Impact Assessment Report: Experiential Science Learning Programme Mobile Science Lab in Anekal

Submitted by CSRBOX

Biocon Foundation
EMPOWERING COMMUNITIES

Disclaimer

- This report has been prepared solely for the purpose set out in the Memorandum of Understanding (MoU) signed between Renalysis Consultants Pvt. Ltd. (CSRBOX) and Biocon Foundation to undertake the Impact Assessment of their Corporate Social Responsibility (CSR) projects implemented.
- This Impact Assessment is pursuant to the Companies (Corporate Social Responsibility Policy) Amendment Rules, 2021, notification dated 22nd January 2021.
- This report shall be disclosed to those authorised in its entirety only without removing the disclaimer; CSRBOX has not performed an audit and does not express an opinion or any other form of assurance.Further, comments in our report are not intended, nor should they be interpreted to be legal advice oropinion.
- This report contains an analysis by CSRBOX considering the publications available from secondary sources and inputs gathered through interactions with the leadership team of Biocon Foundation, project beneficiaries, and various knowledge partners. While the information obtained from the public domain has not been verified for authenticity, CSRBOX has taken due care to receive information from sources generally considered to be reliable.
- In preparing this report, CSRBOX has used and relied on data, material gathered through the internet,research reports, and discussions with personnel within CSRBOX as well personnel in related industries.

With Specific to Impact Assessment (FY 2019-23), CSRBOX:

- Has neither conducted an audit nor due diligence nor validated the financial statements and projectionsprovided by Biocon Foundation;
- Wherever information was not available in the public domain, suitable assumptions were made to extrapolate values for the same;
- CSRBOX must emphasise that the realisation of the benefits/improvisations accruing out of the recommendations set out within this report (based on secondary sources) is dependent on the continuing validity of the assumptions on which it is based. The assumptions will need to be reviewed and revised to reflect such changes in business trends, regulatory requirements or the direction of the business as further clarity emerges. CSRBOX accepts no responsibility for the realisation of the projected benefits;

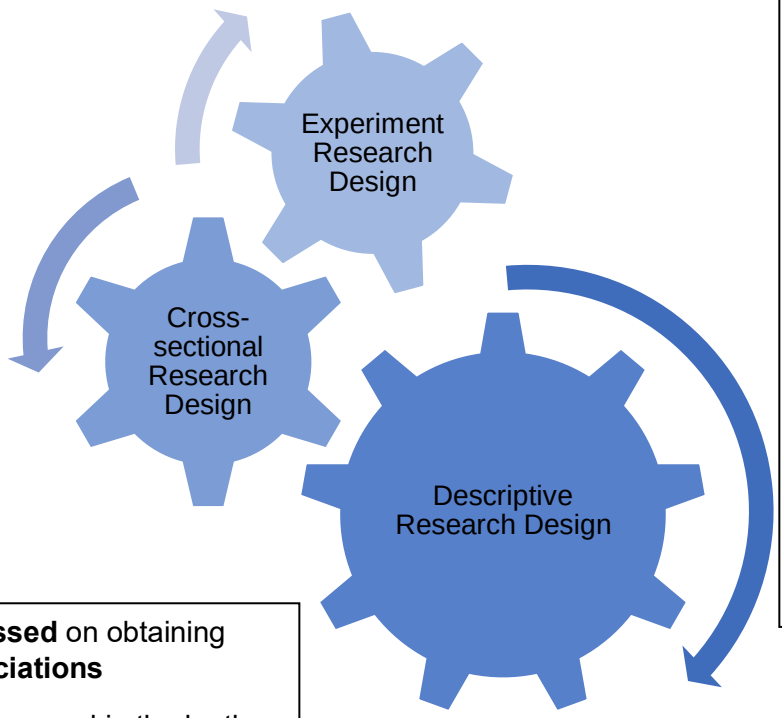
The premise of an impact assessment is the objectives of the project, along with output and outcome indicators pre-set by the programme design and implementation team. CSRBOX's impact assessment framework was designed and executed in alignment with those objectives and indicators.

Executive Summary

Biocon Foundation is committed to providing high-quality education through innovative approaches, ensuring the "Right to Education" for all. Their **primary goal** is to address the **educational disparities** and cater to the unique needs of marginalised communities is achieved through Experiential Science Learning Programme: Mobile Science Labs in Anekal, Bangalore.

Methodology

The assessment period of this study is from **April 2019 to March 2023**, and the study utilised a mixed methodology, incorporating both quantitative and qualitative approaches. The research aimed to assess the effectiveness of these interventions by employing various research designs that comprehensively captured their deeper impact.



Focussed on acquiring comparative analysis using counterfactuals

Considering learning outcomes results of students attending MSL sessions as the **dependent variable** and results from other government schools as the **independent variable**.

Tools used: Learning outcome

Focussed on obtaining **Associations**

Marks scored in the by the students attending MSL sessions vs students not attending MSL sessions

Tools used: Surveys, Learning Outcome Tests

Focussed on capturing the concurrent on-ground impact

Describing the beneficiaries, stakeholders, their roles and the effect caused by Experiential Science Learning Programme in direct and indirect ways

Tools used: FGDs, and Surveys

Sampling

7 Higher Primary Schools 4 High Schools	Survey 7th Grade: 131 8th Grade: 179 9th Grade: 76	Learning Outcome Assessment Treatment School: 172 Control School: 172

Key Findings

Framework Pillars	Information indicators	Data sources	Results
Inclusiveness	• Level of awareness among students and teachers regarding STEM Learning and the topics. • Level of awareness and interest of students in exploring new passions • The extent of participation among all community strata, including children (gender, education level of parents, occupation of parents, etc.)	• Quantitative survey • IDIs with Science Teachers, Biocon Foundation staff, Community Members, Agastya International Foundation Team, STEM trainers, etc • FGDs with various stakeholders	• Nearly equal distribution of male and female students, 48% and 52% respectively • 97% of grade 7 and 83% of grade 8 students had late admissions due to migration • 80% of grade 9 students were in age-appropriate classes • 41% of students' fathers were employed in private jobs, and 33% of students' mothers were employed as daily wage labourers
Relevance	• The extent to which the program's objectives align with the beneficiaries' requirements. • The extent of learning due to the current infrastructure facilities available at the schools • The extent of curiosity and science knowledge among students to implement the learnings	• Secondary Review – including reviewing project-related documents • Baseline study reports assessing the relevance of the project • Qualitative interactions with Agastya International Foundation and Biocon Foundation's Team members and other key stakeholders • KIIs with school officials	• 79% of students prefer Practical as well as Theoretical Science classes • All the science teachers stated that the science lab in school lacked the proper types of equipment and chemicals to facilitate experiments

Expectations	• Increase in academic knowledge and awareness about STEM • Improvement in learning outcomes with STEM subjects • Increase in the development of critical thinking and problem-solving skills among students • Increase in the curiosity level and openness to explore Science subjects among students • Improvement in 21st Century Skills among students	• Quantitative survey with stakeholders, including student • IDIs with the Head of schools, Biocon Foundation Team members, Agastya International Foundation Team members, and other key stakeholders • FGDs with teachers, and students	• 99% of students have attended MSL sessions • 84% of students mentioned that the MSL teacher's instructions were easy to comprehend • 95% of students have asked doubts to MSL Instructors • 65% of students were always willing to answer in MSL sessions • 76% of students share knowledge with parents/ siblings • 64% of students always conduct DIY experiments at home • 69% of students refer to the School Science teacher and MSL Instructor for doubt clearing • 89% of students feel motivated to ask doubts in the MSL sessions • 86% of students demonstrated experiments in MSL sessions/ Science Fair • 66% of students agreed that MSL sessions strengthened their understanding of science concepts
Convergence	• Role and responsibility of teachers, schools, and government to ensure the sustainability of the program	• Quantitative survey • IDIs with Biocon Foundation Team, Agastya International Foundation Team, and other key stakeholders	• Agastya International Foundation: Implementing Partner • Government of Karnataka: Supporting Role

			during project initiation
Service Delivery	• Rating of quality of teaching by MSL trainers in the sessions • Rating of content taught by the MSL trainers • Rating the pedagogy of the MSL trainers • Rating of quality of teaching by MSL trainers during COVID-19	• Quantitative survey • Qualitative interactions with school teachers, Biocon Foundation Team and Agastya International Foundation Project Managers, FGDs with students	• 96% of students rated the course content as 'Outstanding'. • 98% of students rated teaching pedagogy employed by the MSL Instructors as 'Outstanding'. • 98% of students rated Instructor's approachability and responsiveness as 'Outstanding'.

Statistical Analysis of Treatment and Control Schools

The aim of the analysis is to evaluate whether there is a **statistically significant difference** in the **patterns of percentage scores** across **four subjects**, namely Scientific Knowledge, Scientific Thinking, Scientific Attitude, and Proactiveness, between the **Treatment and Control groups**.

Multivariate Tests[a]

Effect		Value	F	Hypothesis df	Error df	Sig.	Partial Eta Squared
Intercept	Pillai's Trace	.852	486.402[b]	4.000	339.000	.000	.852
	Wilks' Lambda	.148	486.402[b]	4.000	339.000	.000	.852
	Hotelling's Trace	5.739	486.402[b]	4.000	339.000	.000	.852
	Roy's Largest Root	5.739	486.402[b]	4.000	339.000	.000	.852
Type of Groups	Pillai's Trace	.041	3.634[b]	4.000	339.000	.006	.041
	Wilks' Lambda	.959	3.634[b]	4.000	339.000	.006	.041
	Hotelling's Trace	.043	3.634[b]	4.000	339.000	.006	.041
	Roy's Largest Root	.043	3.634[b]	4.000	339.000	.006	.041

a. Design: Intercept + Type

b. Exact statistic

The analysis of the table and the statistical tests reveals that there is a **significant difference** in the **marks obtained** in at least one subject between the **control and treatment groups**.

Learning Outcome Assessment Findings

The tool used for comparative analysis was the Learning Outcome assessment. The table highlights the **Evaluation Criteria** utilised for Learning Outcome Assessment:

Category of Students	Percentage Criteria
Developing Primary Concepts	Below 25%
Require Continuous Support	25–50%
Consistently Performing	50–75 %
Exceeding Expectations	Above 75%

The table displays the average percentage marks obtained by students from both Treatment and Control schools, categorised by different parameters. It is evident that **Treatment Schools achieved higher scores compared to Control Schools**. These results highlight the potential requirement for initiatives aimed at improving the scientific mindset and learning approach in Control schools.

Parameters	Control Schools	Treatment Schools
Scientific Knowledge	35%	38%
Scientific Thinking	59%	58%
Scientific Attitude	20%	30%
Proactiveness	30%	45%
Total Marks	37%	40%

The table highlights the grade-wise average percentage marks achieved by students in Treatment and Control Schools. Remarkably, **9th-grade students** benefiting from ongoing MSL sessions demonstrated **enhanced academic performance** compared to other grades.

Grade	Control Schools	Treatment Schools
Grade 7	38%	40%
Grade 8	33%	36%
Grade 9	40%	54%

With continued support and guidance, these students have the potential to progress from Consistently Performing to Exceeding Expectations.

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Abbreviations

ANOVA	Analysis of Variance
CHAMPS	Child Health Activists Mentoring and Promoting Health in Society
CSR	Corporate Social Responsibility
ESG	Environment, Social and Governance
FGD	Focused Group Discussion
GHS	Government High School
GHPS	Government Higher Primary School
GHPGS	Government Higher Primary Girls School
GMPS	Government Middle Primary School
IDI	In-depth Interviews
KII	Key Informants Interview
MANOVA	Multivariate Analysis of Variance
NCDs	Non-Communicable Diseases
NEP	National Education Policy
RTE	Right to Education
STEM	Science, Technology, Engineering, and Mathematics

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Overview of Experiential Science Learning Programme

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1.1 Background & Programme Overview

The Biocon Foundation is dedicated to fulfilling the "Right to Education" by employing innovative approaches to deliver high-quality education. The foundation's objective is to bridge the educational gap and address the specific needs of the **young minds of marginalised communities** by **granting** them **access** to experiential learning opportunities in the fields of Science, Technology, Engineering, and Mathematics **(STEM) Education**. Focusing on STEM education recognises these disciplines' pivotal role in equipping students with the requisite skills and knowledge needed to thrive in the modern world.

Implemetation Partner: Agastya International Foundation

Project Duration: 2019-2023

Project Location: Anekal, Bangalore

Target Beneficiaries: Grade 6th to 10th students

Subjects taught: Physics, Chemistry, Biology

1.2 Geographical Coverage

The project has been implemented in **21 Government schools** located in Anekal, Bangalore. All 21 Government schools are listed below, including 6 High Schools and 15 Higher Primary Schools.

High Schools

- Government Girls High School, Anekal
- GHS, Sabmangala
- GHS, Marsur
- GHS, Chandapura
- GHS, Haragadde
- GHS, Huskur

Higher Primary Schools

- Government Model Primary Girls School, Anekal
- GHPS, Old Anekal
- GHPGS, Attibele
- GHPS, Helalige
- GHPS, Neralur
- GHPS, Iggaluru
- GHPS, Indalwadi
- GMPS, Jigani
- GHPS, Kallubalu
- GHPS, Yarandahalli
- GHPS, Madapatna
- Government Model Primary School, Bannerghatta
- GHPS, Huskur
- GHPS, Bhovipalya
- GMPS, New Anekal

1.3 Alignment with Sustainable Development Goals

The table below mentions the SDGs in alignment with the Experiential Science Learning Programme.

SDG	SDG Targets	Alignment with SDG
	Target 3.4 By 2030, reduce by one-third premature mortality from non-communicable diseases through prevention and treatment and promote mental health and well-being.	The programme focused on increasing awareness of non-communicable diseases among the community members through the students trained to measure Blood Pressure.
	Target 4. 1 By 2030, ensure that all girls and boys complete free, equitable and quality primary and secondary education leading to relevant and effective learning outcomes. **Target 4. a** Build and upgrade education facilities that are child, disability and gender sensitive and provide safe, non-violent, inclusive and effective learning environments for all. **Target 4. c** By 2030, substantially increase the supply of qualified teachers, including through international cooperation for teacher training in developing countries, especially least developed countries and small island developing States.	The Interventions implemented aimed to provide equitable access to high-quality education for marginalised communities. By focusing on marginalised groups, this initiative rectified the educational inequalities prevalent within society and fostered a more inclusive learning environment.

	Target 5.1 End all forms of discrimination against all women and girls everywhere. **Target 5.5** Ensure women's full and effective participation and equal opportunities for leadership at all levels of decision-making in political, economic, and public life. **Target 5. c** Adopt and strengthen sound policies and enforceable legislation for the promotion of gender equality and the empowerment of all women and girls at all levels.	The project promoted quality education for all students, without discrimination of their gender, caste, disability, or background, thereby enabling them to achieve their full potential.

1.4 Alignment with Schedule VII, Companies Act (2013)

In the table below, the sub-sections of Schedule VII, Companies Act (2013) are mentioned in alignment with the Experiential Science Learning Programme.

Area	Activities	Alignment with CSR Programme
(i)	Eradicating hunger, poverty, and malnutrition. Promoting health care, including preventive health care and sanitation, and contributing to the Swachh Bharat Kosh set up by the Central Government to promote sanitation and ensure safe drinking water availability.	**Completely**
(ii)	Promoting education, including special education and employment enhancing vocation skills, especially among children, women, the elderly, and the differently-abled, along with livelihood enhancement projects	**Completely**

1.5 Alignment with Environmental, Social, and Governance (ESG) Principles

The Experiential Science Learning Programme aligns with the ESG Sustainability Report of the corporate. Particularly, concerning the Business Responsibility & Sustainability Reporting Format (BRSR) shared by the Securities & Exchange Board of India (SEBI)[1], the Experiential Science Learning Programme can be covered under the following ESG principle:

[1] https://www.sebi.gov.in/legal/circulars/may-2021/business-responsibility-and-sustainability-reporting-by-listed-entities_50096.html

Principle 4 : Business should respect the interests of and be responsive to all its stakeholders

- Experiential Science Learning Programme ensures an opportunity to access quality education to all students regardless of caste, gender, disability, social and economic status

1.6 Alignment with National Priority

Government Policies/Schemes/Mission	Objectives and Strategies	Alignment with Programme
Sarva Shiksha Abhiyan	To provide Universal Elementary Education to all minors throughout the nation for free	Access to the equitable quality education aspect of the Experiential Science Learning Programme is aligned directly with the Sarva Shiksha Abhiyan programme as it includes universalising elementary education.
Right To Education Act	The act aims towards providing free and compulsory elementary education to kids between the age group of 6 years to 14 years.	Experiential Science Learning Programme is aligned with the Right to Education (RTE) Act which made education for every child between 6 and 14 years a fundamental right.
National Education Policy	NEP focuses on fostering each child's holistic development and integration within society. The primary goal is to nurture the innate talents and abilities of every individual while also establishing an environment that supports the growth of their personality.	Experiential Science Learning Programme is aligned with NEP, which ensures universal access to education at all levels of schooling from pre-primary school to grade 12. The programme promoted a shift from rote learning to activity-based learning, encouraging critical thinking and problem-solving abilities to promote a deeper understanding of concepts.
National Health Policy	To reduce morbidity and preventable mortality of NCDs by advocating pre-screening.	The programme focused on creating awareness and early diagnosis of NCDs (especially Blood Pressure/ Hypertension) in the communities through young kids, also known as CHAMPS.

Impact Assessment Design and Approach

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2.1 Objectives of the Study

The objective of the impact assessment study for the Experiential Science Learning Programme is:

To evaluate the overall impact and effectiveness of the programme in promoting science education and its associated outcomes

To assess the influence of the programme on scientific knowledge, interest in science, and overall academic performance of students

To examine the impact on pedagogical practices of teachers and their ability to effectively engage students in scientific learning through interactive classes

To provide evidence-based insights and recommendations to enhance the effectiveness of the programme and maximize its positive impact on science education

2.2 Approach and Evaluation

In order to assess the inclusivity, relevance, appropriateness, coherence, effectiveness, potential impact, and efficiency of the program, a parallel evaluation was conducted utilising the **IRECS framework**. This framework was instrumental in generating pertinent insights, including identifying on-the-ground challenges extracting valuable lessons and formulating recommendations for program implementation. The evaluation findings are significant for the implementing team, funding team, and other key stakeholders involved in evaluating the program's performance.

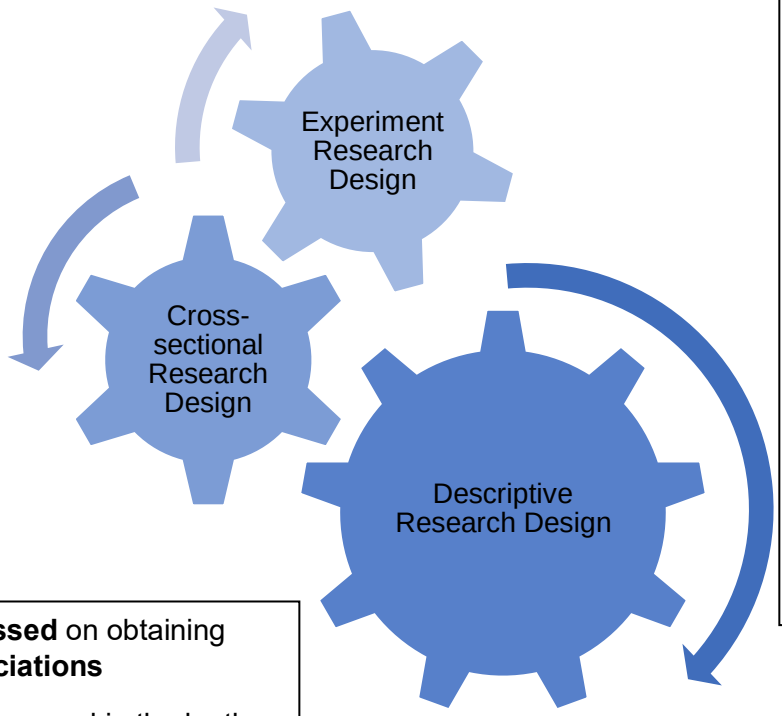
The below assessment indicators were designed in alignment with IRECS.

Framework Pillars	Information indicators	Data sources
Inclusiveness	• Level of awareness among students and teachers regarding STEM Learning and the topics. • Level of awareness and interest of students in exploring new passions • The extent of participation among all community strata, including children (gender, education level of parents, occupation of parents, etc.)	• Quantitative survey • IDIs with Science Teachers, Biocon Foundation staff, Community Members, Agastya International Foundation Team, STEM trainers, etc • FGDs with various stakeholders
Relevance	• The extent to which the program's objectives align with the beneficiaries' requirements. • The extent of learning due to the current infrastructure facilities available at the schools	• Secondary Review – including reviewing project-related documents

	• The extent of curiosity and science knowledge among students to implement the learnings	• Baseline study reports assessing the relevance of the project • Qualitative interactions with Agastya International Foundation and Biocon Foundation's Team members and other key stakeholders • FGDs with community members • KIIs with school officials
Expectations	• Increase in academic knowledge and awareness about STEM • Improvement in learning outcomes with STEM subjects • Increase in the development of critical thinking and problem-solving skills among students • Increase in the curiosity level and openness to explore Science subjects among students • Improvement in 21st Century Skills among students	• Quantitative survey with stakeholders, including student • IDIs with the Head of schools, Biocon Foundation Team members, Agastya International Foundation Team members, and other key stakeholders • FGDs with teachers, community members, parents, and students
Convergence	• Role and responsibility of teachers, schools, and government to ensure the sustainability of the program	• Quantitative survey • IDIs with government officials, Biocon Foundation Team, Agastya International Foundation Team, and other key stakeholders
Service Delivery	• Rating of quality of teaching by MSL trainers in the sessions • Rating of content taught by the MSL trainers • Rating the pedagogy of the MSL trainers • Rating of quality of teaching by MSL trainers during COVID-19	• Quantitative survey • Qualitative interactions with school teachers, Biocon Foundation Team and Agastya International Foundation Project Managers, FGDs with students

2.3 Methodology and Research Design

This study employed a **mixed methodology** encompassing both quantitative and qualitative approaches. It aimed to assess the impact of Experiential Science Learning Programme interventions implemented between **April 2019 and March 2023**. To align with the study's objective, the research was conducted utilising the following research designs to comprehensively capture the more profound impact of the interventions.



Focussed on acquiring comparative analysis using counterfactuals

Considering learning outcomes results of students attending MSL sessions as the **dependent variable** and results from other government schools as the **independent variable**.

Tools used: Learning outcome

Focussed on obtaining **Associations**

Marks scored in the by the students attending MSL sessions vs students not attending MSL sessions

Tools used: Surveys, Learning Outcome Tests

Focussed on capturing the concurrent on-ground impact

Describing the beneficiaries, stakeholders, their roles and the effect caused by Experiential Science Learning Programme in direct and indirect ways

Tools used: FGDs, and Surveys

The research mentioned above designs guided in exploring **360° impact**. The assessment had a **two-pronged approach** to data collection. Desk review included secondary data sources and primary data obtained from quantitative and qualitative data collection methods.

Primary Study

- Quantitative surveys and approaches to data collection and analysis
- Quantitative analysis of students survey
- In-depth Interviews with key stakeholders including school principals, science teachers
- Focused Group Discussions (FGDs) with various groups (7th, 8th and 9th Grade students)
- Observations of the study area

Secondary Study

- Review of annual reports, past studies, research studies by renowed organisations available in public domain to draw insights into the situation of the area

2.4 Sampling Strategy and Data Collection

Quantitative Sampling

Out of **21 schools**, **50% of the schools**, which amounts to 11, were selected for data collection. The sampled schools were further based on their student's educational level, precisely the middle stage (5th to 7th grade) and the secondary stage (8th to 10th grade).

Using proportionate sampling, the distribution of the 11 sampled schools was as follows:

7 Higher Primary Schools	4 High Schools

This stratification of schools was determined by considering the varying levels of student participation, i.e., maximum and minimum levels of participation in each category.

Thematic Area	Location	Total Schools	Sample Schools	Rationale
School Students (from Classes 6th-10th)	Anekal	21	11	Considered 50% of the participating schools

Student Sampling

The sampling of students was conducted exclusively based on the beneficiary level. The sample size calculation considered a confidence level of 95% and a Margin of Error of 5%.

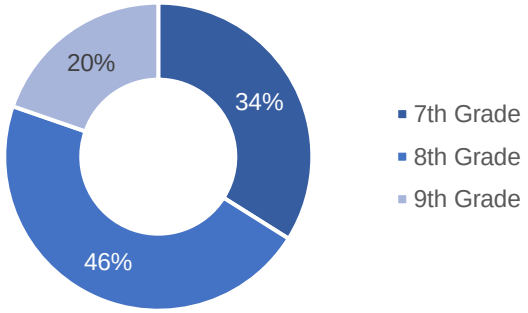
Student Beneficiary	Mode of data collection	Targeted Sample Size	Achieved Sample Size
Students in 11 Government Schools	Survey Questionnaire	364 (344 + 5% Buffer)	386
	Age-appropriate STEM Test	172	172
Counterfactuals	Age-appropriate STEM Test	172	172

Class-wise and Gender-wise Sampling

The students were stratified based on their grade level, considering the inclusion criterion of having at least one year of exposure to the Mobile Science Lab sessions. Proportionate sampling was then conducted for the 7th, 8th, and 9th.

Grade	Number of students	
	Targeted sample	Achieved Sample
7th Grade	123	131
8th Grade	173	179
9th Grade	68	76
Total	**364**	**386**

Class-wise distribution of sample



Additionally, the stratification of students was done based on their gender.

Grade	Class and Gender-wise Stratification (from 11 schools)			
	Targeted sample of Boys	Achieved Sample of Boys	Targeted Sample of Girls	Achieved Sample of Girls
7th Grade	63	70	60	61
8th Grade	76	82	97	97
9th Grade	23	32	44	44
Total	**162**	**184**	**201**	**202**

Comparative Analysis

A comparative analysis was undertaken in this study to assess the learning outcomes achieved by students attending the MSL sessions to evaluate the overall effectiveness of the program delivery. The analysis involved comparing the level of retained knowledge between students attending the MSL sessions (referred to as the '**Treatment Group'**) and students from neighbouring government schools who did not participate in the MSL sessions (referred to as the '**Control Group**' for this study).

To conduct the analysis, a sample of students was selected from the Treatment and Control groups. The **primary tool** used for assessment was the **Learning Outcome Assessment**. The intention was to measure and compare the following aspects to provide insights into the relative efficacy of the Experiential Science Learning programme in enhancing learning outcomes:

Scientific Knowledge: Ability to understand the scientific concepts and its application

Scientific Thinking: Ability to analyze and understand the world by asking questions, making observations, testing ideas, and drawing conclusions based on evidence.

Scientific Attitude: Ability to be curious and open-minded when looking at the world around themselves and relating it with the scientific concepts

Proactiveness: Ability to take initiative, anticipate potential challenges, and actively seek out opportunities to solve problems

Confidence: Ability to stand up and speak their mind, and participate in group activities and peer-learning

Curiosity: Ability to explore, investigate, observe and learn more

In the table below is the targeted vs achieved number of students assessed for Learning Outcomes in Treatment, as well as Control Schools:

Grade	Sample Size for quantitative tool- Learning Outcome Assessment	
	Achieved Sample in Treatment Schools	Achieved Sample in Control Schools
7th Grade	58	26
8th Grade	85	69
9th Grade	29	77
Total	**172**	**172**

Qualitative Sampling

The following list of key stakeholders was considered for Focused Group Discussions/ In-depth interviews:

S. No.	Stakeholder	Method of Data Collection	Total No. of FGDs/ Interviews
1.	7th Grade	FGD	7
2.	8th Grade	FGD	9
3.	9th Grade	FGD	4
4.	MSL Instructor	IDI	2
5.	Science Teacher	IDI	11
6.	School Principal	IDI	3
7.	Implementation Team	KII	2
8.	Biocon Foundation CSR Team	KII	1

Inclusion Principle

Students Survey and Learning Outcome Assessment (Treatment Schools)

- Students shall be enrolled in 11 selected Government Schools during the assessment period of the study (2019-23) and;
- Students shall be enrolled in grade 7th, 8th and 9th and;
- Students must have attended MSL sessions for at least one year

Learning Outcome Assessment (Control Schools)

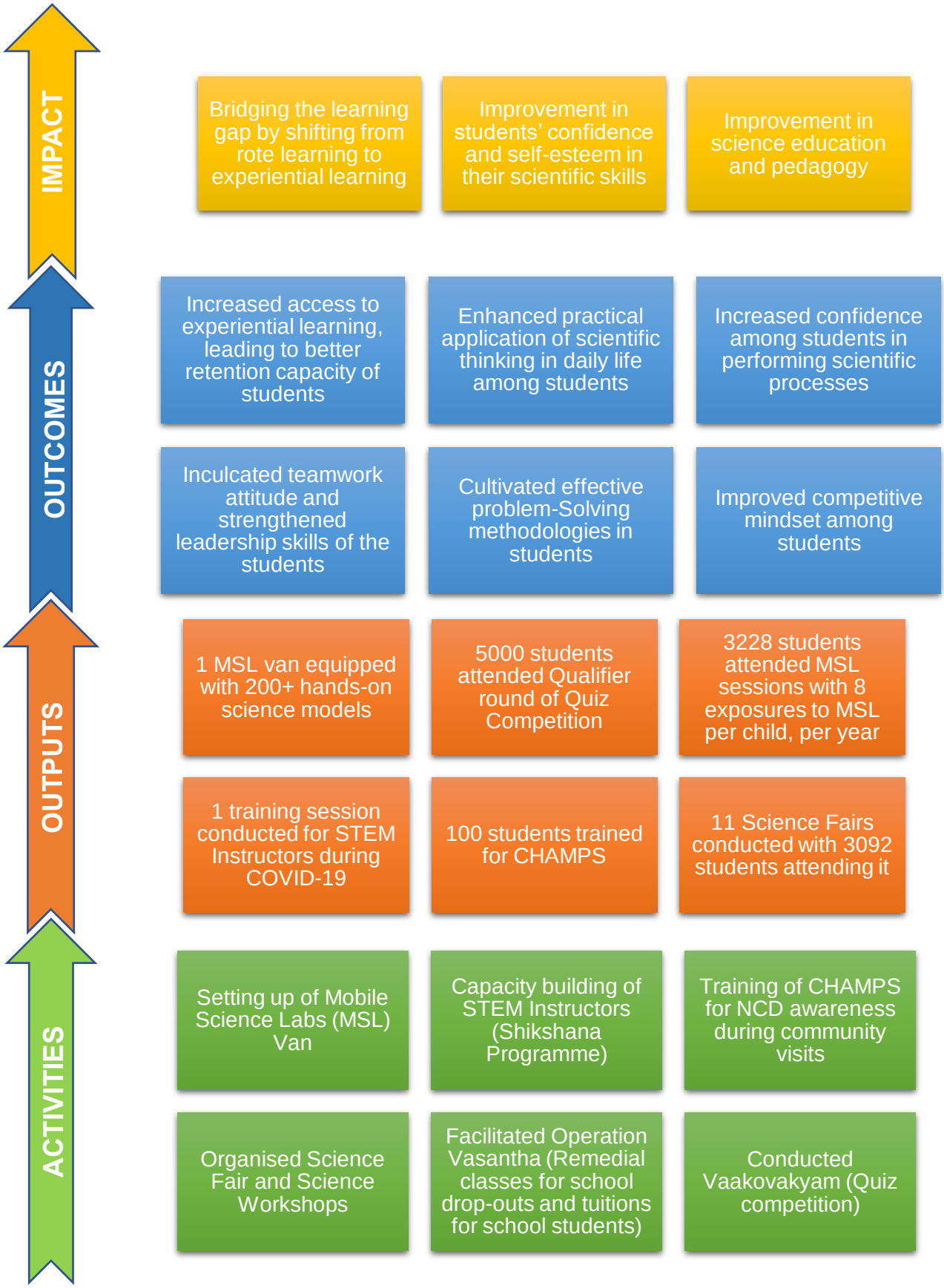
- Selection of 5 schools under this category was subjected to permission from school authorities to conduct these assessments
- Students were enrolled in grade 7th, 8th and 9th and;
- Selected schools were government, government-aided, or charitable schools certified by State Board/CBSE
- Selected schools were not covered under STEM Learning Program interventions by Agastya Foundation
- Selected school students belonged to similar socio-economic status (e.g., similar family occupation, family income band, situated in the same geography, with a similar level of parents' education, etc.)

2.5 Challenges in Data Collection

- Due to high absenteeism among students during the Learning Outcome Assessment Test in Control schools, there was difficulty in achieving the sample proportionately.

Figure 1: Instructions given to students for Learning Outcome Assessment in Government Higher Primary School, Manchenahalli

2.6 Theory of Change



Impact Numbers

79%

- students prefer Practical as well as Theoretical Science classess

99%

- students have attended MSL sessions

84%

- students mentioned that the MSL teacher's instructions were easy to comprehend

95%

- students have asked doubts to MSL Instructors

65%

- students were always willing to answer in MSL sessions

76%

- students share knowledge with parents/ siblings

64%

- students always conduct DIY experiments at home

69%

- students refer to School Science teacher and MSL Instructor for doubt clearing

89%

- students feel motivated to ask doubts in the MSL sessions

86%

- students have demontrated experiments in MSL sessions/ Science Fair

66%

- students agreed that MSL sessions strengthened the understanding of science concepts

Brand Equity

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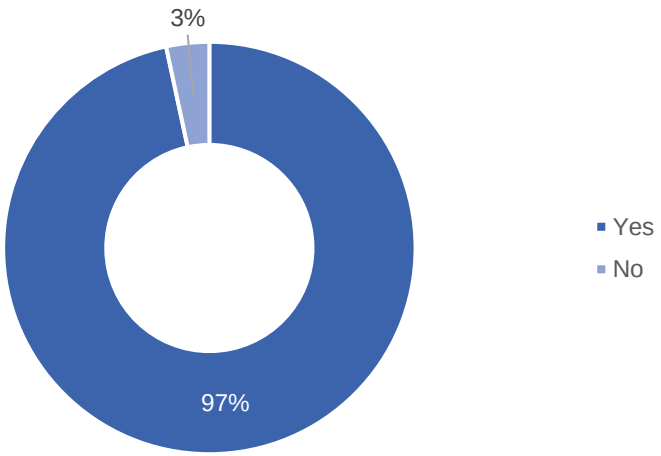
3.1 Brand Equity

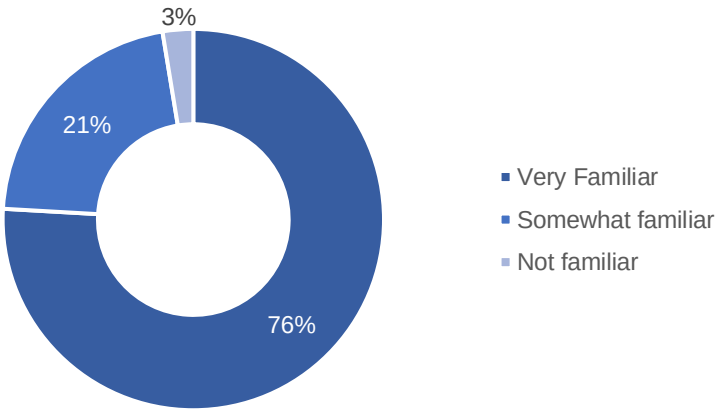
Brand Equity refers to a value premium that a company generates from a product or service through its name recognition. Organisations can enhance their **brand value and reputation** by providing service that is reliable, efficient, memorable, and of superior quality. Brand Reputation can have a significant impact on Brand Equity. Brand Equity comprises important components like how the consumers perceive the brand and the negative and positive effects resulting in value for the brand and the company as a whole. In this study, we have determined the brand equity of Biocon Foundation as stated by the students in the intervention schools.

Familiarity with 'Biocon Foundation' Logo (N=386)

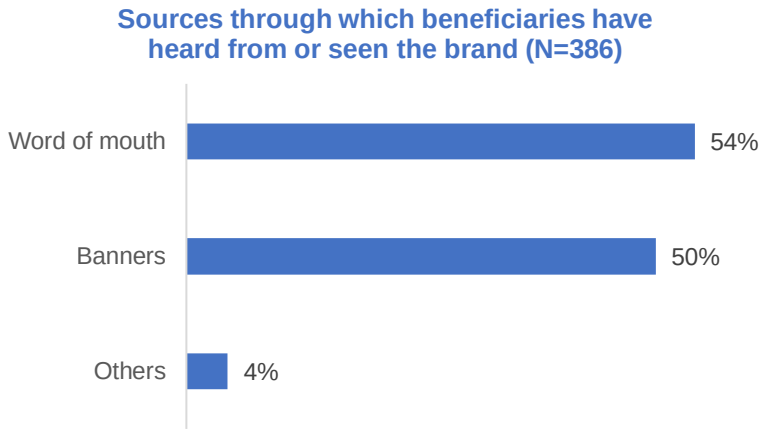


The provided figure illustrates that 97% of students were familiar with the brand "Biocon Foundation" through its logo. This finding indicates that the efforts undertaken by the Biocon Foundation have **effectively created brand recognition and value** among the students. The success in conveying their message and objectives can be attributed to effective communication strategies implemented by the team.

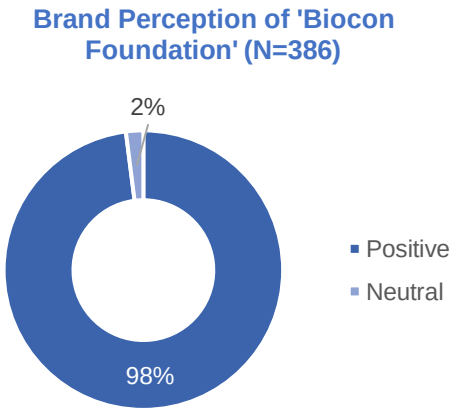
Familiarity with 'Biocon Foundation' as brand (N=386)

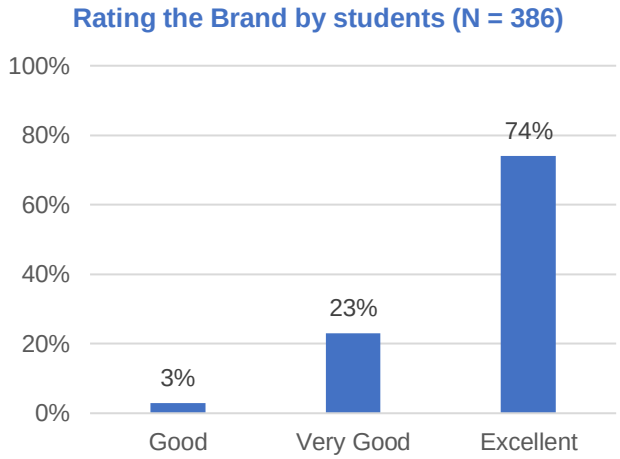


The presented graph indicates the level of familiarity with the brand "Biocon Foundation" among the students. It is evident that a significant proportion of students, 76%, expressed a **high level of familiarity** with the brand, while 21% of students reported being somewhat familiar with it. This data highlights the **brand's recognition and prominence among the student** population.



The above graph highlights the primary mediums that significantly contributed to **brand awareness** and familiarity with Biocon Foundation. It is evident that **Word of Mouth** played the most significant role, followed by banners and posters. As a strategic measure to enhance brand visibility among the beneficiaries, Biocon Foundation could consider organising more events. The increased brand visibility would create trust in the community and assist in the successful implementation of the projects.





The depicted graph demonstrates a significant improvement in the perception of students towards Biocon Foundation over time. Specifically, 98% of the students expressed a **positive brand perception** towards Biocon Foundation. This indicates a significant and favourable shift in how the foundation is perceived by its target audience.

Further, 97% of students rated Biocon Foundation Very Good or Excellent (on a scale of 1 to 5, with 5 being the highest and 1 being the lowest).

Quality of Education

Biocon Foundation
EMPOWERING COMMUNITIES

Education is the cornerstone of individual and societal progress. It plays a crucial role in shaping the future of the nation by empowering its citizens, fostering social mobility, and driving economic growth. Education provides children from marginalised backgrounds with an opportunity to escape the vicious cycle of generational poverty. It equips them with the necessary skills to secure better employment prospects, higher incomes, and improved living standards. The Experiential Science Learning Programme is breaking the stereotype of rote learning and introducing activity-based learning in 21 Government Schools in Anekal, Bangalore. This section of the report presents findings in alignment with the assessment indicators through the lens of the IRECS (Inclusiveness, Relevance, Expectation, Convergence, Service Delivery) framework.

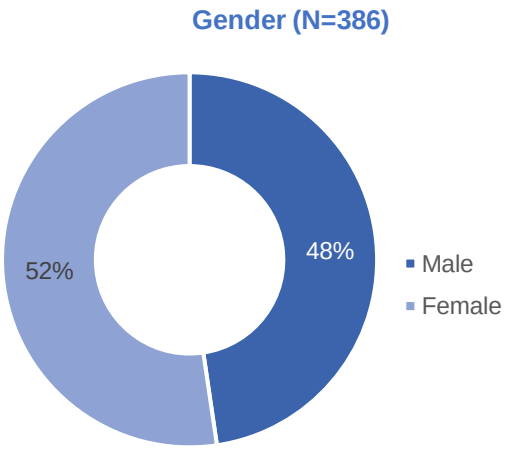
4.1 Inclusiveness

Nearly equal distribution of male and female students, 48% and 52% respectively

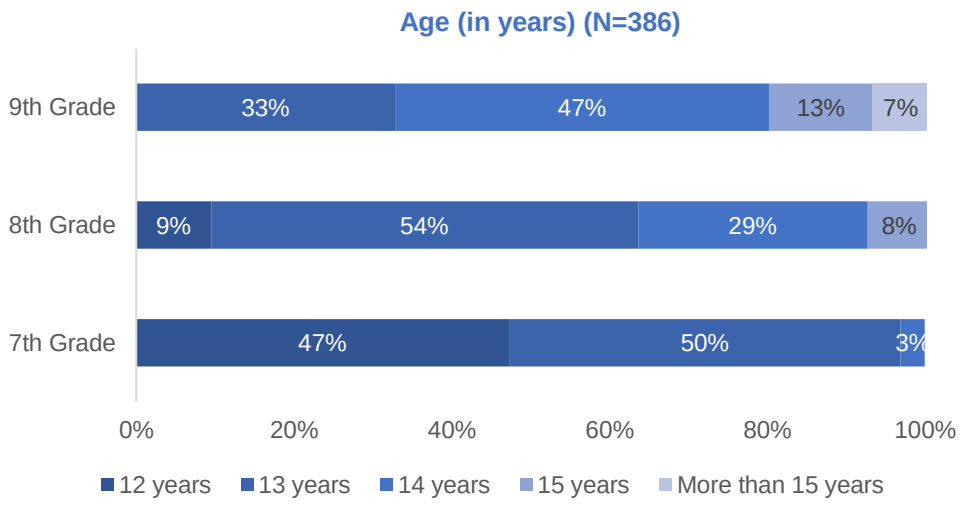
Average Age
9th Grade: 14 years
8th Grade: 13 years
7th Grade: 13 years

Employment Status: 41% of Fathers Engaged in Private Sector Employment, 33% of Mothers Employed as Daily Wage Labourers

This parameter assesses the degree of inclusivity of the programme, specifically focusing on the engagement of various stakeholders. The interventions implemented within the program have received significant acceptance from the students, science teachers, and school principals. In terms of this indicator, the programme demonstrates a significant performance by effectively reaching students from diverse socio-economic backgrounds.



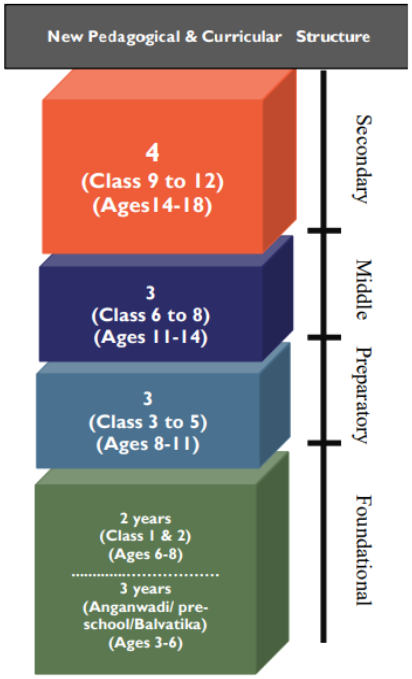
It was observed during the field visit that the treatment schools implemented a policy to ensure that the admission process remains unbiased, refraining from any form of discrimination based on caste, gender, language, economic status, disability, and other relevant factors. Hence, the data collected was of **nearly equal distribution of male and female students**, which is 48% and 52%, respectively.

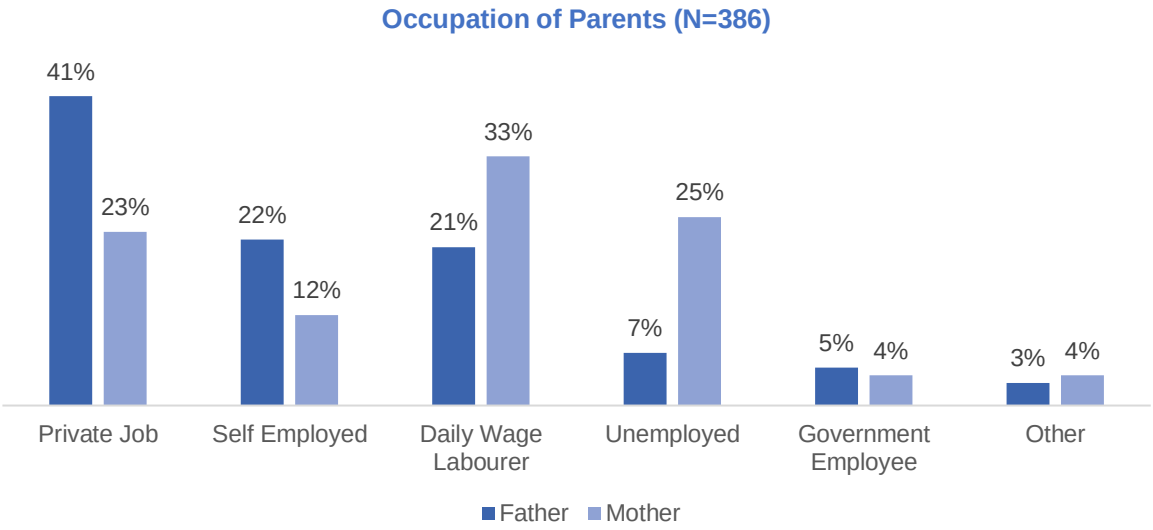


According to NEP 2020, pedagogical structure and the curricular framework for school education consist of various stages. The Experiential Science Learning Programme focused on **Middle Stage** (Grades 6 – 8, covering ages 11 – 14) and **Secondary Stage First Phase** (Grades 9 – 10, covering ages 14 – 16).

The above graph highlights that 97% of students in grade 7 were in the age group 12 – 13 years, and 83% of students in grade 8 were in the age group of 13 – 14 years, which emphasised late admissions due to migration from other states. However, as the majority of students belonged to the same age group, it ensured benefits from academic and social experiences and instilled **a sense of belonging and self-confidence** among them.

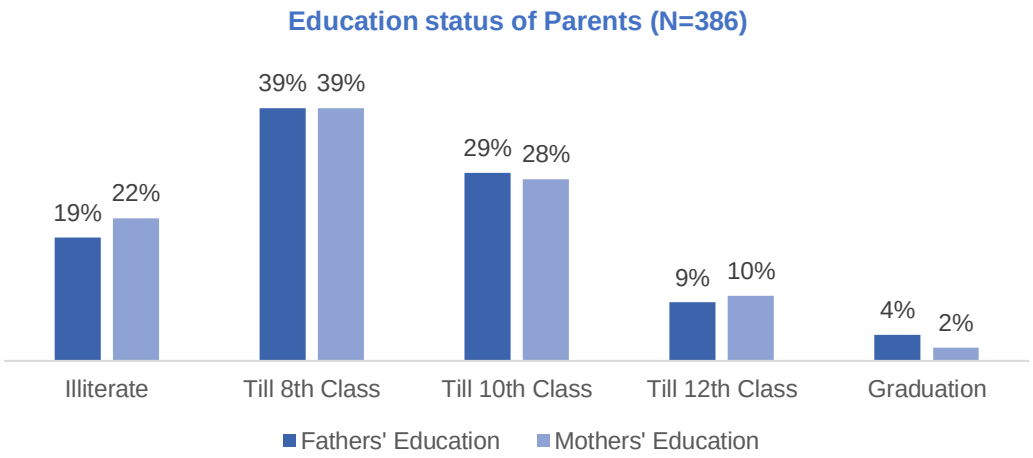
80% of grade 9 students were in age-appropriate classes, which helped them in gaining an **optimal learning environment** aligning with their developmental stage





As can be observed from the above graph, 41% of students' fathers were employed in private jobs such as security personnel, drivers, tailors, etc., and 33% of students' mothers were employed as daily wage labourers in the factories/industries present in Anekal. The long working hours in informal jobs and the unavailability of parents at home **restricted** a **conducive learning environment at home**.

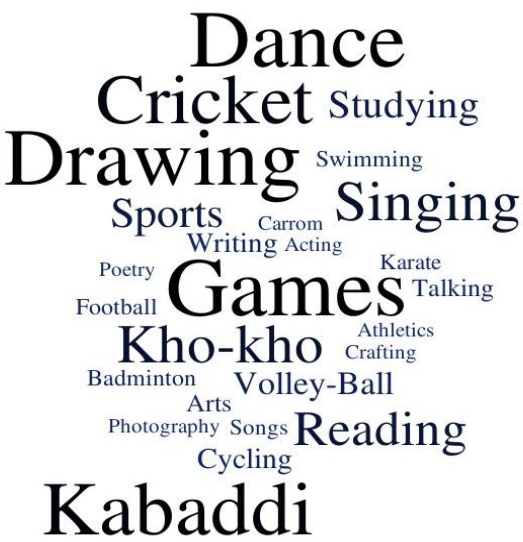
Further, it was noticed during the field visit that due to irregularity in employment, **migration** was significantly high, and it had caused interruptions in the children's schooling, thus, leading to **irregular attendance and gaps in learning.**



The graph focuses on the education status of students' parents, and as observed, merely 4% of fathers and 2% of mothers were graduates. The lower educational level of parents highlights their limited understanding of the importance of education in their own lives, thereby affecting their motivation to prioritise their children's education.

Given the socio-economic status of the **parents,** their **primary focus** revolved around **securing livelihoods** and ensuring the provision of basic sustenance for their families, including two square meals daily. Additionally, during the IDI with science teachers, it was mentioned that the daily challenges confronted by parents in meeting basic necessities forced them to consider the educational needs of their children as a secondary priority.

The word cloud represents the hobbies of the students.



The interest in extra-curricular activities highlights the **exposure** provided by the government schools to the students, thus, ensuring the **holistic development of students**.

The **programme demonstrated inclusivity** by providing equal access to experiential learning for all students, irrespective of their gender, age group, and the occupational and educational qualifications of their parents, thus ensuring **equitable opportunities for all students** to engage in experiential learning.

4.2 Relevance

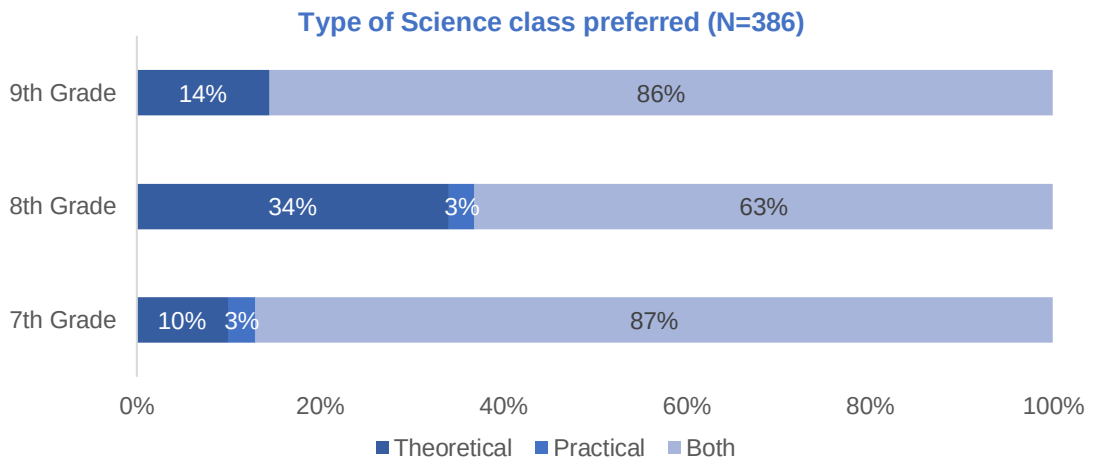
The relevance of a programme is determined by the extent to which the intervention inclines towards the 'felt' needs of the communities.

Preference for engaging in practical and theoretical classes: 9th Grade: 86%; 8th Grade: 63%; 7th Grade: 87%

Goverment school lacks the proper types of equipment and chemicals to perform experiments

Experiential learning is a defined process in which students acquire knowledge, skills, and fundamental values through experiences that extend beyond the confines of traditional academic settings. It actively engages students in activities that encourage critical thinking, problem-solving, and decision-making in daily life contexts. This approach also fosters the creation of opportunities for the development of ideas and skills through constructive feedback, observation, and the practical application of concepts.[2] (Dr. Rashmi Bhatia, 2019)

The National Education Policy (NEP) 2020 in India recognises the importance of experiential learning as a key pedagogical approach. The policy emphasises the need to shift from rote-based learning to a more holistic and experiential learning model to promote **21st-century skills** among students.



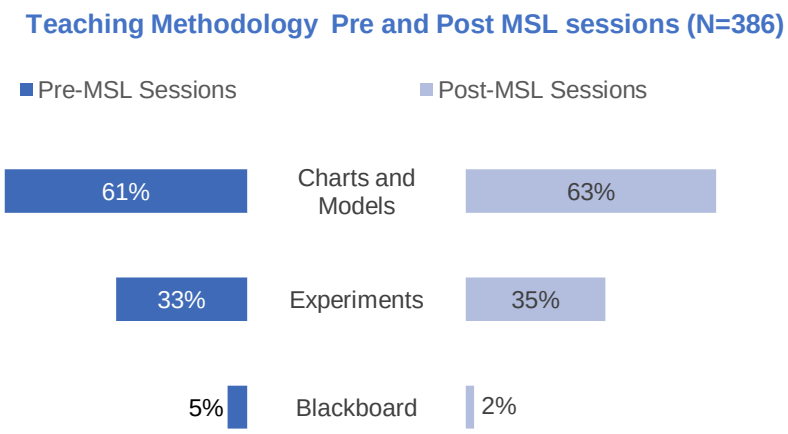
[2] Dr. Rashmi Bhatia, D. A. (2019). Assiduous Study On Experiential Learning in Entrepreneurship Education With Reference to Higher Education In India. *International Journal of Scientific and Technology Research*, 2773.

During the IDIs conducted with teachers, it was emphasised that the learning abilities of school children were impacted post the COVID-19 pandemic. Hence, in response, the Karnataka Government organises an annual learning festival called 'Kalika Habba' to address the learning gap and facilitate the recall of significant and continuing learning outcomes. However, it was also stated that due to the extensive scale of the event, every student got limited opportunity to participate. Contrary, the **Science Fair** organised by Biocon Foundation and Agastya International Foundation provided **ample opportunities** for all the students to **participate, explore and learn science topics actively**.

Furthermore, the availability of these narrow possibilities to engage in **real-time experiences** has significantly **increased** the **enthusiasm** of students for **learning science** through both **practical and theoretical classes**. As depicted in the graph, 7th grade (87%), 8th grade (63%) and 9th grade (86%) highlight the percentage of students with a preference for engaging in both types of classes.

Figure 2: The MSL Instructor arranging the setup before commencing the MSL session

Moreover, due to the **sudden increase** in the **complexity and difficulty level** of topics in **8th grade**, 34% of students **preferred theoretical classes** as it is **easier to memorise information** rather than comprehend the underlying concepts.



Prior to the intervention, the science teaching pedagogy prominently emphasised the use of visual representation methodologies, with a specific focus on charts, diagrams, and models as the primary instructional tools. However, this approach did not allow students to engage in hands-on experiments and explore science through practical application. Further, as mentioned, all the science teachers stated that the science lab in **school lacked** the proper types of **equipment and chemicals** to facilitate experiments.

"The programme is providing necessary opportunities to our school students, and we can observe their willingness to learn science and continue their higher education. This eagerness to study will help them to break the shackles of poverty and lead a dignified life."
Shweta, In-charge Principal and Science Teacher, GHPS Yarandahalli

Additionally, the teacher training programme conducted by the Karnataka Government for newly recruited science teachers focuses primarily on imparting pedagogy for teaching theoretical lessons and incorporates a limited number of practical experiments. Hence, identifying a lack of creative pedagogical techniques within conventional classrooms, twice-a-year **capacity-building programmes** were conducted to enhance teaching skills.

These sessions were held from 10:30 AM to 4:30 PM and consisted of interactive components that involved a role reversal for teachers where teachers formed a group with fellow science educators to conduct various experiments. This **participatory approach** enabled teachers to **gain firsthand insights** into the **challenges faced by students** and **implement** these **learnings** in their science classes.

Thus, The Experiential Science Learning Programme proved instrumental in **bridging** the **learning gap** and provided an **innovative academic environment** for the students.

Considering the current **highly competitive world** and the **limited resources** in these schools, the **programme** was **highly relevant** for improving the educational landscape of Anekal.

Figure 3: Glimpses of the Teacher Training Programme

4.3 Expectations

Expectations define the extent to which the intended and unintended positive benefits, socio-economic changes and cultural changes are experienced by the beneficiaries. The insights drawn from the data collected as a part of the survey are stated below.

95% of students have actively posed their doubts to the MSL instructor	86% of students had demonstrated experiments during MSL sessions and science fairs	64% of students always conducted DIY experiments at home.

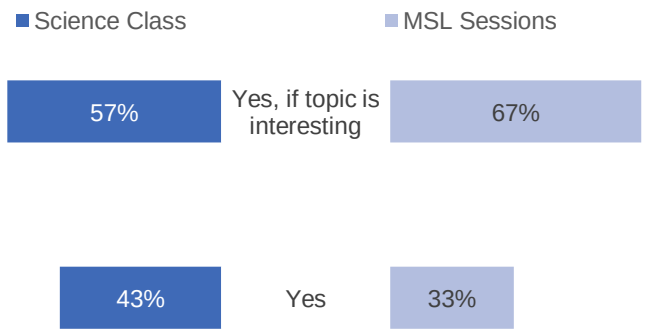
Synergizing Scientific Learning: Dual Impact of Science Classes and MSL Sessions

Science education provides students with the essential knowledge and skills to comprehend and actively participate in their surrounding environment. It nurtures curiosity, inquiry, and a sense of wonder about the natural world. It encourages students to ask questions, explore new ideas, and seek answers through experimentation and investigation. This fosters a lifelong passion for learning and a desire to explore the unknown. Thus, to build a **strong foundation** and **enhance scientific thinking skills**, schools conduct science classes regularly for a duration of **40 – 45 mins** for **6th – 10th grades**.

Additionally, to strengthen the handholding of students in science learning, **Mobile Science Lab** visited these 21 schools once a month. Agastya International Foundation, in coordination with the school calendar, meticulously prepared **annual visit plans** encompassing **6 – 8 sessions per student per year**. During the calendarization stage, the **2 MSL instructors** formulated a list of **topics aligning** with the **latest curriculum**. The average duration of each session is 2 hours, including the preparation time needed by the instructor for the smooth functioning of the session.

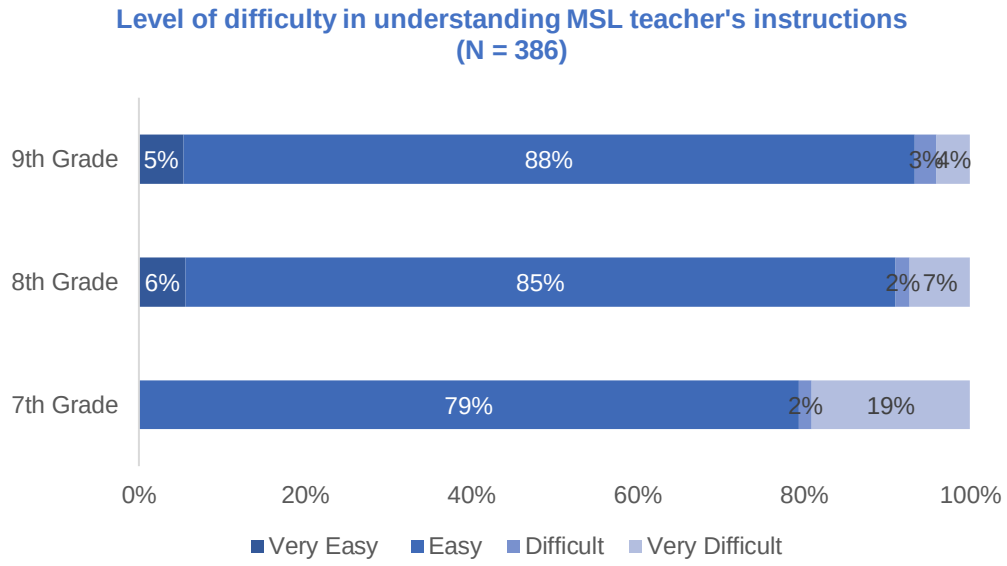
Considering the socio-economic conditions, they also incorporated topics that resonate with their daily life, for instance, good and bad habits in students' life. Further, certain **experiments** were **customised** to meet the **specific requirements** of the school science teachers.

Eagerness to attend Science class and MSL sessions (N = 386)



The above graph emphasised that a significant percentage of students, specifically **67%**, showed a strong **enthusiasm** to **participate** in **Mobile Science Lab (MSL) sessions** as compared to 57% of students who demonstrated eagerness towards attending regular science classes. The students showed keenness to attend MSL sessions as they got a unique opportunity to **conduct experiments themselves** in a group of 5 – 6 members in every MSL session. Through these hands-on activities, students gained a **deeper understanding of scientific concepts**.

Figure 4: Students of Grade 8 attending MSL session on Metals and Non-Metals



79% of 7th–grade, 91% of 8th–grade and 93% of 9th–grade students mentioned that they find the instructions provided by MSL instructors to be **easily comprehensible**. The instructors used to **break down complex instructions/activities** into smaller steps which helped in the better understanding of the concepts. Further, the primary language of communication in these Kannada medium schools was Kannada, which a considerable number of students were able to comprehend proficiently. However, it was observed that some students in the classes faced challenges in understanding the instructions due to a language barrier, as their native language was different.

Figure 5: MSL Instructor explaining the experiment through flash card

Community Visits

The community visits are conducted twice a month after school hours. The 3 hours of community visit include the following.

4:30 - 5:00 PM	•Setup of equipment •Mobilisation of community members
5:00 - 7:00 PM	•Demonstration of experiments
7:00 - 7:30 PM	•Doubt clearing session

With science experiments as a foundational base, the MSL Instructor helps the **students** to **draw references** to these **experiments from their daily life**. For instance, during the field visit, the Instructor mentioned that when a black magician visits your house to remove evil energies, he adds some ingredients post which fumes come out. One of the reactions can be Potassium Permanganate and Glycerine. The students were able to relate to this experiment easily.

Figure 6: Reaction of Potassium Permanganate and Glycerine conducted during Community visit

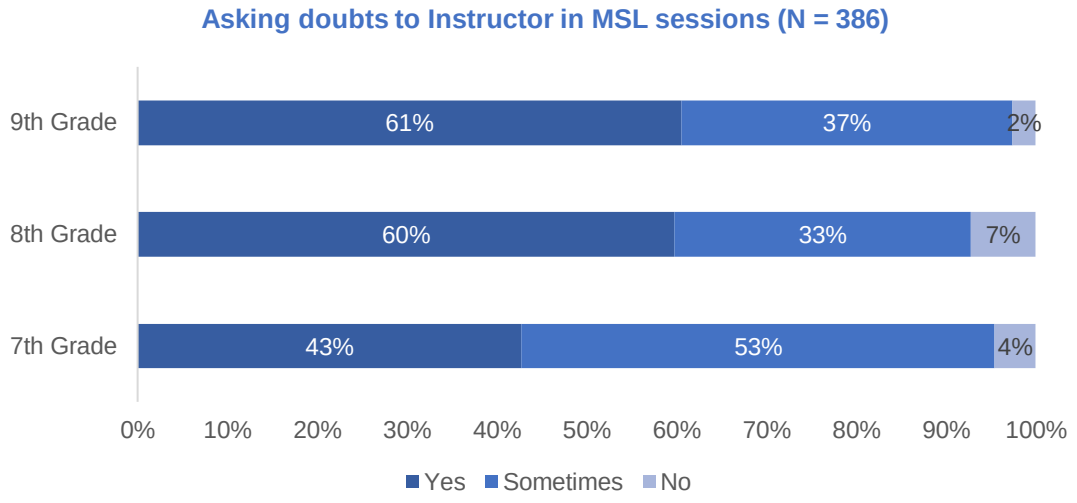
These visits were more like amusement shows for the community members, where everyone's attention was captivated, and important lessons were taught in an entertaining way. During these visits, the Instructors **actively engaged** with the **crowd**, inviting students to participate in experiments and serve as live examples of the demonstrated effects. This interactive approach added an **element of enjoyment to the learning process**, fostering a deeper understanding of scientific concepts in the community.

"I'm always eager to participate in these science activities. Me and my friends are always excited whenever this yellow van visits our community. Sir shows some magic tricks and then explains the science and chemical reaction behind it. I enjoy these sessions."

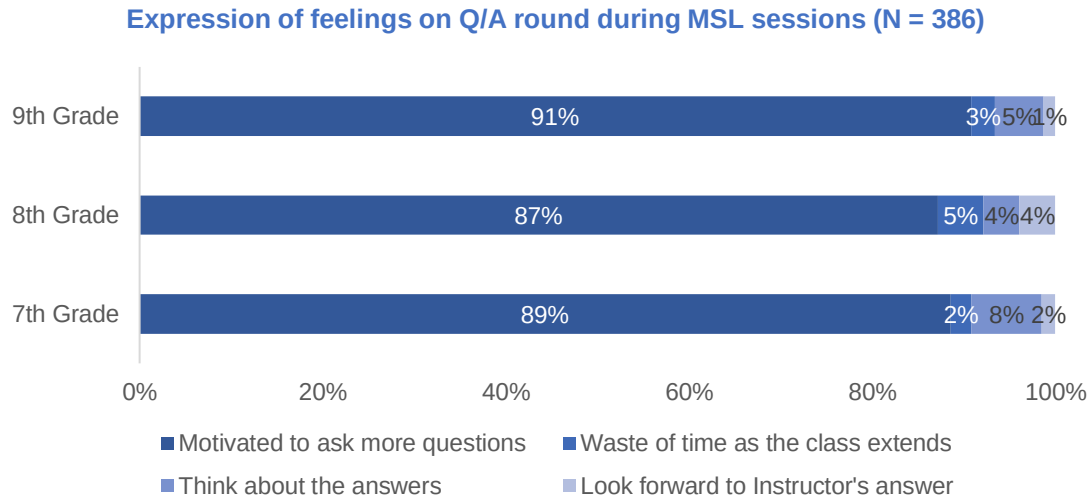
Ganesh, Resident of Kachanayakanahalli

Figure 7: MSL Instructor explaining scientific concepts during a community visit in Kachanayakanahalli

Sparking Curiosity: Impact of MSL sessions



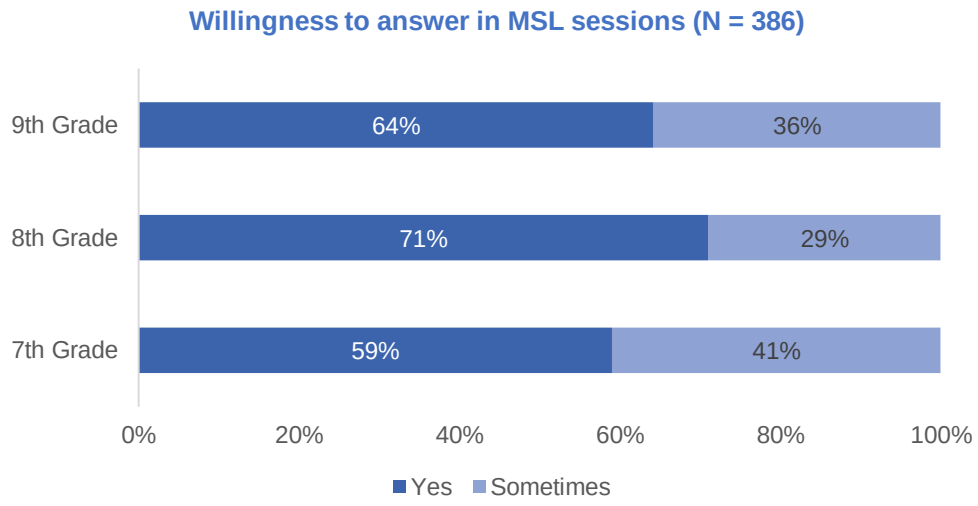
Prior to starting every session, MSL Instructors conduct a **Super Start quiz**. It consists of a group activity where the objective is to ignite curiosity among the students. Following the completion of the experiment, **students are encouraged to pose questions** to MSL Instructors, and the group is rewarded with 10 marks for each relevant question asked. This quiz fosters a **culture of active questioning** among students and supports them in overcoming the fear of public speaking and being judged by their peers. The above graph highlights that 7th–grade (96%), 8th–grade (93%) and 9th–grade (98%) students have actively raised their doubts for clarification to the MSL instructor in the sessions.



As can be observed from the above graph, 7th–grade (89%), 8th–grade (87%) and 9th–grade (91%) students are motivated to ask more relevant questions in MSL sessions. The **active participation among the students** encouraged them to explore beyond the information provided by the Instructors. Further, it **cultivated problem-solving skills** as they learned to **approach challenges from different perspectives**. Additionally, it promoted in development of critical thinking to analyse information, evaluate different perspectives, and consider alternative solutions.

Figure 8: Students answering questions during MSL sessions

Nurturing Confidence: Significance of MSL Sessions



During the discussion with students, it was observed that students were actively involved in the sessions by expressing their thoughts and ideas; further, they also **enthusiastically demonstrated experiments**. These experiences significantly contributed to a notable **increase in their self-esteem and confidence level** through these MSL sessions. This trend is also reflected in the data depicted in the provided graph, wherein 7th–grade (59%), 8th–grade (71%) and 9th–grade (64%) students were actively engaged in the sessions by responding when questions were posed to them. Further, 41% of 7th–grade, 29% of 8th–grade and 36% of 9th–grade students responded to the Instructor if they had prior knowledge of the solution/answer. It was noteworthy to observe that none of the students selected the option "I'm too shy to ask questions in class" in the questionnaire.

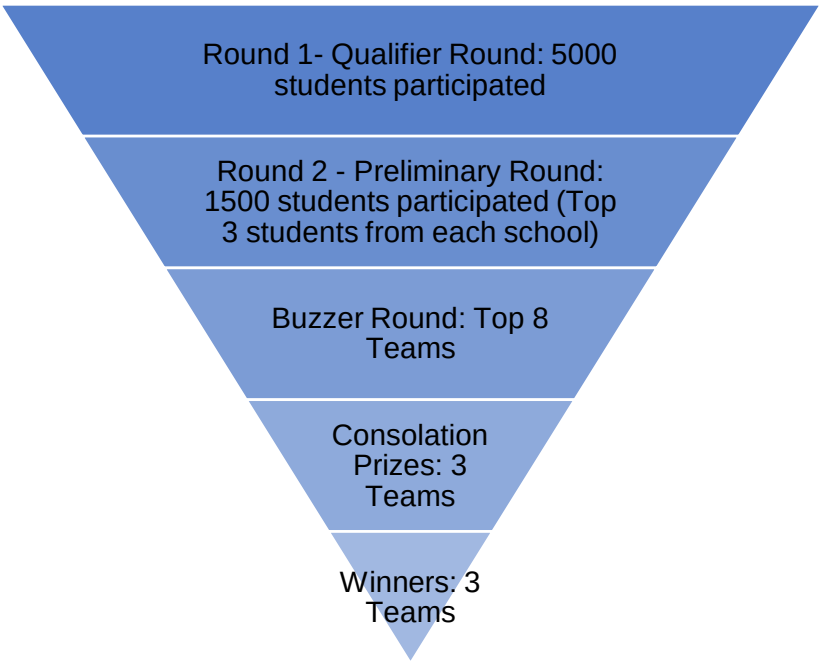
Post every MSL session, a **Super Finish quiz** is conducted. During this quiz, the MSL Instructor poses questions to each student group, and when a group answers correctly, they are awarded 10 marks. The quiz serves as a **valuable tool for revising the concepts** taught

in the session. This approach enhances the understanding and clarifies the concept, and improves retention of the subject topic.

Vaakovaakyam: Quiz Competition

Considering the significant importance of the quiz and looking at it from a broader lens as an educational tool, a district-level quiz competition, 'Vaakovaakyam', was organised by Agastya International Foundation in collaboration with the Biocon Foundation. The event witnessed participation from 5000 students and involved 50 schools in the Anekal. In the Qualifier Round, preliminary test was conducted at the school level in which 6th – 10th–grade students participated.

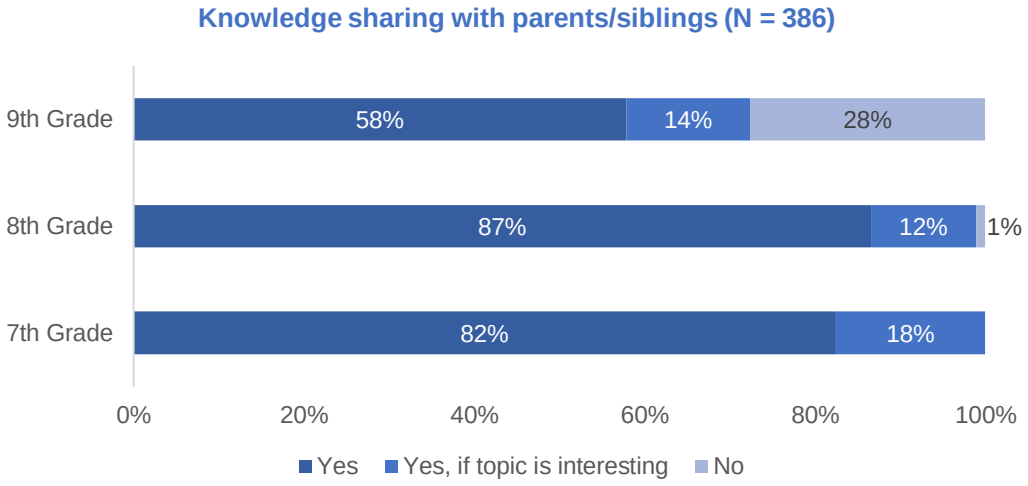
The top three students from each school, 1500 students, formed teams, resulting in a total of 50 teams advancing to the second round, which was held at St. Francis School, Anekal. The Preliminary Round of the final event included General Knowledge questions, which the teams discussed and answered. Following this, the selected top 8 teams proceeded to the Buzzer Round. In the end, the top 3 teams were recognised as Winners, Runner-ups, and Second Runners-up prizes, respectively and the remaining three teams were awarded Consolation prizes. Furthermore, the winning team was presented with the prestigious Rolling Trophy, and the cash prize was conferred by their School Science Teacher. In addition to Rolling Trophy, the top 6 teams received medals and certificates for their commendable efforts throughout the competition.



"It was an exceptional experience to be part of the quiz competition. I was selected with 2 other seniors from my school. I learnt that the quiz competition was not only about science, and it included general knowledge questions. After my experience, I understood the importance of teamwork and time management. The exposure to St. Francis School made me feel confident and motivated to study further. I hope this time we will win the competition."

Soumya, Grade 6th Student

Figure 9: Students participating in Vaakovaakyam: Quiz Competition organised at St. Francis School



7th grade (82%), 8th grade (87%) and 9th grade (58%) students always shared their experiences and learnings with their parents/siblings. Additionally, 7th–grade (18%), 8th–grade (12%) and 9th–grade (14%) students shared their experiences and learnings with their parents/siblings if the topic was interesting. The **sharing of knowledge** supported students in **reinforcing their learnings**, better understanding of the subject and consolidating their knowledge to **enhance retention of the topic**. Furthermore, the FGD highlighted that 28% of 9th-grade students refrained from sharing their learning at home, primarily due to the increasing complexity of the topics discussed in the sessions and the limited understanding ability of their parents.

Figure 10: Students of GMPS Yarandahalli actively participating in FGDs during the field visit

Child Health Activists Mentoring and Promoting health in Society (CHAMPS)

100 students of 8th and 9th–grade participated in the CHAMPS. For selecting the cohort of students from each school, six students were identified by the school Head Masters, Science teachers, Agastya International Foundation, and Biocon Foundation. This innovative activity caters to two objectives:

- To develop a curiosity for science through hands-on experience
- To increase awareness of NCDs among the community members

The students underwent comprehensive training conducted by a team of 5–6 experienced doctors affiliated with the Biocon Foundation. Through the structured training programme, which included Presentations and demonstrations with a sphygmomanometer, the students were trained to measure BP. Moreover, the one-day introductory training of 3–4 hours included the following topics:

- To measure Blood Pressure
- Reasons for high and low BP
- Chemical used in sphygmomanometer
- Ground Rules to be followed while measuring Blood Pressure
- Suggestions to be provided in case of high and low BP

Figure 11: Training conducted for CHAMPS

Post the training, considering the sociocultural sensitivity, two divisions based on gender were created by the Instructors. After-school hours, the division of boys, with the MSL Instructor, visited the nearby villages, and the division of girls visited the Science Fair, some special events like programmes organised in Block Office, Anekal, and exhibitions, where these students measured the BP of community members and visitors respectively.

"I visited Block Office, Anekal and there I got the opportunity to measure the BP of elders. The experience made me feel like a doctor, and it made me realise my interest in science. I aspire to become a doctor. I'm grateful to Biocon Foundation and Agastya International Foundation for this opportunity."

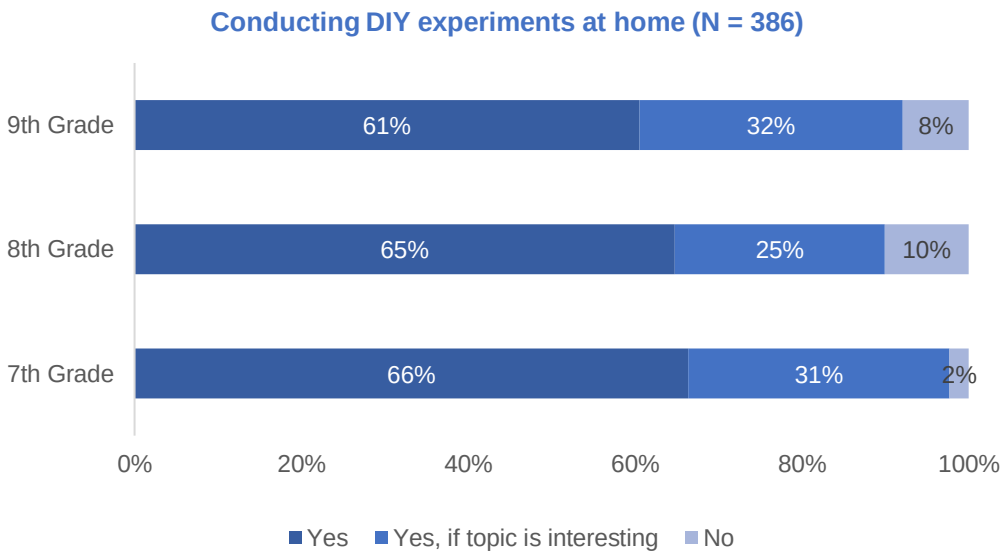
Amrutha, Grade 10th Student

The exposure gave them the opportunity to showcase their scientific learnings to their parents, families and community members. The activity increased confidence among the students as they learned to communicate information with various age groups. Further, being the future change makers, this intervention was the stepping stone in bringing a positive impact in society by creating awareness of NCDs and informing mitigation actions to the community members.

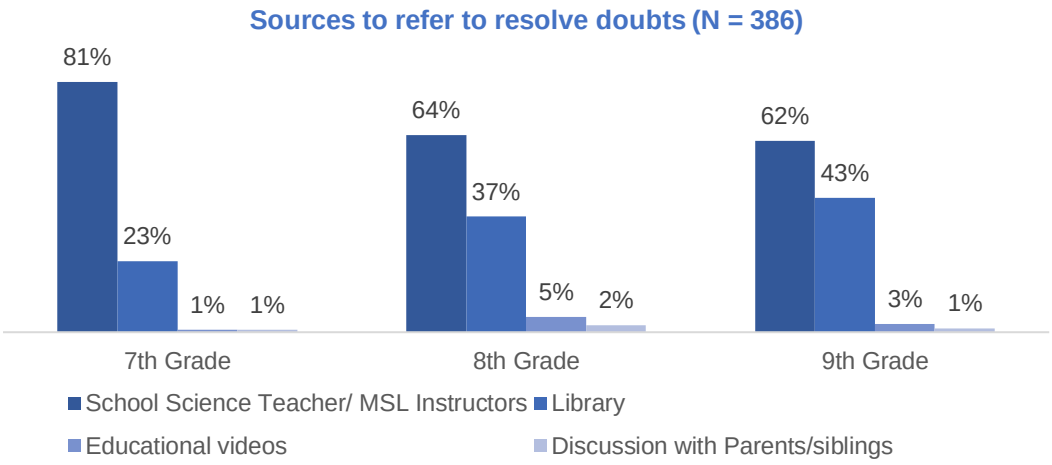
"When I got selected for CHAMPS, I was excited as I would be using the actual medical instrument. I was intrigued by the thought itself, and when I visited the village, it was an amazing lifetime experience. I felt a sense of responsibility towards my community."

Jayanth, Grade 10th Student

Figure 12: Students receiving certificate post the CHAMPS intervention

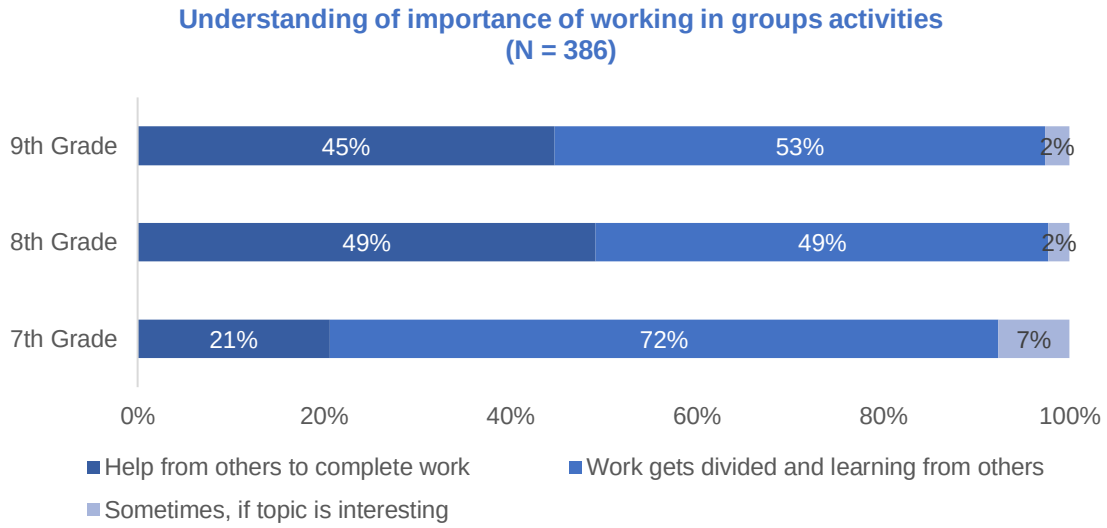


DIY experiments provide students with an opportunity to actively engage in hands-on exploration. It helps them to **observe reactions/phenomena** and **experience the outcomes**, which sparks curiosity and a **desire** to further **understand the underlying concepts**. 66% of 7th–grade, 65% of 8th–grade and 61% of 9th–grade students always conducted DIY experiments at home. Additionally, 7th–grade (31%), 8th–grade (25%) and 9th–grade (32%) stated that they sometimes conducted DIY experiments if the topic was interesting. This emphasised the fact that students were more **inclined towards science** when concepts were **presented in current context/surroundings** that **aligned** with their **interests and experiences**; they were more likely to engage and **establish connections** with the topic.



Based on the above graph, 81% of students of 7th grade, 64% of students of 8th grade and 62% of students of 9th grade recognise the significance of their school science teachers or MSL Instructors as valuable resources for addressing their queries. Further, 7th–grade (23%), 8th–grade (37%) and 9th–grade (43%) students visit the library to resolve their doubts. Libraries promoted **self-directed learning**, allowing them to independently **explore topics of interest** and **seek answers** to their questions. The **quest for learning** among the students highlighted their **proactive approach** to acquiring knowledge of science topics and seeking clarification from their teachers or MSL Instructors whenever required.

Cultivating Peer Learning: Role of MSL Sessions

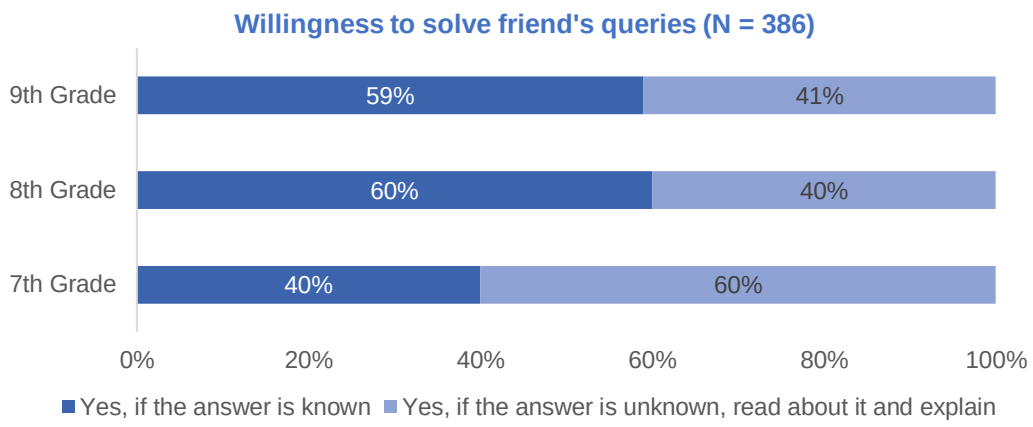


The MSL sessions inculcated **soft skills** like leadership, teamwork, communication, active listening, critical thinking and many more. As observed from the above graph, 7th–grade (93%), 8th–grade (98%) and 9th–grade (98%) students understood the **importance of working** in **group activities** and were able to identify the advantages of it. They learned to work together, share ideas, and actively listen to their peers. Further, they developed an ability to **express their thoughts**, **articulate their opinions**, and engage in meaningful discussions with their classmates, as well as with MSL Instructors.

Figure 13: Students making notes during the MSL sessions

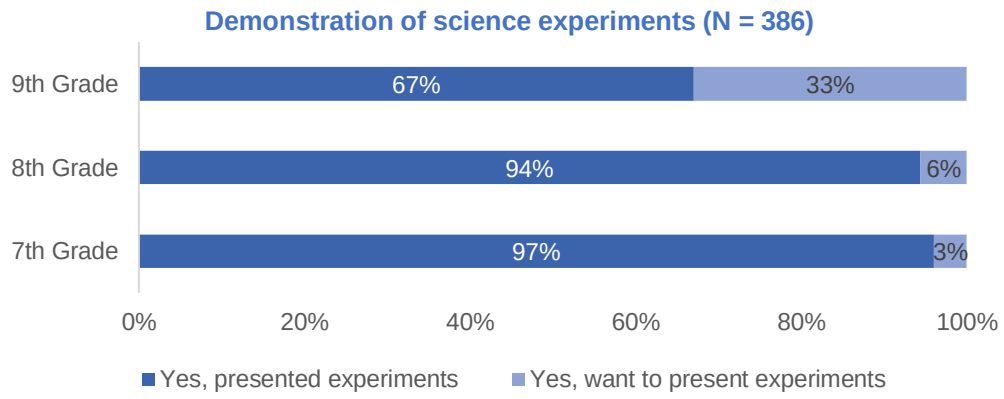
"Participating in MSL sessions allows me to work with my friends and engage in group work. I find it beneficial to learn from them during these sessions. For instance, when our instructor conducted the metals and non-metals session, we worked together as a group to experiment with various objects such as watches, chalk, bangles, anklets, and copper wires to complete the circuit. It was an exciting experience of exploration and learning as we collectively discovered and understood the concept."

Shilpa, Grade 8th Student



During the MSL sessions, it was observed that students were willing to resolve the queries raised by their peers. The same trend is depicted in the above graph, wherein 7th–grade (40%), 8th–grade (60%), and 9th–grade (59%) students expressed their willingness to resolve their classmate's query if the topic and answer were known to them. Additionally, 60% of 7th–grade, 40% of 8th–grade, and 41% of 9th–grade students were willing to put in extra effort by researching and explaining the answer to their friends' queries, even if they were unaware of the solution. This signified the **readiness** among the students to **support their peers** and demonstrated their efforts for **collaborative learning** through the MSL sessions.

It was worth noting that none of the students selected the option "No, I won't explain it to my friend" when responding to the questionnaire. Further, as the education level increases, the development of competitive spirits plays a pivotal role in shaping characteristics among students and enhancing their academic achievements. However, it was observed during the field visits that during the MSL sessions, students were conducting discussions to resolve doubts, thus, highlighting the **collaborative spirit prevailing over the competitive spirit** among students.



7th grade (97%), 8th grade (94%) and 9th grade (67%) students stated that they had demonstrated experiments during MSL sessions and science fairs. Further, the remaining students expressed their **willingness to present experiments** in the sessions. Students highlighted that the hands-on experiments helped them to **improve the retention** of knowledge and bolster **inquiry-based learning** among them.

Science Fair

Annually, 4 Science Fairs were organised by Agastya International Foundation, with the support of Schools and Biocon Foundation. The school possessing adequate facilities and

essential resources to accommodate and host the Science Fair was selected as the designated venue for organising this event. The 2–day event witnessed a crowd of at least 2000 students as the nearby schools, teachers, headmasters and Biocon Foundation were invited to the Fairs.

The students of 5th to 10th grade from the host schools were trained for 2–3 days to demonstrate various experiments to the visitors. These experiential demonstrations served as a revision for the students, as they had previously acquired knowledge about these experiments during the MSL sessions. The Instructors actively engaged in the Science Fair by hosting the following activities:

Meditation and Ayurveda Corner

- Significance of Ayurveda in Daily Living
- Relevance of Ayurvedic Plants in Health and Wellness
- Role and Benefits of Meditation in Daily Well-Being

Puzzle Corner

- Demonstration of scientific facts through puzzles and games

Pawada Corner

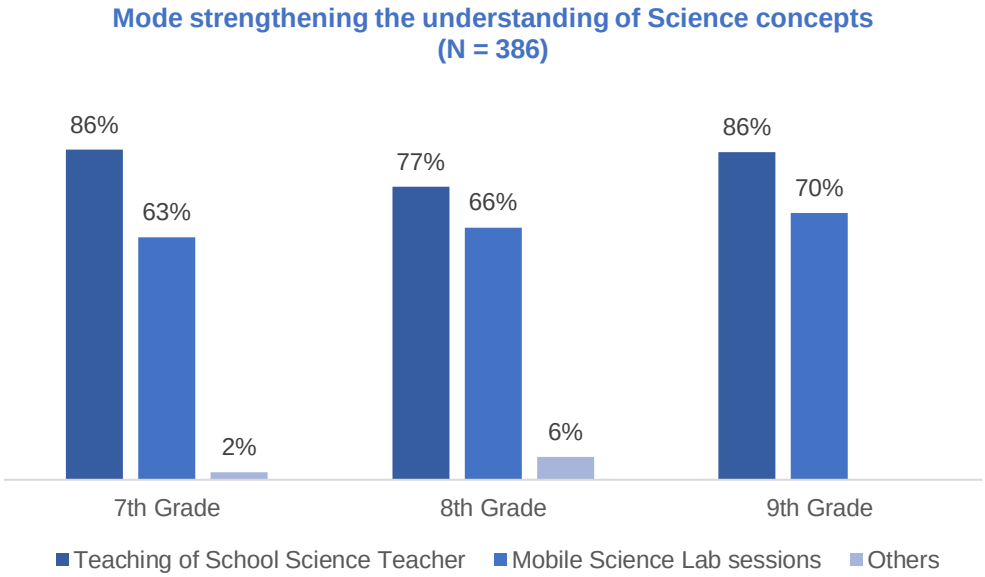
- Overcoming superstitious beliefs
- Recognizing the Importance of Scientific Understanding

Figure 14: Students demonstrating experiments during Science Fair

The Fairs provided a platform for students to explore and showcase their scientific curiosity and creativity. Further, demonstrating experiments to the visitors and peers helped the students to overcome their fear of public speaking. Science fairs provided a nurturing and supportive environment where students wherein students were encouraged to embrace risk-taking, learn from their mistakes, and celebrate their accomplishments.

"I attended the science fair and with science experiments, I learned new things like the importance of meditation and Ayurveda. The Instructors were explaining the concepts in a storytelling way, and I thoroughly enjoyed it."

Pallavi, Grade 8th Student



Based on the above graph, it can be noticed that **both** science classes and MSL sessions supported students in **strengthening** their **understanding of science concepts**. Regular science classes contribute to comprehensively covering diverse topics, including the topics of Physics, Chemistry and Biology. Further, MSL sessions provided them with an opportunity to have **hands-on experience**, thus, enabling them to **grasp scientific concepts** through practical experiments and **comprehend cause-and-effect relationships** effectively.

Additionally, during the FGDs, students mentioned that the mode of communication was Kannada; hence, schools lacked an English-speaking environment. This led the students to seek additional tuition for English language proficiency.

Operation Vasantha

The Operation Vasantha program was conducted across three centres:

Mantapa	Neraluru	Kachanayakanahalli

Considering the underprivileged socioeconomic backgrounds of the families, these daily classes served as essential remedial education for students. The teacher recruited by the Agastya International Foundation taught the students of 1st–7th grade after school hours, 4:30 – 7:00 PM. For effective and efficient learning, the students were made to form class-wise groups. The teacher taught the following subjects:

- English
- Kannada
- Mathematics

- Science
- Social Studies

On average, the strength at each centre was 25–26 students. Further, these centres acted as safety places for these students as the parents were daily wage labourers working in garment factories till 7 PM. These supportive classes proved to be constructive utilisation of students' time. Further, to make this intervention sustainable, the teachers were recruited from these communities, which fostered a sense of understanding and relevance for the learning experience of the students.

"Every day after school I come to this centre as my parents work in a nearby garment factory. I complete my homework here and also revise my lessons. After my parents are back at 7 PM, I return back to home. Due to these classes, I get some time to spend with my parents.

Yashaswini, Grade 7th Student

Statistical Analysis of Treatment and Control Schools

In this study, there were **two categories of students**: the **treatment group** (students attending MSL sessions) and the **control group** (students not attending MSL sessions). For each group, Learning Outcome Assessment was conducted, and percentage scores in **four subjects**, namely **Scientific Knowledge**, **Scientific Thinking**, **Scientific Attitude**, and **Proactiveness**, were calculated.

The primary objective of this analysis is to explore and assess whether there **exists a statistically significant difference** in the **patterns of percentage scores** across these **four subjects** between the **two groups**, i.e., the Treatment and Control groups. Through statistical examination, **MANOVA** (Multivariate Analysis of Variance), the aim is to identify potential variations in academic performance between the groups, highlighting the impact of the intervention on the students' scientific learning outcomes.

Further, if the MANOVA result indicates statistical significance, it will suggest that at least one subject exhibits a significant difference in the mean patterns of scores between the control and treatment groups. Following the MANOVA analysis, a subsequent **ANOVA** (Analysis of Variance) will be performed for each subject to further delve into any specific **subject-level differences between the groups**, providing a more nuanced understanding of the intervention's impact on the student's academic performance in these respective subjects.

Table 1: Statistical Analysis MANOVA Test

Multivariate Tests[a]							
Effect		Value	F	Hypothesis df	Error df	Sig.	Partial Eta Squared
Intercept	Pillai's Trace	.852	486.402[b]	4.000	339.000	.000	.852
	Wilks' Lambda	.148	486.402[b]	4.000	339.000	.000	.852
	Hotelling's Trace	5.739	486.402[b]	4.000	339.000	.000	.852

	Roy's Largest Root	5.739	486.402[b]	4.000	339.000	.000	.852
Type of Groups	Pillai's Trace	.041	3.634[b]	4.000	339.000	.006	.041
	Wilks' Lambda	.959	3.634[b]	4.000	339.000	.006	.041
	Hotelling's Trace	.043	3.634[b]	4.000	339.000	.006	.041
	Roy's Largest Root	.043	3.634[b]	4.000	339.000	.006	.041
a. Design: Intercept + Type							
b. Exact statistic							

Based on the results obtained from the table and statistical analysis, it can be observed that the calculated p-value is less than the significance level of 0.05. As a result, the Null hypothesis is rejected, indicating that there is a **significant difference** in the marks obtained in **at least one subject** between the **control and treatment groups**.

Having established the presence of at least one subject with a significant difference in marks between the treatment and control groups through MANOVA, a follow-up ANOVA test was conducted to further assess specific subject-level differences between the groups.

Table 2: Statistical Analysis ANOVA Test

Tests of Between-Subjects Effects

Source	Dependent Variable	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	Scientific Knowledge %	.094[a]	1	.094	3.039	.082
	Scientific Attitude%	.873[b]	1	.873	4.632	.032
	Scientific Thinking%	.012[c]	1	.012	.048	.827
	Proactiveness%	1.817[d]	1	1.817	6.958	.009
Intercept	Scientific Knowledge %	45.392	1	45.392	1460.731	.000
	Scientific Attitude%	21.495	1	21.495	114.047	.000
	Scientific Thinking%	117.842	1	117.842	485.312	.000
	Proactiveness %	48.375	1	48.375	185.249	.000
Type	Scientific Knowledge %	.094	1	.094	3.039	.082
	Scientific Attitude%	.873	1	.873	4.632	.032
	Scientific Thinking%	.012	1	.012	.048	.827
	Proactiveness %	1.817	1	1.817	6.958	.009
Error	Scientific Knowledge %	10.628	342	.031		
	Scientific Attitude%	64.459	342	.188		

	Scientific Thinking%	83.044	342	.243		
	Proactiveness%	89.308	342	.261		
Total	Scientific Knowledge %	56.115	344			
	Scientific Attitude%	86.827	344			
	Scientific Thinking%	200.898	344			
	Proactiveness%	139.500	344			

The analysis reveals a **significant difference** in the **average marks** scored on the subject of **Scientific Attitude and Proactiveness** between the treatment and control schools. The findings indicate that the intervention implemented in the treatment schools has had a notable impact on students' attitudes towards science and their proactiveness levels.

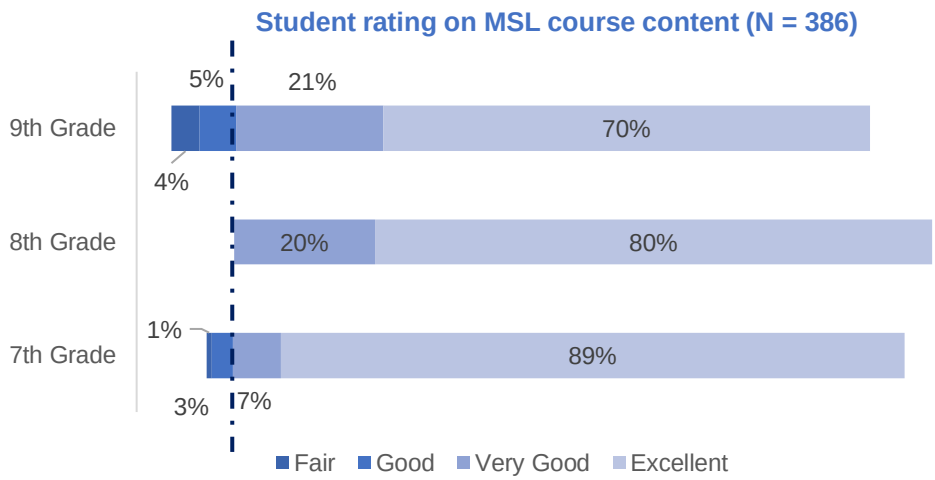
4.4 Convergence

The programme was solely funded by Biocon Foundation and was implemented by Agastya International Foundation.

Sr. No.	Name of the Partner	Type of Partnership	Responsibilities
1	Agastya International Foundation	Implementing Partner	• Conducting MSL sessions in schools • Mobilisation of community members • Conducting Science Fair, Vaakovaakyam: Quiz Competition, community visits, CHAMPS and Operation Vasantha • Pre and Post Outcome Measurement Analysis
2	Government of Karnataka	Supporting Role during project initiation	• Identifying Government Schools for implementing the project

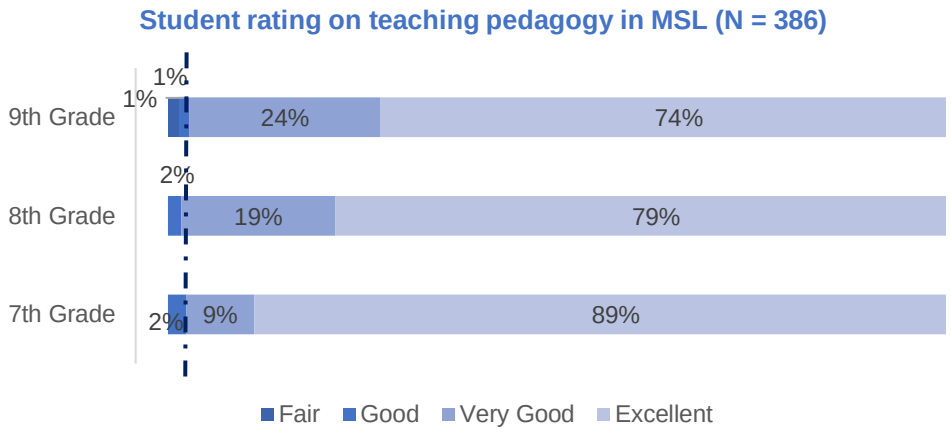
4.5 Service Delivery

This section defines the extent to which efficient methods and services were delivered as a part of the project intervention to achieve the results of outcomes and impacts.

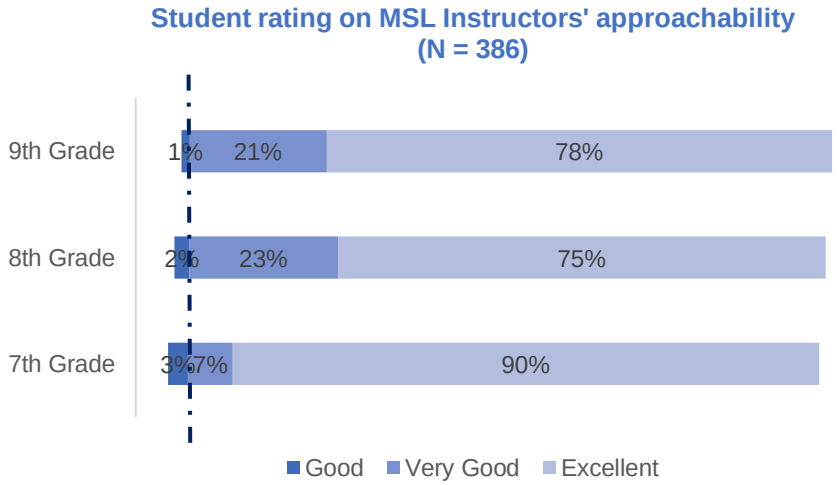


The course content was **thoughtfully curated** in alignment with the **requirement of the school's science teacher** and the **current syllabus**. Additionally, the MSL Instructors customised the experiments and topics to cater to the specific needs of the teacher, which supported them in delivering science classes efficiently. As observed from the presented graph, a significant majority of students, 7th grade (96%), 8th grade (100%), and 9th grade (91%), rated the course content as 'Outstanding'.

Figure 15: Students participating in the community visit



During the Focus Group Discussions (FGDs) with the students, it was highlighted that the MSL Instructors utilise an **impactful storytelling approach** to explain complex scientific concepts. This approach results in an **enhancement in the comprehension** and grasp of the subject matter among the students. The graph illustrates that a significant proportion of students in 7th grade (98%), 8th grade (98%), and 9th grade (98%) assigned an 'Outstanding' rating to the teaching pedagogy employed by the MSL Instructors.



As observed from the above graph, 7th grade (97%), 8th grade (98%), and 9th grade (99%) rated the Instructor 'Outstanding', highlighting a **high level of satisfaction**. The Instructor's approachability and responsiveness to students' questions and concerns played a crucial role in nurturing a positive learning experience. The effective use of innovative pedagogical techniques, including storytelling and practical demonstrations by the Instructors, was appreciated by the students.

"I find Satish sir's explanations to be exceptionally clear, and I can easily grasp the concepts he teaches. He patiently addresses all my doubts, enabling me to develop a deeper understanding of the subject. His classes are enjoyable, and we all greatly appreciate his teaching style."

Tarun, Grade 7th Student

Learning Outcomes Assessment Findings

Biocon Foundation
EMPOWERING COMMUNITIES

5.1 Overall Learning Outcomes Assessment

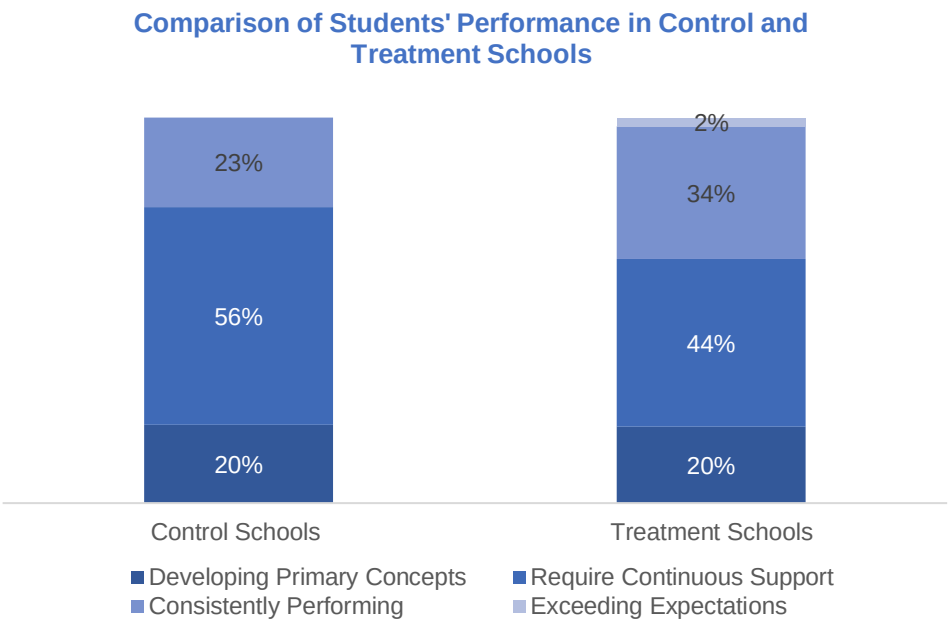
The Learning Outcome Assessment was conducted in 8 Treatment and 5 Control Schools to assess and compare the following aspects to gain insights into the relative effectiveness of the Experiential Science Learning programme in improving learning outcomes:

- Scientific Knowledge
- Scientific Thinking
- Scientific Attitude
- Proactiveness
- Confidence
- Curiosity

The table below explains the Evaluation Criteria utilised for Learning Outcome Assessment:

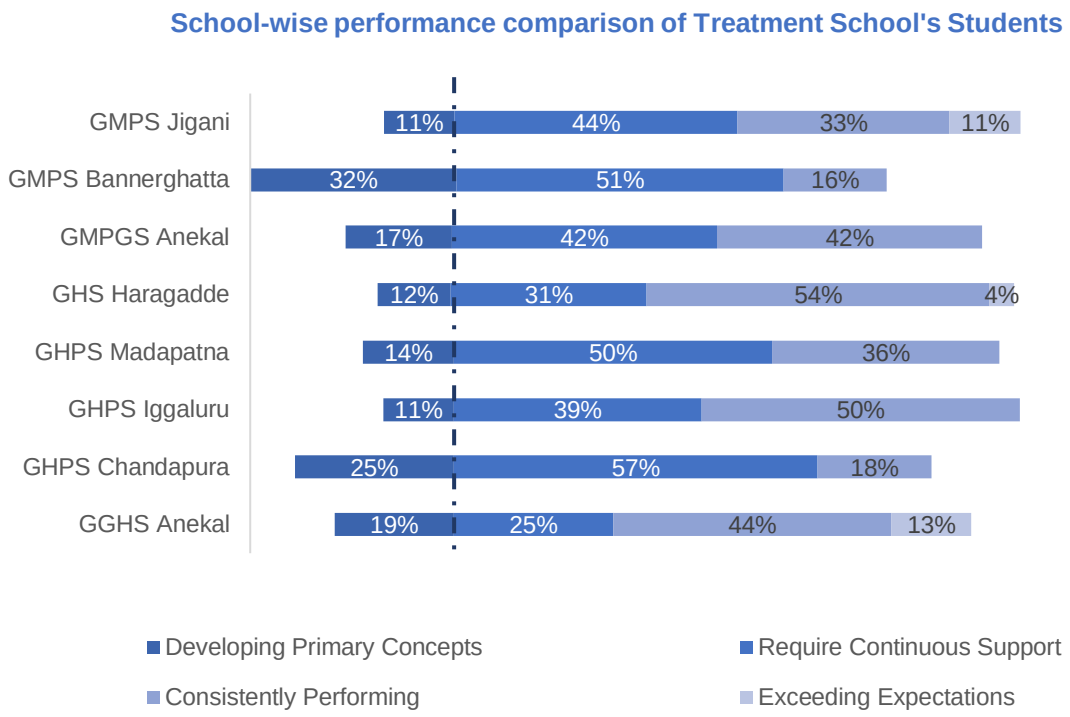
Category of Students	Percentage Criteria
Developing Primary Concepts	Below 25%
Require Continuous Support	25–50%
Consistently Performing	50–75 %
Exceeding Expectations	Above 75%

Key Findings

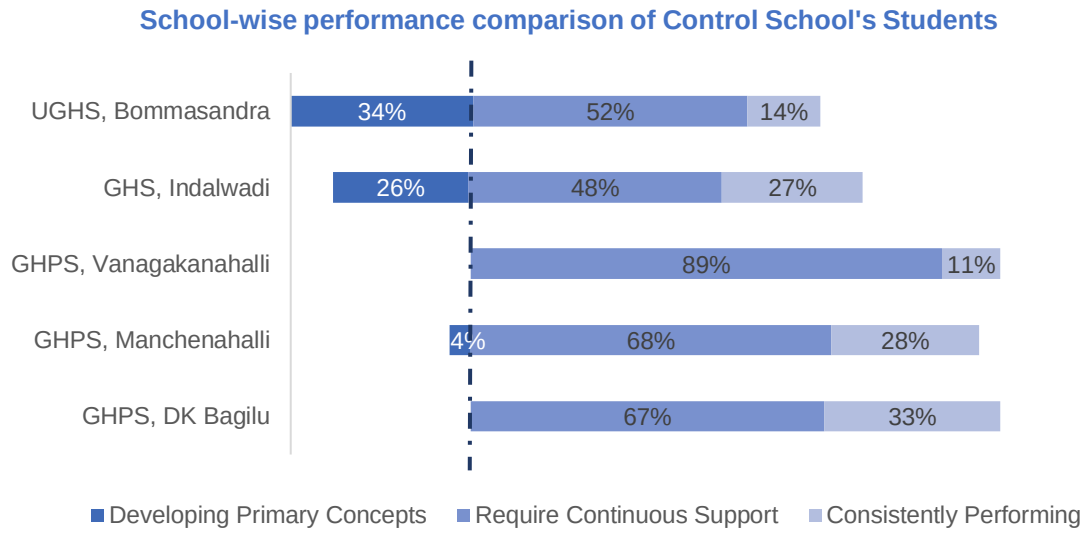


The graph illustrates that 34% of students from Treatment schools were classified under the Consistently Performing category, whereas only 23% of students from Control schools fell into the same category. Additionally, 56% of students from Control schools were in the Require Continuous Support category, while 44% of students in Treatment schools belonged to this category.

Further, 2% of students in Treatment Schools are in the Exceeding Expectations category. This highlights the potential of **continuous handholding and guidance** in **shifting students** from the Require Continuous Support category to the Consistently Performing category and to the Exceeding Expectations category in Treatment schools.

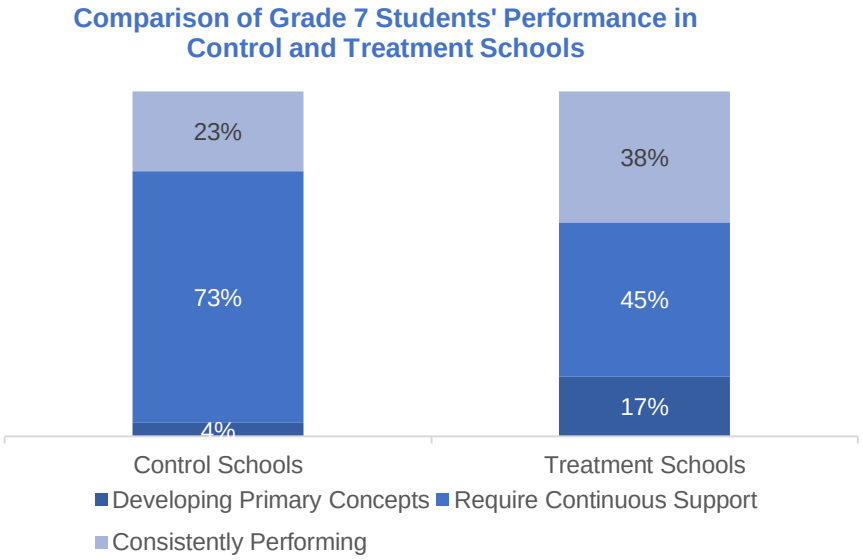


In the Exceeding Expectations category, 13% of students from GGHS Anekal, 11% from GMPS Jigani, and 4% from GMPS Haragadde showcased exceptional performance. On the other hand, 50% of students from GHPS Iggaluru and 42% from GMPGS Anekal demonstrated consistent proficiency in the Consistently Performing category. Conversely, 32% of students from GMPS Bannerghatta and 25% from GHPS Anekal were placed in the Developing Primary Concepts category, indicating a need for further support and improvement in their understanding.

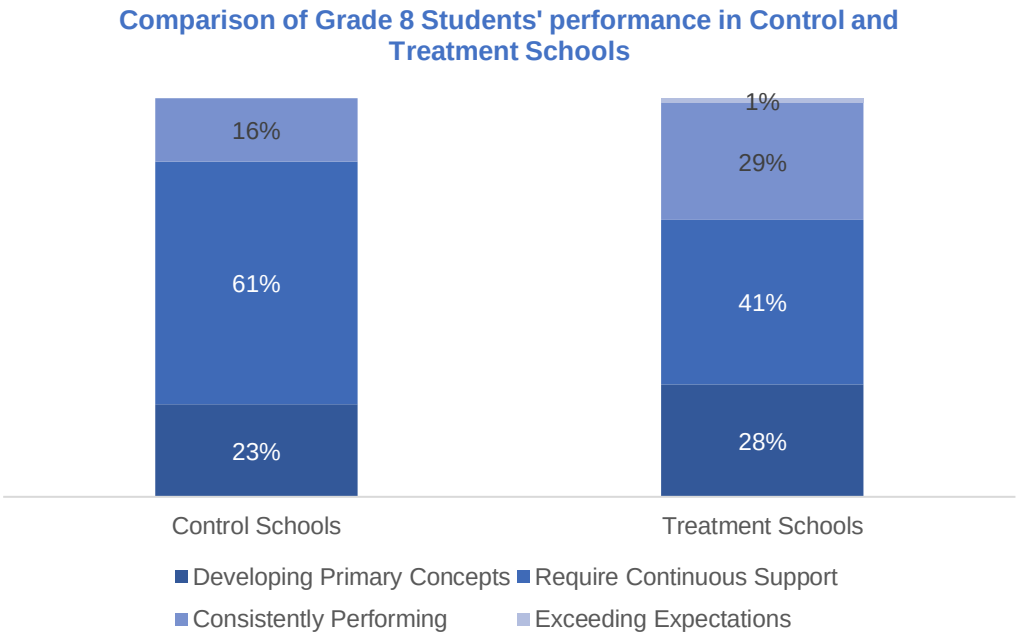


The Consistently Performing category included 33% of students from GHPS, DK Bagilu, and 28% from GHPS Manchenahalli. Conversely, 34% of students from UGHS Bommasandra and 26% from another school belonged to the Developing Primary Concepts category, indicating the need for additional support in their learning. To enhance the performance of the Control

Schools, the Experiential Science Learning Programme can be extended to these schools, offering them the opportunity to benefit from the programme's positive impact on student's academic growth.

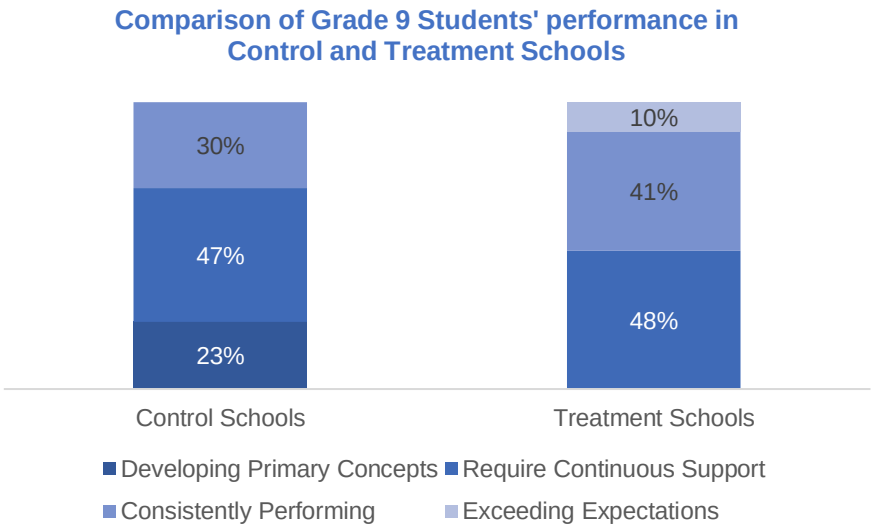


Based on the data depicted in the graph, it can be observed that 38% of 7th-grade students from Treatment schools were categorised as Consistently Performing. In contrast, only 23% of 7th-grade students from Control schools fell into the same category. Additionally, 45% of 7th-grade students in Treatment schools were classified as Requiring Continuous Support, whereas a higher percentage of 73% of 7th-grade students in Control schools were placed in the same category.

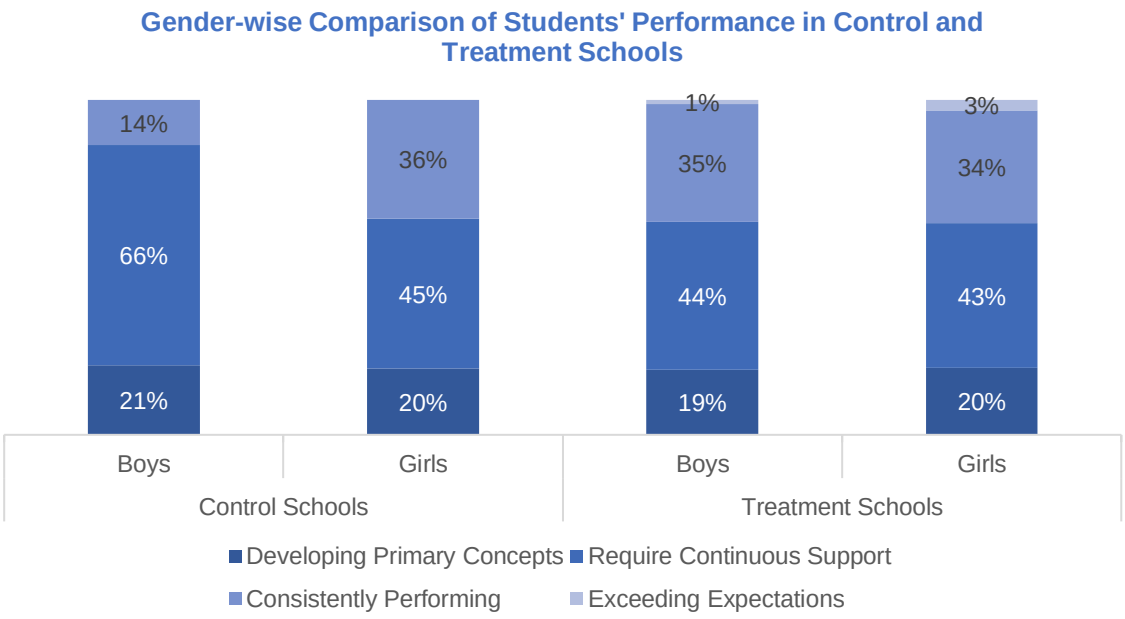


The data analysis found that only 1% of 8th-grade students from Treatment schools were classified under the Exceeding Expectation category. In comparison, 29% of 8th-grade students from Treatment schools were categorised as Consistently Performing, which is higher than the 16% of 8th-grade students from Control schools falling into the same category. Moreover, 41% of 8th-grade students from Treatment schools were placed in the Require

Continuous Support category, whereas a higher percentage of 61% of 8th-grade students from Control schools were categorised similarly. These results indicate **notable differences** in students' performance levels between the **Treatment and Control schools**, potentially influenced by the Experiential Science Learning Programme implemented in the Treatment schools.



The data analysis revealed that 10% of 9th-grade students from Treatment schools were classified under the Exceeding Expectation category, showcasing the remarkable impact of the 3-year continuous exposure to MSL sessions on their learning journey. This highlights the **significant contribution of MSL sessions** in supporting the student's **academic progress,** leading them to achieve improved outcomes. Furthermore, 41% of 9th-grade students from Treatment schools were categorised as Consistently Performing, a percentage higher than the 30% of 9th-grade students in Control Schools falling into the same category.



In the context of Treatment schools, the analysis revealed that 3% of female and 1% of male students were classified under the Exceeding Expectation category. Additionally, 35% of male students and 34% of female students from Treatment schools were categorised as

Consistently Performing, a percentage higher than the Control schools, where 14% of male and 36% of female students fell into the same category. This observation highlights the contribution of the Experiential Science Learning Programme in Treatment schools, promoting consistent performance levels among both male and female students and enriching their learning outcomes.

Table 3: Parameter–wise Average Percentage Marks of Students in Treatment and Control Schools

Parameters	Control Schools	Treatment Schools
Scientific Knowledge	35%	38%
Scientific Thinking	59%	58%
Scientific Attitude	20%	30%
Proactiveness	30%	45%
Total Marks	37%	40%

The table presents the parameter-wise average percentage marks achieved by students from both Treatment and Control schools. It can be observed; Treatment Schools comparatively scored better than Control Schools. This suggests the **potential need** for initiatives to **enhance** the **scientific mindset and approach** towards learning in **Control schools**.

Table 4: Grade–wise Average Percentage Marks of Students

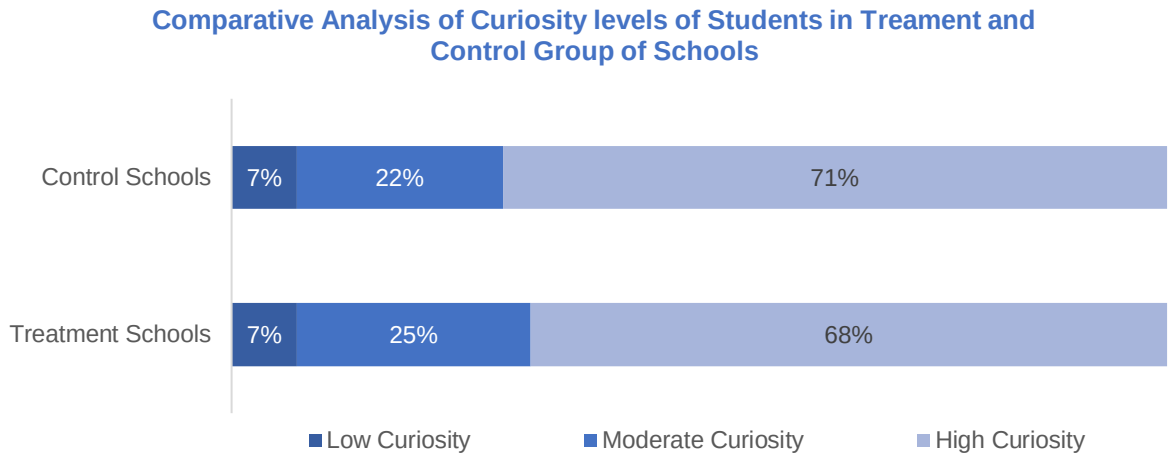
Grade	Control Schools	Treatment Schools
Grade 7	38%	40%
Grade 8	33%	36%
Grade 9	40%	54%

The table provides a comprehensive overview of the grade-wise average percentage marks attained by students in both Treatment and Control Schools. Notably, the data indicates that students in 9th grade, benefiting from ongoing exposure to MSL sessions, exhibited improved academic performance compared to other grades. With sustained support and guidance, these students have the potential to transition from the Consistently Performing category to the Exceeding Expectations category.

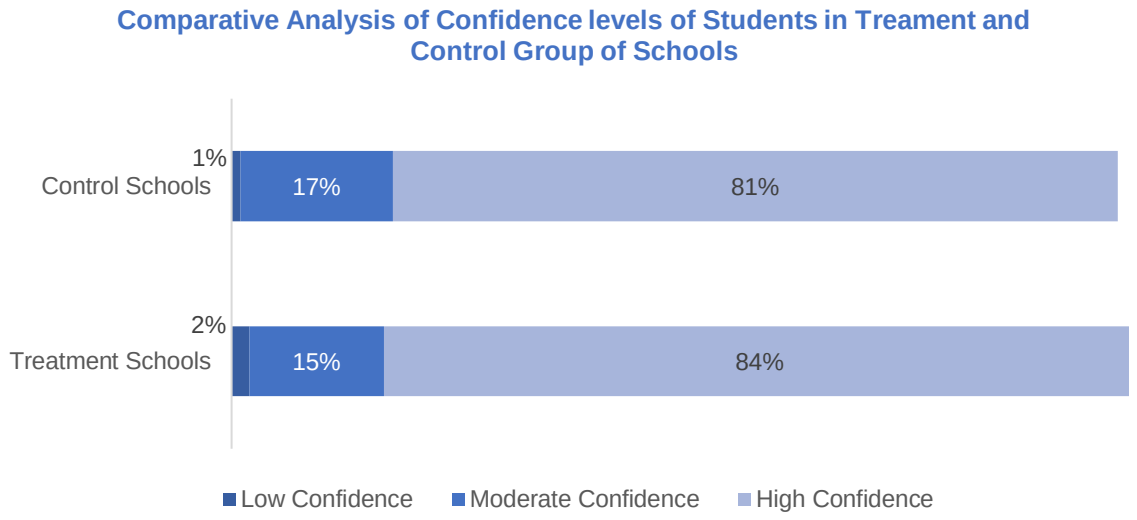
Table 5: Gender-wise Average Percentage Marks in Control and Treatment Schools

Gender	Control Schools	Treatment Schools
Female	39%	40%
Male	35%	40%

The findings presented in the table are disaggregated by gender. Based on the table, it is evident that both male and female students from Treatment schools demonstrated relatively higher academic performance compared to their counterparts in Control Schools. However, despite the higher scores, students of both genders in Treatment schools still fell within the "Require Continuous Support" category. These results indicate the ongoing potential for further improvement and the **importance of providing continuous assistance** and support to enhance their learning outcomes **through the Experiential Science Learning Programme**.



The data presented in the graph indicates that a significant proportion of students from both Control schools (71%) and Treatment schools (68%) exhibited a **high level of curiosity**. The students' keen interest and inquisitiveness reflect a **positive attitude** towards **learning** and a genuine **desire to explore** and understand various scientific concepts.



The data presented in the graph highlights the students' confidence levels. Notably, 84% of students from Treatment schools and 81% from Control schools belong to the **High Confidence** category. This indicates that most students in both groups possess a strong **sense of confidence in their abilities**, particularly in the context of **learning science**.

5.2 Learning Outcomes Findings in Treatment Schools

This section presents the key findings of the Treatment schools. It is an overview of the observations and results pertaining to each school within the Treatment group, providing valuable insights into the impact of the MSL sessions on the learning experiences and performance.

Table 6: School–wise Average Percentage Marks

Name of the School	Average Percentage
GGHS Anekal	48%
GHPS Chandapura	35%
GHPS Iggaluru	41%
GHPS Madapatna	44%
GHS Haragadde	49%
GMPGS Anekal	41%
GMPS Bannerghatta	32%
GMPS Jigani	43%

The table presented the school-wise average percentage scores achieved by the students. It was evident that a majority of the schools fell under the category of Require Continuous Support. However, exceptions were GHS Haragadde and GGHS Anekal, which attained average percentages closer to the category of Consistently Performing.

Table 7: Grade–wise Average Percentage Marks in each Treatment School

Name of the School	7th Grade	8th Grade	9th Grade
GGHS Anekal	-	32%	58%
GHPS Chandapura	-	29%	46%
GHPS Iggaluru	41%	-	-
GHPS Madapatna	44%	-	-
GHS Haragadde	-	44%	58%
GMPGS Anekal	38%	43%	-
GMPS Bannerghatta	36%	28%	-
GMPS Jigani	-	43%	-

The table provided presents the grade-wise average percentage scores achieved by the students of each Treatment school. It is evident that 9th-grade students of GGHS Anekal and GHS Haragadde belonged to the Consistently Performing category. This observation suggests that the continuous support through **MSL sessions** has contributed to a **better understanding of scientific concepts** among the 9th-grade students.

Table 8: Gender–wise Average Percentage Marks for each Treatment school

Name of the School	Female	Male
GGHS Anekal	48%	-
GHPS Chandapura	29%	45%
GHPS Iggaluru	43%	38%
GHPS Madapatna	42%	46%
GHS Haragadde	52%	46%
GMPGS Anekal	36%	47%
GMPS Bannerghatta	31%	32%
GMPS Jigani	58%	32%

The presented table provides insights into the gender-wise average percentage of marks obtained by the students. Further, the girls of GMPS Jigani and GHS Haragadde scored 58% and 52%, respectively, placing them in the Consistently Performing category. These findings suggest that female students in these schools have consistently performed academically.

Table 9: Subject–wise Average Percentage Marks for each school

Name of the School	Scientific Knowledge	Scientific Attitude	Scientific Thinking	Proactiveness
GGHS Anekal	**51%**	38%	**63%**	31%
GHPS Chandapura	31%	19%	46%	**73%**
GHPS Iggaluru	43%	11%	48%	**61%**
GHPS Madapatna	46%	36%	**64%**	14%
GHS Haragadde	39%	**62%**	**81%**	46%
GMPGS Anekal	45%	17%	**63%**	23%
GMPS Bannerghatta	28%	25%	41%	**50%**
GMPS Jigani	34%	44%	**89%**	28%

The provided table presents the subject-wise average percentage marks achieved by each Treatment school. 5 out of 8 schools performed exceptionally well in the Scientific Thinking parameter. Two schools belonged to the Exceeding Expectations category, while three were in the Consistently Performing category. This achievement demonstrates **significant progress** in the **development of Scientific Thinking**, aligning with one of the critical objectives of the Experiential Science Learning Programme.

5.3 Learning Outcomes Findings in Control Schools

This section presents the key findings of the Control schools, analysed on various parameters. The Control schools have been assessed for their performance in different parameters, grade-wise average percentage marks, and gender-wise performance, among other factors. These findings contribute valuable information to evaluating the educational landscape and propose a basis for further analysis and improvement strategies.

Table 10: School–wise Average Percentage

Name of the School	Average Percentage
GHPS, DK Bagilu	43%
GHPS, Manchenahalli	40%
GHPS, Vanagakanahalli	35%
GHS, Indalwadi	37%
UGHS, Bommasandra	33%

The provided table displays the school-wise average percentage scores achieved by the students in the Control schools. Moreover, all the schools were categorised as Require Continuous Support. UGHS Bommasandra and GHPS Vanagakanahalli obtained the lowest percentage scores, with 33% and 35% respectively. These findings highlight the areas where **additional support and improvement** measures are necessary to enhance the academic performance of the Control schools.

Table 11: Grade–wise Average Percentage Marks in each Control School

Name of the School	7th grade	8th grade	9th grade
GHPS, DK Bagilu	43%	-	-
GHPS, Manchenahalli	42%	39%	-
GHPS, Vanagakanahalli	30%	39%	-
GHS, Indalwadi	-	29%	44%
UGHS, Bommasandra	-	-	33%

The provided table presents the grade-wise average percentage scores students in each Control school achieved. The students of Treatment schools obtained higher scores compared to those of Control schools. These results indicate a significant difference in academic performance between the two groups.

Table 12: Gender–wise Average Percentage Marks for each school

Name of the School	Female	Male
GHPS, DK Bagilu	38%	47%
GHPS, Manchenahalli	39%	41%
GHPS, Vanagakanahalli	36%	35%
GHS, Indalwadi	41%	34%
UGHS, Bommasandra	36%	29%

The table above illustrates the gender-wise average percentage of marks attained by the students in each Control school. Notably, among all the Control schools, the boys of GHPS DK Bagilu achieved the highest percentage, with a score of 47%.

Table 13: Subject–wise Average Percentage Marks for each school

Name of the School	Scientific Knowledge	Scientific Attitude	Scientific Thinking	Proactiveness
GHPS, DK Bagilu	35%	17%	**83%**	**67%**
GHPS, Manchenahalli	32%	48%	**84%**	12%
GHPS, Vanagakanahalli	27%	28%	**83%**	22%
GHS, Indalwadi	37%	14%	49%	36%
UGHS, Bommasandra	34%	12%	**52%**	24%

The table presents the subject-wise average percentage marks obtained by students in each Control school. Upon observation, it becomes evident that the average percentages scored by students in **Scientific Knowledge** and **Scientific Attitude** were **comparatively lower** compared to the Treatment schools. This highlights the necessity of expanding the Experiential Science Learning Programme to Control schools, aiming to improve scientific knowledge and cultivate a scientific attitude among students.

Figure 16: Students attempting Learning Outcome Assessment in GHPS Chandapura

Education During COVID-19 Pandemic

Biocon Foundation
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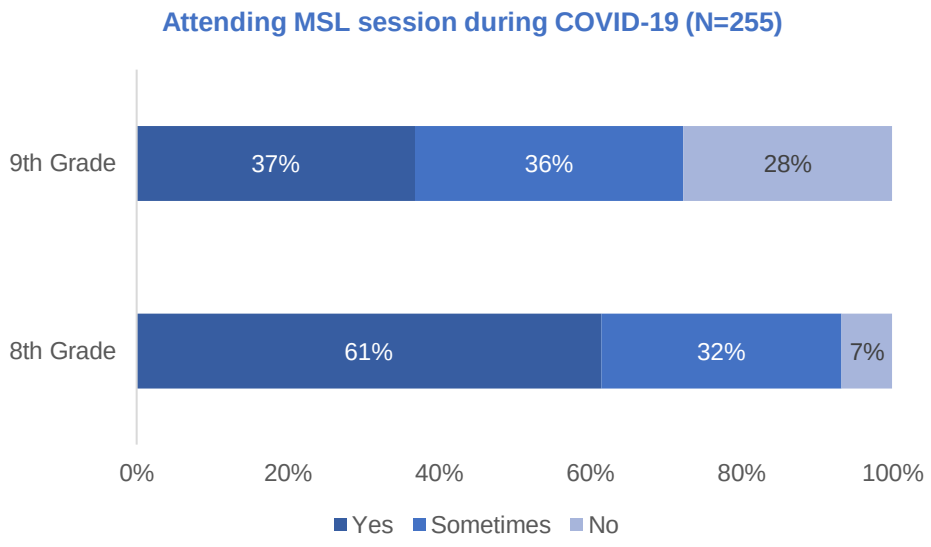
The global COVID-19 pandemic has had far-reaching consequences, impacting countries worldwide. As a result, educational institutes were forced to close, and social distancing measures were implemented. In response to these challenges, a paradigm shift was observed in delivering quality education – through various online platforms. Online learning, distance education, and continuing education became vital solutions during this unprecedented global crisis.

However, transitioning from traditional face-to-face learning to online education presented unique challenges for both learners and educators. With limited alternatives available, they were forced to adapt to this new mode of learning. The education system was compelled to adopt "**Education in Emergency**" through various online platforms, even though they weren't fully prepared for such a shift.

In response to the challenges posed by the COVID-19 pandemic, the Agastya International Foundation Team, in collaboration with the Biocon Foundation, took proactive measures. They provided **Home Lab kits** containing materials for approximately 50 experiments to the MSL Instructors. During the initial phase of the lockdown, the MSL Instructors initiated outreach efforts by contacting school Head Masters and subsequently reaching out to the students. Moreover, school-wise WhatsApp groups were created to facilitate the sharing of homework, worksheets, and other educational resources. These initiatives aimed to ensure continuity in learning and engagement despite the limitations imposed by the pandemic.

The COVID-19 pandemic extended over a duration of approximately two years. Hence, the survey questionnaires included students in the 8th and 9th grades who had previously been in the 6th and 7th grades, respectively and had participated in the online MSL sessions.



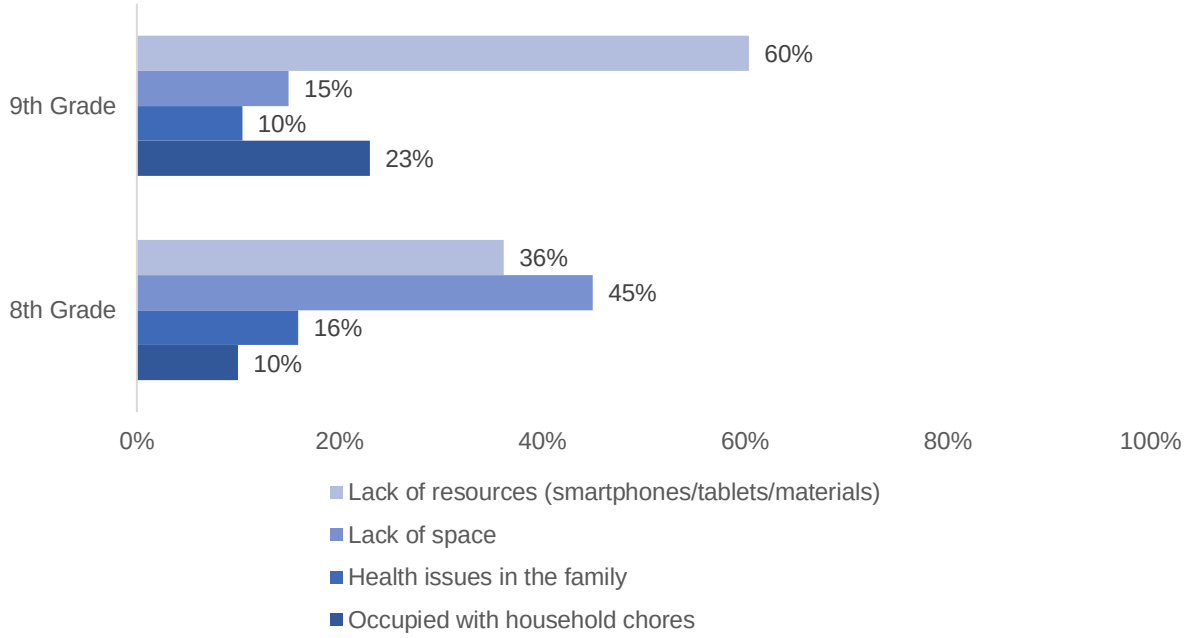
Based on the data presented in the above graph, it can be observed that a substantial number of 8th-grade students (61%) and 9th-grade students (37%) consistently attended the online MSL sessions. Additionally, 32% of 8th-grade students and 36% of 9th-grade students occasionally participated in these sessions. The COVID-19 pandemic brought about significant educational disruptions, leading to the adoption of **alternative learning approaches**.

In response to the challenges posed by the pandemic, the Karnataka Government introduced the **Karnataka Vidyagama scheme**, aimed at providing education to students who lacked access to mobile phones for online learning. Under this scheme, **offline classes** were

conducted on **school premises or community areas**, with students grouped in small clusters of 15 to 20 members. Consequently, **online classes could not be conducted by schools** during this period, and students who had migrated to their native places were unable to attend these offline classes.

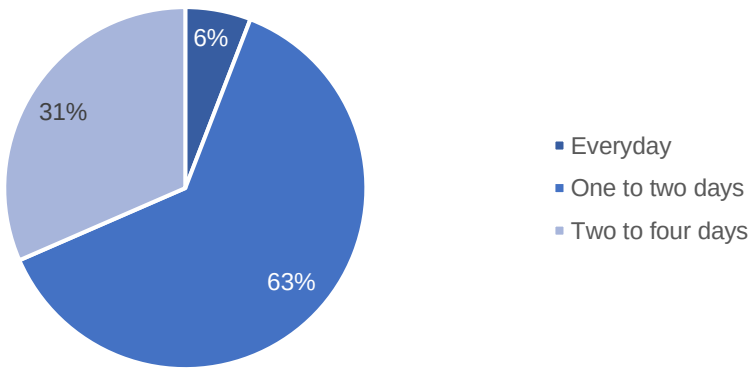
Amidst these circumstances, the **MSL online sessions** emerged as a **vital alternative** to bridge the education gap and further **complemented** the efforts of the Karnataka **Vidyagama scheme** and enabled continuous learning opportunities for the students.

Challenges in attending online MSL sessions (N=255)



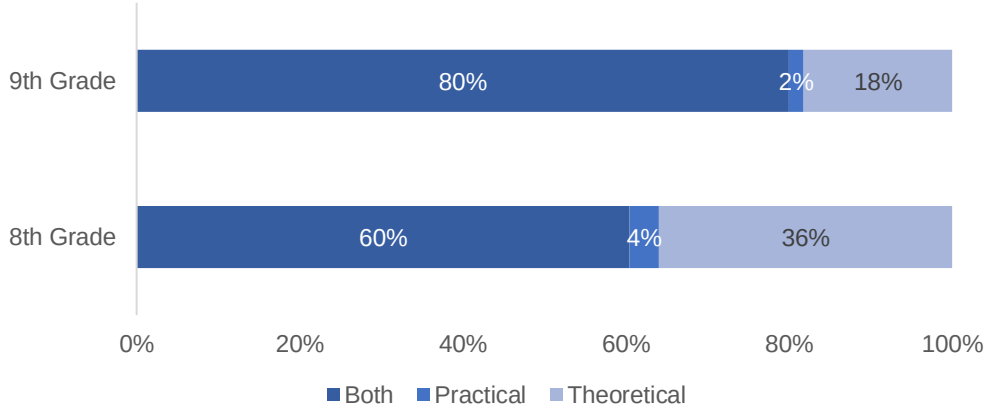
As observed from the above graph, in 9th grade (60%), the primary hindrance to attending the online MSL sessions was the **lack of resources**, particularly the **absence of mobile phones**. On the other hand, in 8th grade (45%), a significant challenge was the lack of adequate space, likely due to the presence of **siblings sharing limited resources**. Despite these obstacles, it is noteworthy that **students** were able to **attend the sessions sometimes**, ensuring that their education continued amidst the COVID-19 pandemic.

Frequency of attending MSL sessions (N=222)



During the IDI with the MSL Instructor, the online classes were conducted on a daily basis, covering a group of 3–4 schools. The students participated in three batches, with each batch consisting of 1-hour sessions. Since it was the initial phase of the MSL programme and the experiments were different to the students, combined classes were conducted to facilitate the learning process. According to the data presented in the graph, 63% of students reported attending the sessions 1–2 days per week. The MSL Instructors made efforts to **articulate the experiments using simple language** to ensure comprehension among students of different grades attending the sessions.

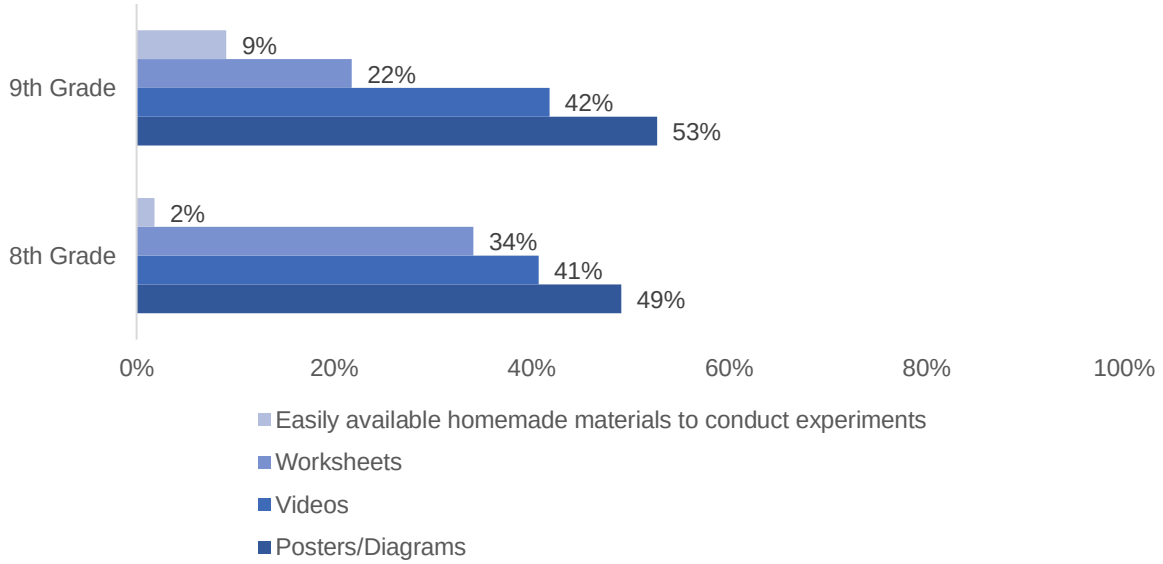
Type of MSL sessions conducted during COVID-19 (N=222)



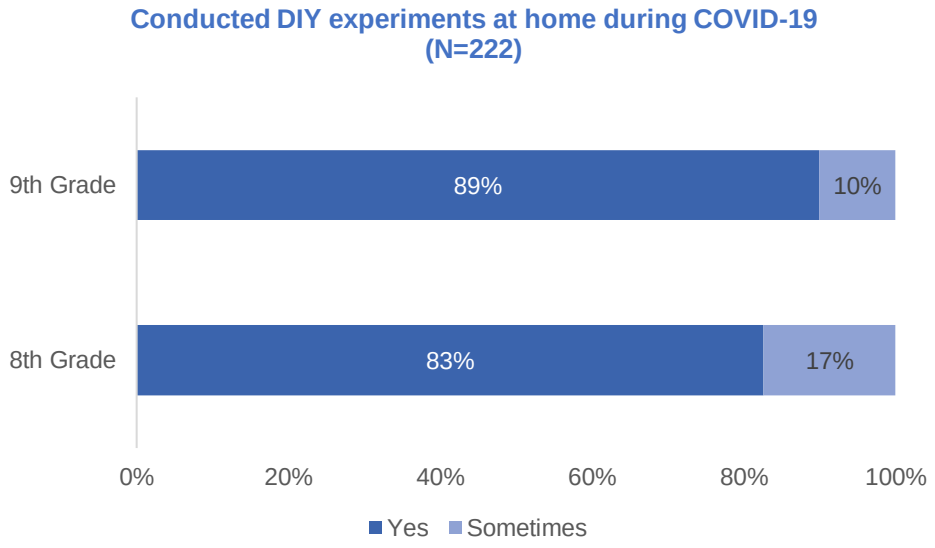
80% of 9th-grade students and 60% of 8th-grade students reported that during the pandemic, both practical and theoretical sessions were conducted. These findings highlight the adaptability and resilience of MSL Instructors and the Agastya International Foundation in navigating the challenges posed by the COVID-19 pandemic.

During the interactive sessions, the students revealed that in the **initial phase** of online learning, **Google Classroom** was utilised as a platform to share homework assignments, pictures, and worksheets. Subsequently, the **sessions transitioned** to being conducted on **Google Meet**. Despite the limitations and constraints, the students had **access to a balanced blend of hands-on practical sessions and theoretical learning experiences**.

Resources used by MSL Instructors during online classes (N=222)

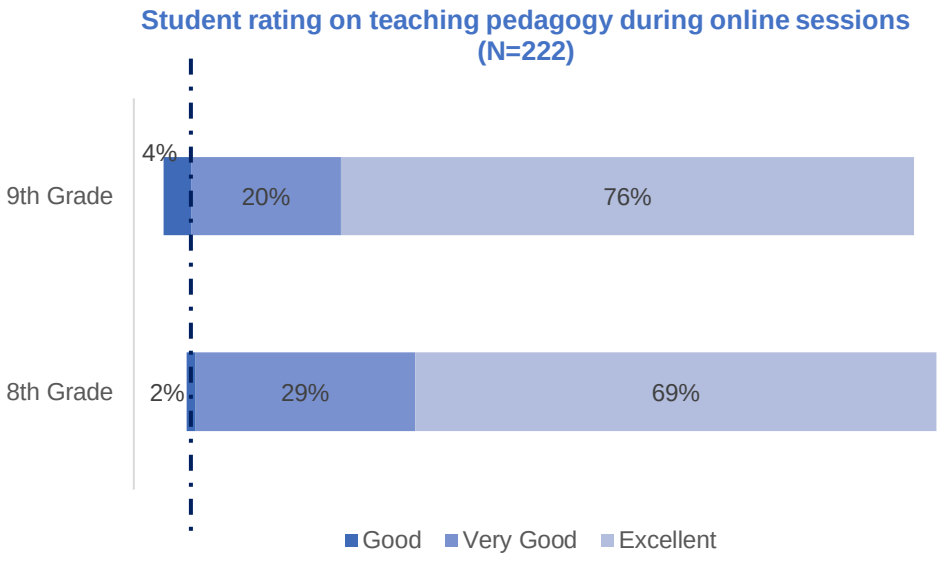


Based on the above graph, 8th-grade (53%) and 9th-grade (49%) students highlighted the substantial role of posters and charts in facilitating the online sessions. Further, the **students actively participated in creating and preparing** various educational materials such as **charts and posters** related to topics like the respiratory system, digestive system, light, electricity, and the human eye and colourful world. This **participatory approach** enriched their learning experience and contributed to a deeper understanding of the subject matter during the online sessions.



During the COVID-19 pandemic, a significant proportion of 8th-grade students (83%) and 9th-grade students (89%) reported engaging in DIY experiments at home. For instance, to grasp the concepts of physical and chemical changes, they were tasked with crushing paper and subsequently burning it to ashes. These hands-on experiments facilitated a deeper comprehension of scientific concepts.

Additionally, the **students actively involved their parents and siblings** in the demonstration of experiments at home. The pandemic-induced shift to DIY experiments at home facilitated **continued learning during challenging times**, strengthened family bonds, and **instilled a love for science in students**.



The graph illustrates that a significant proportion of students in 8th grade (98%) and 9th grade (96%) assigned an **'Outstanding' rating** to the teaching pedagogy employed by the MSL Instructors during online sessions.

Figure 17: Students attending online MSL sessions during COVID-19

Success Stories

Biocon Foundation
EMPOWERING COMMUNITIES

Jayanth, a 9th-grade Government High School Haragadde student, has benefited from Agastya International Foundation's Mobile Science Lab (MSL) sessions. Having attended the MSL sessions in the previous year, he expresses his profound appreciation for the classes. His interest in science was already evident, but the MSL sessions further fueled his curiosity and passion for the subject.

The highlight of Jayanth's experience with the programme was his participation in the "CHAMPS Program." As one of the selected students from his school, he underwent specialised training that included learning how to use BP machines and understanding the chemicals involved. The program also covered crucial aspects to consider during BP testing and provided guidelines for offering suggestions to villagers with higher-than-normal blood pressure readings. Jayanth finds the entire process intriguing and enriching, citing the program as an amazing learning opportunity.

As part of the CHAMPS Program, he and his fellow friends had the unique opportunity to visit villages such as Haragadde, Madapatna, and Kumbarnahalli. After school hours, they travelled in vans to these locations to mobilise villagers and conduct blood pressure tests. The students took on the responsibility of explaining the health hazards associated with high blood pressure and educating villagers on self-care practices.

Jayanth acknowledges that "MSL sessions and the CHAMPS Program have not only deepened his knowledge but also nurtured his self-assurance and communication skills."

Sinchana is a 9th-grade student currently enrolled at Government Girls High School Anekal. Her father is a doctor, and her mother is a yoga teacher. The family resides within close proximity to the school, making the commute convenient for Sinchana. Notably, she transitioned from a private school to the current government school during her 8th-grade year. Sinchana's experience at Government Girls High School Anekal has been delightful. The school has provided her with a plethora of opportunities, including participation in science camps and sports events. Despite the shift to a government school, Sinchana emphasises that the quality of education remains consistent between her previous private school and her current institution. However, she observes that English is not widely used in government schools, leading her to attend tuition classes to enhance her English language skills.

Sinchana participated actively in MSL sessions, attending five classes of 1-2 hours each since July 2022. The MSL classes proved to be highly engaging and interesting for the students. During the MSL classes, Sinchana and her peers were introduced to a wide range of topics, including photosynthesis, magnets, and electricity. One experiment that left a lasting impression on her was observing the behaviour of two candles, one open and the other covered with transparent glass.

She says, "The supportive and interactive learning environment created by the MSL instructors has instilled confidence in me and my friends, motivating us to actively participate in the learning process."

The MSL instructors explained that the candle inside the glass stopped burning due to the lack of oxygen, whereas the open candle continued to burn. Sinchana and her classmates learned that oxygen is essential for combustion, and carbon dioxide alone cannot sustain the burning process. She praises the MSL instructors for their teaching methods. They made the classes interactive and ensured that students' doubts were promptly addressed.

Samarth, an 8th-grade student at GHPS, has been actively participating in Agastya Foundation's Mobile Science Lab (MSL) sessions for the past two years. Initially, Samarth was not particularly interested in science, finding it challenging to grasp concepts. However, his perspective changed when the Agastya MSL instructor introduced captivating experiments during the sessions. The engaging hands-on learning approach piqued his curiosity, making the classes more enjoyable and conducive to learning.

The MSL sessions enriched Samarth's knowledge and boosted his confidence in answering quiz questions and actively participating in experiments in the classroom. He even took the initiative to present an experiment on Light's positive and negative connectivity, utilising batteries, demonstrating his growing understanding and confidence in science concepts. His newfound enthusiasm for science extended beyond the classroom as he eagerly shared his learning experiences with his family at home.

One notable instance of Samarth's application of knowledge was during the field visit. Along with his friends, Samarth conducted an experiment showcasing how sound travel and the origin of telephone ideas. Utilising materials like woollen thread, broomstick pieces, and paper cups, the experiment demonstrated how sound waves could be transmitted through the setup, resembling an early form of communication.

"I am grateful to attend these interactive classes with experiments, and this approach helped me to better comprehend and understand scientific principles."

Manoj, an inquisitive 7th-grade student at GHPS Iggaluru, resides in close proximity to his school, where his father works as a driver, and his mother works in a garment factory. Through the MSL sessions, he has been exposed to a diverse range of topics, including the intricacies of the human body, the anatomy of plants, and the functioning of the heart and its size.

Unlike the usual noise in the classroom, the atmosphere during MSL sessions changes dramatically. The students maintain rapt attention, eager to absorb every bit of knowledge shared by the innovative teachers. Despite the usual noise in the classroom when other teachers are around, the atmosphere changes dramatically during MSL sessions, as all the students maintain a keen silence, eager to absorb every bit of knowledge shared.

"The MSL sessions were engaging, igniting a deep interest in Science within me. Now, I dream of pursuing a career as a Scientist in the near future."

Manoj is thankful to the MSL teachers for their creative teaching approach, making science interesting and easily understandable. The hands-on experiments have transformed his perspective on science, making it an exciting and accessible subject. The MSL sessions succeeded in igniting a spark of curiosity within them, and the students are indebted to their teachers for this invaluable gift.

Soumya R, a 13-year-old Government Higher Primary School Madapatna student, is currently studying in the 7th grade. Living close to the school, her parents, Ramesh Mundas and Annapurna Mundas, work as housekeeping staff in nearby companies. Soumya's academic journey at GHPS Madapatna included a remarkable turning point when MSL sessions were introduced during her 6th grade.

One of the highlights of her experience was the opportunity to participate in the Quiz competition - Vaakovaakyam. Soumya's exceptional performance during the preliminary test led her to be chosen as one of the representatives for the competition, along with senior students from 7th grade. The competition brought together talented students from various schools, and her team displayed remarkable knowledge and skills throughout the rounds, securing a position among the top teams.

"Participating in the Quiz competition was incredible! Despite initial nervousness, my confidence soared as we advanced. It brought joy, valuable life lessons and motivated me to explore more activities beyond regular classes. Grateful for the opportunity."

Participating in the Quiz competition was a transformative experience for her. The MSL sessions and participation in the competition have significantly fueled Soumya's passion for learning science. Inspired by the experience, she now aspires to become a doctor in the future.

Rakshitha, a student who joined the GMPS Jigani in 7th grade, has been an enthusiastic participant in MSL sessions. She holds the MSL teachers in high regard, appreciating their effective teaching methodologies. They divide the students into small groups, allowing them to explore various topics.

Through MSL classes, she and her peers have delved into subjects like plant anatomy, conservation, and the nutritional value of plants. Fascinating experiments, such as using mirrors to create multiple reflections and the study of kaleidoscopes utilised in submarines, have expanded their scientific knowledge.

One notable experience was the inter-school quiz competition. Rakshitha and her team participated after excelling in the preliminary test conducted at their school. Although they did not qualify for the next round, the experience served as valuable exposure, igniting their curiosity further. Rakshitha also actively engaged in creating models taught by her MSL Instructors for Science Day celebrations at the school.

"I am delighted with the progress I've made in science learning, thanks to both the school and the MSL instructors. I'm eager to conduct more experiments on my own."

Radhika, a 7th-grade student at GHPS Yarandahalli, is passionate about attending Science classes at her nearby school. Her parents, who work as a carpenter and a factory worker, support her education diligently.

While at GHPS Yarandahalli, Radhika has been exposed to a diverse range of scientific concepts and experiments. From learning about the separation of oil from water to conducting the Telephone experiment with Cups and woollen thread, she has explored topics like magnetic poles, electricity, and more. The engaging and fun learning atmosphere encourages active participation, with students supporting each other in their quest for knowledge.

Inspired by the MSL sessions, Radhika has set ambitious career goals, aspiring to become an engineer to positively impact the world through scientific knowledge. She acknowledges the positive transformation brought about by the MSL sessions, finding experiments engaging and enlightening.

"Thanks to the engaging quizzes of the MSL sessions, I have overcome my hesitation of asking questions and actively participating in class discussions. The sessions have fueled my eagerness to learn, making me more attentive and enthusiastic. I am grateful for the wonderful learning experience provided by the MSL program."

With renewed enthusiasm, she eagerly looks forward to more sessions to explore new concepts and conduct further experiments. Her 7th-grade journey at GHPS Yarandahalli has been filled with excitement and joy in her Science classes. The MSL program has ignited her passion for science and transformed apprehension into eagerness for learning.

Vyshali, a seventh-grade student at GHPS Yarandahalli, has been attending the Mobile Science Lab sessions, a transformative program introduced at her school, for the past one year. The proactive and interactive approach towards science education in the school has ignited her curiosity and kindled a deep passion for the subject.

The MSL classes have exposed Vyshali to various fascinating experiments, ranging from exploring magnetic poles and electricity to understanding the separation of water and sand. Through hands-on activities, she and her classmates actively participate in the learning process, making it both enjoyable and highly educational. The school's emphasis on fun activities fosters a collaborative learning environment where she and her peers eagerly support each other and seek clarity on doubts.

"I always eagerly look forward to more experiments and learning opportunities that the MSL sessions bring. The knowledge and skills I have gained through these classes have shaped me into a more curious and enthusiastic learner."

The MSL classes have played a pivotal role in empowering her to be more confident and interactive in their science classes. Initially hesitant to ask questions and actively participate in class discussions, Vyshali's confidence has soared with the encouragement of her MSL teachers. Engaging in quiz sessions during the classes has further bolstered confidence, prompting her to seek deeper insights into the subject matter actively. The enthusiasm and dedication are a testament to the profound influence of the MSL programme in nurturing a lifelong passion for science in young minds.

Recommendations and Way Forward

Biocon Foundation
EMPOWERING COMMUNITIES

8.1 Recommendations to the Programme

The Impact Assessment study drew out various findings to check the outcomes of the programme as was stated by the direct beneficiaries, i.e., students. The team presents its recommendations based on field interactions with the multiple stakeholders of the project.

MSL Sessions

Current Scenario:

- The MSL sessions primarily serve as introductory sessions, providing the students with a foundational understanding of the scientific concept.
- In the Biology topics of the MSL programme, students were taught using charts and models, which visually represent complex biological concepts and processes. These visual aids help students grasp intricate details and concepts effectively.
- The frequency of students attending MSL sessions per year is 6-8 exposures.

Recommendations:

- To enrich the learning experience for higher-grade students in the MSL programme, it is recommended to **integrate more advanced and in-depth experiments** aligned with a higher-standard curriculum. By aligning, 9th and 10th-grade students can develop a deeper understanding of scientific concepts and improve their critical thinking skills, preparing them for future higher studies.
- In addition to charts and models, incorporating **hands-on experience with microscopes** would be highly beneficial for students. This will provide students with a unique opportunity to observe biological structures at a cellular level. Further, witnessing **live specimens** and conducting their own microscopic investigations can spark a deeper interest and reduce hesitations about the subject among students.
- The **frequency of MSL sessions** should be **increased** to effectively explore and reinforce scientific concepts. Further, students will have more opportunities for hands-on experiments and interactive learning experiences, leading to a **deeper understanding** and **lasting retention** of scientific principles.

Science Fair

Current Scenario:

- Agastya International Foundation, in association with Biocon Foundation, organises 4 Science Fairs annually.

Recommendations:

- To complement the science fair, **organising science symposiums or exposure talks** at the school level can further enrich the scientific knowledge and curiosity of the students.

- The **Biocon Foundation** can extend its support through **Employee Volunteering Programme** and collaborate with schools and Agastya International Foundation in inviting eminent personalities from the scientific community, as well as Biocon's Research and Development Team, to share their expertise and insights. These interactions will inspire students, offering them valuable opportunities to engage with real-world scientists and researchers, thus developing a deeper appreciation for science and its applications. These events will also **encourage students** to **explore diverse scientific fields** and consider **future career paths** in STEM disciplines.

Teacher Training Programme

Current Scenario:

- Capacity-building programmes for teachers are conducted twice a year, focusing on imparting innovative teaching techniques for effective education of children.

Recommendation:

- To enhance the teacher training programme, **incorporating teaching through open-source materials** can be beneficial. Teachers can form small groups of 10-12 students and utilise these resources to facilitate learning. Considering socio-economic constraints and limited resources, Agastya International Foundation can provide a curated list of materials to teachers, which can be shared with students to provide a 360-degree understanding of the concepts.

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