

# High School Student's Participation In Scientific Investigations: Its Impact On Their Competencies And Attitude Towards Science

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# Introduction

- Practical independent research projects (PIRPs) can take a wide variety of forms, but they all share several common characteristics.
- PIRPs or extended investigations in science are **open-ended scientific investigations undertaken and led by a student**, with the support of a teacher and/or a researcher in working laboratory groups.
- The **outcomes of the scientific investigation is typically unknown** to the student and their teacher.
- Frequently, IRPs take place outside the formal school science curriculum.
- In line with the goals of the **NEP 2020**, Anveshana program at Prayoga intends to develop students into independent researchers and scientists.



# Literature review

- It is evident from the literature review, that IRPs can improve students attitudes to science work, students learning abilities, presentation skills, confidence, ability to work in a team, self-regulation etc., and students are likely to consider careers in science as a result of their participation in IRPs.
- IRPs are offered to **high school students** in a number of countries, across all the major science disciplines and have proven more successful.
- However, there **are no similar studies reported from India**. The literature reports school student's participation in IRP activity from twelve countries. (Bennett et al., 2018).

**Table 1. Country of study.**

Country	Publications
Australia	2
Ireland	1
Israel	1
Netherlands	1
New Zealand	1
Qatar	1
Singapore	1
Spain	1
Taiwan	1
Turkey	2
UK	8
USA	19
More than one country	2
<b>TOTAL</b>	<b>39</b>



# Purpose of the study

- Practical independent research projects are **relatively new in Indian schools**, with little research to back it up. Thus, it is of interest to study how investigative science projects can be implemented in a class at the secondary school level, and how the students respond to this mode of learning.
- To provide opportunities for school-children to participate in and conduct research and collect the data, analyze and interpret the data

## Course work prior to Independent Research Project:

- A short-term coursework is designed for the students who are interested to take up projects
- Students are required to complete pre-project course work on **research methodology** and **guide paper**



# Materials and methods:

**Participants and study context: Anveshana:** Class of 12 high school students worked in **five groups**. Students were selected through the **personal interview process** and paired with a science research faculty member and allocated to a specific research project. At the end of the project students submit their research findings in a report and a formal oral presentation.

## Data collection and assessment

- The students were asked to rate each statement on a **Likert-type scale** by selecting a number between 1 and 5 (1 - 5): Strongly disagree, disagree, don't know, agree, strongly agree.
- The analysis focused on generating profiles of the participants' understandings of the **nature of science, attitude towards science** and **scientific inquiry** before and after their research experiences.
- Also, they have **stated** how these practical independent research projects impacted them.

Student details	Project Title
Suvratha Herur, Age: 16, Class: 10 <sup>th</sup> Shreeadithya Kashyap, Age: 14, Class: 9 <sup>th</sup>	In vitro analysis of antibacterial activity of <i>Dombeya wallichii</i> plant extracts against food pathogens
Sachin Vashisht, Age: 16, Class: 10 <sup>th</sup> Dhruva Shankara , Age: 15, Class: 10 <sup>th</sup> Punya Shree, Age: 16, Class: 10 <sup>th</sup>	Effect of coating seeds with micronutrients and bacterial consortia on stomatal conductance and yield at different stages of plant growth
Chinmaya Praveen, Age: 15, Class: 10 <sup>th</sup>	FTIR analysis of kidney stones and antibacterial activities of cranberry extracts.
Vishwajit Adiga, Age: 15, Class: 9 <sup>th</sup>	
Samanyu Chandra, Age: 16, Class: 10 <sup>th</sup> Varnika K, Age: 15, Class: 10 <sup>th</sup>	Identifying the relationship between stomatal conductance, specific heat and thermal conductivity for leaf samples
Sameer Jois, Age: 16, Class: 10 <sup>th</sup> Pranav Sharma, Age: 15, Class: 10 <sup>th</sup> Saathvik Bhaaradwaj, Age: 16, Class: 10 <sup>th</sup>	Can copper displace zinc from its solution?

# Results and discussion



- Students' understandings about the **nature of science** has significantly changed.
- Throughout all stages of the inquiry, all of the participants acquired some role to **creativity**.
- By participating in research activities, they have improved their **experimenting and analysing skills**.
- The results of the post-research questionnaires and interviews revealed a considerable shift in participants' **perceptions of science and their enthusiasm for it**.
- The participants obtained an understanding of **how to organise investigations, establish hypotheses, gather and evaluate data, construct explanations, and present their findings**, after participating in an intensive 3-month science research project.
- The student poster presentations revealed that they have learnt the **concept in-depth** and developed very good **presentation skills**.



Students participating in research at Prayoga



Students during their research poster presentations at Prayoga