decision-making skills by engaging them in inquiry-based activities such as engaging them in investigating scientifically orientated questions and justify their decisions, providing students with hands-on experience wherein they collect data and use it to take decisions and giving opportunities to students to reflect on and take responsibility for their individual learning. Many teachers accomplish this by allowing students to communicate and justify their proposed explanations.
5. Majority of the teachers rarely , sometimes give opportunities to students to enhance their problem solving skills by engaging them in inquiry based activities such as providing opportunities to students to search for possible solutions for a given problem, design a learning environment which enables students to investigate problems through discovery, translate student's questions in to experiments and activities that extend the students' conceptual understanding, encourage students to construct explanations based on the experimental evidence.

#### **4.2 Result from semi structured interviews**

- Many teachers believe that life skill education entails teaching students skills that will help them live successfully, as well as training students on topics such as health and personal issues. A similar number of teachers believe that life skill education entails training students on health and sex education, as well as making students aware of issues related to adolescence and addressing such issues.
- The majority of teachers believe that life skill education is essential for living a balanced life. I.e. students who will be developed both cognitively and emotionally, and who will be able to make sensible life decisions without being influenced by peer pressure. Few people believe it is also critical to educate students about concerns such as adolescence and sex education.
- To enhance student' life skills, most teachers employ role plays, discussions, expert talks, storytelling, and narrating incidents, while just a few teachers organise workshops.
- Majority of the teachers integrate life skills in science subject by telling students day today life incidences related to the topic, few are the of the view that they do not integrate life skill education in their subject.

- Making students learn via activities and their experiences, and learning science through discovery, according to all teachers, is inquiry-based learning.
- All of the teachers agree that giving students the opportunity to ask questions about science topics and finding answers through activities and worksheets is the best strategy to encourage inquiry in the classroom.

### **Discussion**

The data obtained from the science teachers rating scale and semi structured interview showed that a large proportion of teachers are aware about inquiry based learning strategies but they rarely or sometime use it in classroom science teaching to enhance life skills such as Critical thinking, Creative thinking, Decision Making and Problem Solving. Majority of the teachers are of the view that Life skills are developed through activities such drama and role plays, they do not integrate in the science subject which they teach.

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