2022

MakerGhat Annual Report

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With the pace of technological innovation, our youth today face an uncertain future. On one hand, emerging technologies promise healthier and happier lives. On the other, we are already experiencing the inequitable nature of technological progress— amplifying existing class, caste, gender, and other barriers and accelerating climate change. The next generation is going to be most profoundly affected by these issues, and need to have a voice in shaping technology development to better to meet their community's needs. Our youth are also entering a changing job market with widespread digitization and automation. No longer is it enough to be able to recall information and learn routine tasks that can be performed by a machine. Critical thinking, problem solving, collaboration, and communication, along with the ability to self-learn, are essential skills to stay relevant in the workplace, and to drive innovation and social change in India over the next few decades.

These skills are laid out clearly in India's National Education Policy (NEP) 2020, which aims to develop 'higher-order' cognitive capacities, such as critical thinking and problem solving, alongside social, ethical, and emotional capacities and dispositions. NEP also lays out a focus on experiential learning, and conceptual clarity over rote learning. MakerGhat has taken several bold steps in this direction. The making or tinkering philosophy that we embrace, supports learning through exploration, experimentation, and play, while centering youth agency. It creates room for failure, encouraging youth to take risks and exercise their creativity without fear. The collaborative environment of a makerspace or tinkering lab also offers an opportunity to exercise socioemotional skills, and learn to communicate one's ideas effectively.

MakerGhat's programs have been developed through countless conversations with educators and youth across the country, who expressed an interest in making but lacked resources to get started. We are excited to support educators, by providing curriculum, mentorship, training, and assessment resources. Over the next decade, we are building a network and movement of makers—educators and youth—who can usher in change at a local, national, and global level. The pressing problems of our time need creative solutions from diverse communities, and we invite young people, educators, and organizations to join hands with us to enable this change.

Our 2022 Annual Report charts what we have accomplished and learned in our journey with making, and our path forward. It is an attempt to make our work more accessible, and invite others to build the maker movement with us.

A NOTE FROM THE FOUNDERS

WE ARE
MAKERGHAT

MakerGhat is a non-profit organization that aims to create a movement of grassroots 'making' and entrepreneurship across India.

Inspired by the 'Maker Education' movement, we incorporate a model focused on experiential learning. Through the process of 'making', children are able to realize their potential, build their skills and see themselves as changemakers.

Having generationally experienced a sense of disempowerment, youth need spaces where they can imagine how they can challenge the status quo and bring about lasting change through socio-technological solutions. Allowing students from such communities to have tangible hands-on making experiences motivates them to feel empowered to design solutions for their everyday problems.
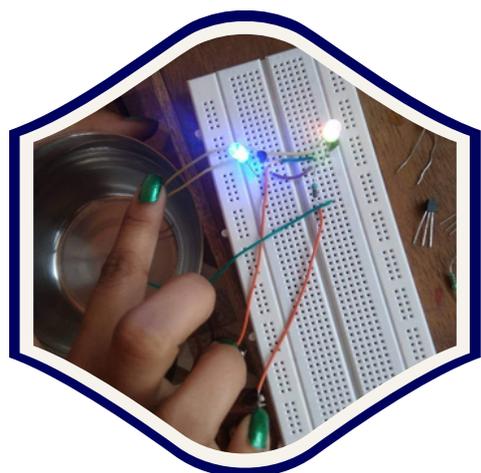
SIZE OF THE PROBLEM WE ARE TACKLING

90 MM
Jobs needed in India to tide over youth unemployment

46.2%
Employability rate among youth across different industry domaind

2X
Unemployment rate among educated women than men

OUR VISION

Identifying and shaping change-makers and entrepreneurs of tomorrow who can enable social and economic change in their community.

Our vision is to support children and youth to fearlessly ideate, and work in open and safe community spaces equipped with resources and mentors. Setting up such places in close proximity to the communities is done to enable the creation of solutions and designs that are hyper-local and have a connection with the community.

Over time the idea is to evolve into an incubator for projects, enabling youth to launch social and commercial enterprises. This will act as a resourceful platform for youth to have opportunities to experiment, showcase and scale their ideas and solutions.

HOW WE WANT TO EMPOWER CHILDREN AND YOUTH

Attitudes

Develop a sense of agency and self-confidence

Skills

Be trained in ways to design techno-social solutions

Mindsets

A systems thinking approach to scale their innovations

WE ARE COMMITTED TO...

▲ Bringing the 'hands-on making' experience to maximum children and youth.

▲ Taking tinkering and making beyond the confines of laboratories and maker-spaces.

▲ Enabling children to view making as a simple, satisfying, and joyful learning experience.

MakerGhat, with its team of researchers from Stanford University, Georgia Tech, IIT-Bombay, and partners across India, is working towards realizing this vision. We started with a single 'maker-space' and are steadily spreading to several other states and communities.

Our Growth Story

Community makerspace launched in Powai, Mumbai

Grew to 50,000 youth across 4 states

Exploring new stakeholders and communities

2019

2021

2023

2018

2020

2022

MakerGhat Founded

Grew to 10,000 youth

Grew to over 250,000 youth across 6 states

ABOUT OUR PROGRAM

Our entire program is activity based to expose students to different kinds of materials and making processes. Group-based activities are carefully chosen to spark interest, curiosity, and sustained liking towards hands-on making. Students can explore and learn while making and sharing their reflections. Every class is an opportunity for the children to build on their collaboration and communication skills.

The curriculum of the program hence draws a lot from 21st-century skills. Students have to think critically, imagine, plan, direct, and iterate as they make or assemble their activity. All of this is mounted on the program to help students develop a sense of innovative thinking.

Key elements of the program

1. Learner friendly curriculum
   - Every module is designed keeping in mind the age group and exposure to making

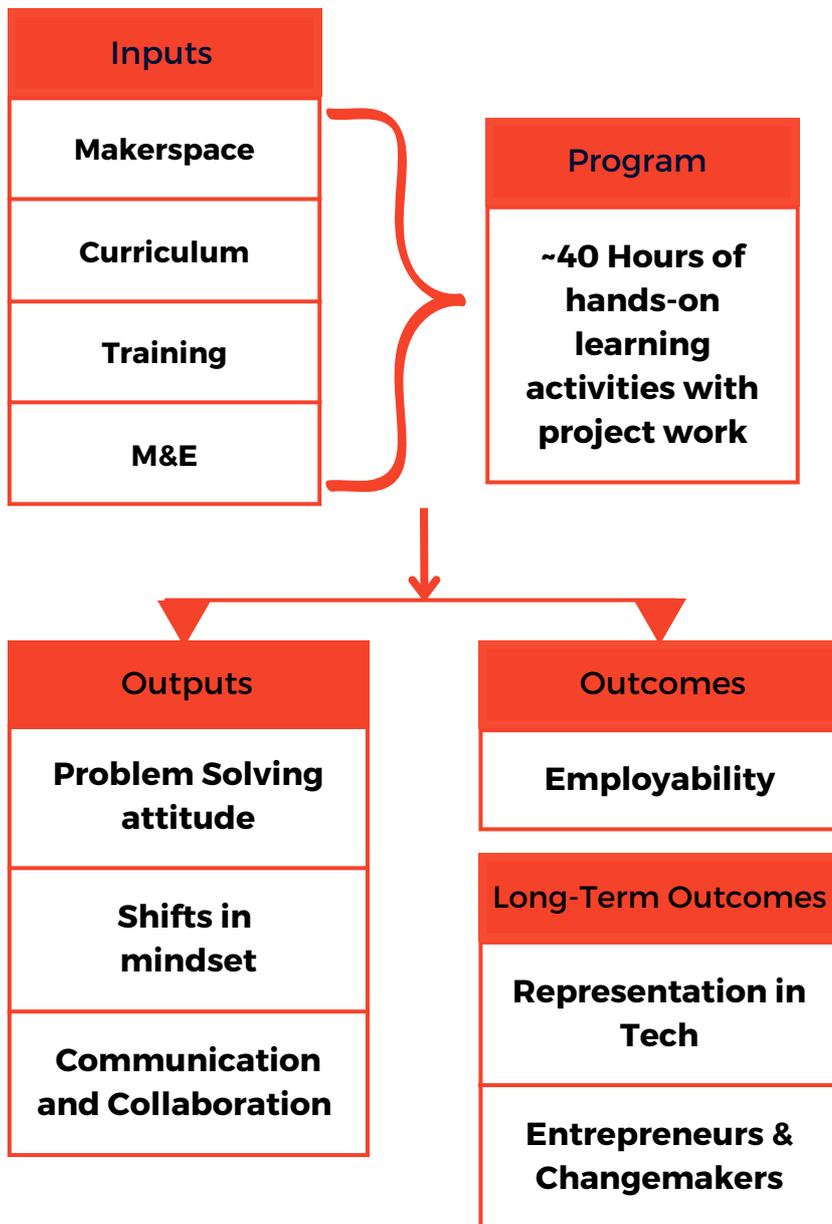2. Encourages children to be inquisitive
   - Students can be experimental in classrooms and try new ways of making

3. Scope for peer based learning
   - Activities happen in group and children can co construct meaning

Our Theory of Change

Inputs

- **Makerspace**
- **Curriculum**
- **Training**
- **M&E**

Program

~40 Hours of hands-on learning activities with project work

Outputs

- **Problem Solving attitude**
- **Shifts in mindset**
- **Communication and Collaboration**

Outcomes

- **Employability**

Long-Term Outcomes

- **Representation in Tech**
- **Entrepreneurs & Changemakers**

We believe that when children and youth have access to open, free spaces to experiment, they can explore their full innovation potential. When students are mentored and guided in the innovation process, they start exhibiting self-confidence and a growth in their critical thinking and problem-solving skills. Over time these skills have compounding benefits of shaping the students to be job ready or be prepared to showcase and scale their innovations to the wider community.

More on the Inputs

Makerspace	⋯⋯▶	Community spaces, Schools, Laboratories, Libraries
Curriculum	⋯⋯▶	Making and 21st century skils
Training	⋯⋯▶	Pedagogy, Facilitation skills, Advocating 'Maker' culture
M&E	⋯⋯▶	Monitoring, Assesments, Feedback

A Look at Our Program Model

OUR CURRICULUM

Guided Hands-on Activities		Design Thinking & Community Project
Expose students to different materials and making techniques	**+**	Encourage application of learnings to a community problem

OUR MAKER KITS

Many of our activities can be completed with materials that easily available in the home or environment. We also supply **Maker Kits** consisting of simple resources to help initiate making. We want to instill that making is possible with the simplest and most commonplace resources. Aligned with this philosophy, we have 4 versions of our program, listed below.

NO KIT PROGRAM INR 0

BASIC KIT INR 1000

ADVANCED KIT INR 5000

FULL-SCALE MAKER LAB INR 1,00,000

Program version	Students reached
No kit program	251161
Basic kit (~Rs. 1,000)	3762
Advanced kit (~Rs. 5,000)	3090
Full-scale Maker Lab (upcoming)	Planned (10,000+)

OUR OUTREACH NUMBERS IN 2022

Community Spaces	Government Schools	MakerGhat Fellows
124	5097	10

Students Reached	Students Reached	Students Reached
13,762	2,43,661	590

Total Outreach

2,58,013
Students

7401
Teachers Trained

Community programs

We brought together children in a common community space and helped them participate in hands-on making. We often saw good student-teacher bonding in these programs as all participants were from the same community

School programs

School programs gave us a chance to witness how students make a connection to their school curriculum through making. It has given us insights to customize our programs in closer connection with students interests

Fellowship

The fellowship has brought together 10 maker educators from different technical and non-technical education streams to acquaint them with 'maker' education and be advocates of maker culture

A HIGHLIGHT ON OUR CONSORTIUM PROGRAM

Entrepreneurship Mindset Development Program

MakerGhat in collaboration with 3 other non-profits has launched an entrepreneurship mindset development program, focused on building an entrepreneurial mindset shift among students. Global Alliance for mass entrepreneurship (GAME) conceptualized and helped bring together a consortium of 4 nonprofits- Udhyam foundation (Lead partner), Aflatoun, Reap Benefit, and MakerGhat to design and operationalize this program in partnership with the state government of Andhra Pradesh.

The program is implemented in the state in government schools for 9th-grade students. The program was designed collaboratively by bringing together modules from all consortium partners. It was launched as a pilot in 2021 and is currently in its 3rd phase.

Outreach Achieved:

5073+ Schools	241788+ Students	7213+ Teachers

Phase I
- A pilot project was launched in 2021.
- Launched as an online program in 30 schools

927 students

Phase II
- In-school program post-schools re-opened
- 267 schools in 13 districts

29851+ students

Phase III
- Program expanded and has a statewide roll out.
- Program currently targeting 4776 schools

211010+ students

1 — 2 — 3

A SPECIAL FOCUS ON EDUCATORS

MAKERGHAT FELLOWSHIP'22

A specialized fellowship program was launched for teachers to give them exposure to maker curriculum and train them to be maker educators. The fellowship designed as a 6-month program was flagged off in September 2022. Fellows were selected through multiple rounds of interviews.

As a part of the fellowship, the fellows were introduced to our program modules, given a chance to interact with key figures and advocates of maker culture, and carve out an individual outreach plan for taking maker education modules to their respective communities.

Cohort of 2022

Space: Classroom/ Science Lab
State: New Delhi

Satyaprakash

Space: ATL Laboratory
State: Kerala

Raihana MK

Space: Polytechnic college
State: Kerala

Mohamed Ziyad

Space: Tuition centre
State: Andhra Pradesh

Hazi Begum

Space: Community centre
State: Maharashtra

Suraj Landge

Space: Physics Laboratory
State: New Delhi

Avijit Chakravarti

Space: Tuition center
State: Uttar Pradesh

Akash Maurya

WHAT WE LEARNT THIS YEAR

Evaluating our impact

We see every program as an opportunity to learn something about our students. We have employed different forms of data collection in form of classroom observations, interviews, and surveys at different points based on the feasibility and opportunities offered in different programs. Analyzing this data helps us gauge the engagement, participation, and kind of response students have to our program the specs of our program, and some of the gaps that can be plugged in to facilitate better learning.

In the sections below, we have presented some of our key learnings from the data collected this year that have helped us to make our programs better for the next year.

Data collected 2022

Learnings collected from our independent programs

Endline survey with students

Classroom observations

Student + Teacher interviews

Learnings collected from our consortium program

Student project work observations

Student post program feedback survey

WHAT WE OBSERVED IN OUR CLASSES

Findings from our 24 classroom observations across 3 programs

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Classroom Attentiveness and Understanding

Insights we collected through classroom observations

Are students engaged?

Yes! Students were attentive in **3/4th** of our classes

When were students not attentive?
When classes turned disruptive, and the teacher was not equipped with sufficient classroom management skills. This was typically the case with community trainers teaching for the first time.

Are students able to do hands-on learning?

In **70%** of the classes, students could follow the material

What did students find difficult to follow?
Students had initial struggles during the transition from guided to independent making activities.

Are students thinking critically?

Definitely! Students asked questions in **87%** of our classes

How did we enable inquiry-based learning?
Teachers were given feedback and training on classroom management and engagement techniques.

Participative Culture Observed in Classes

We want to encourage equitable participation in classrooms among students while undertaking to make. We carefully curate and pick activities, that can allow students to collaboratively, plan, make, and reflect on them.

In **All** classes we observed girls had access to the resources to make as much as the boys in class

79% classes we observed girls were at least as active as boys in group discussions (and more active in many cases!)

From a gender perspective on participation, we checked in our classes, to what extent girls could participate in the activities. In most of the classes we found, girls had a high participation rate, both in the planning, and discussions and in the making of the activities. Girls went foraging for materials, sorted things, handled large card papers, cut out cardboard, and also presented their projects at end of the class.

We found that the way students carry out teamwork needs to be more participative. It was found in almost half of the classes we observed that few students take lead in doing the activities and few participate very minimally. However, students are enthusiastic to work in groups. In 66% of the classes, they usually plan and divide work, based on the kind of work liked by every member of a team, and work together to complete the project or activity.

66% classes we observed students planned out how to work on the activity in a coordinated way.

# HOW STUDENTS RESPONDED TO OUR PROGRAMS

FINDINGS FROM OUR END-LINE SURVEY WITH WORLD VISION INDIA PROGRAM

ENDLINE STUDY: WORLD VISION INDIA

We partnered with the non-profit, World Vision India for carrying out our program at 4 locations in Tamil Nadu. An endline survey was implemented at the end of the program. Endline data was collected from 281 students from 7 centers in 2 locations. The students surveyed were from the neighboring community aged between 8–16-year-old, studying between classes 5-12.

The endline survey was designed to capture details on student engagement, student learning, any shifts that were seen in their perceptions and attitudes. Through the endline, we wanted to check whether students feel attentive and are able to understand and participate, what students do to keep themselves immersed in continuous learning post class. We tried to use the endline to understand their attitudes on collaboration, their understanding of making and their long- term aspirations.
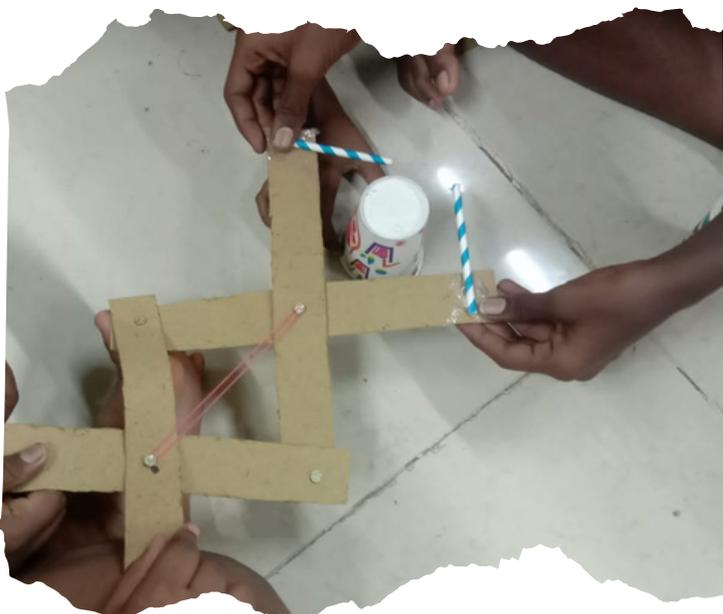
Prior Exposure to Making

Students that performed experiments before becoming a part of the program
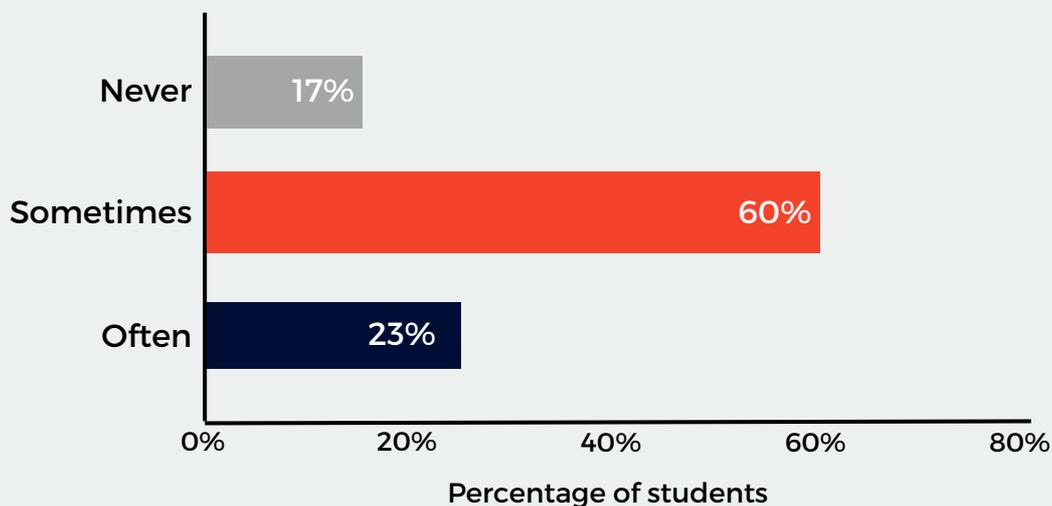
17% students had never performed an experiment

60% students had tried out experiments sometimes

Students' exposure to making

Students' prior exposure to making is important to get insights into how prepared or skilled students already are for the culture of making. E.g. Students would be able to handle more complex activities if they have prior exposure to make. We usually have found students are new to the concept and culture of making.

These insights also help reflect, while assessing their prototypes. The exposure to making that students have had outside the program intervention can also guide them in understanding the shifts and changes seen in the students in the program.
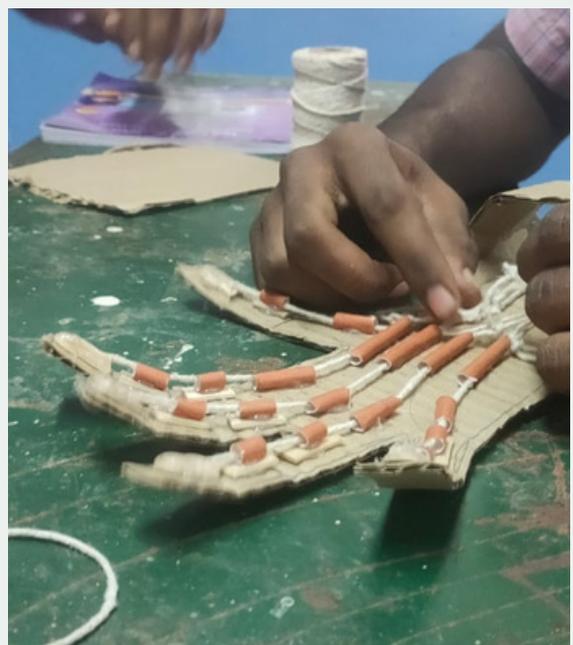
To What Extent Did Students Engage and Participate?

Student engagement in class

Number of students

- 80%
- 67% — Students understood what the teacher taught (Never 1%, In some classes 8%, In most classes 24%, In all classes 67%)
- 69% — Students follow the instructions to make the activity (Never 1%, In some classes 6%, In most classes 24%, In all classes 69%)
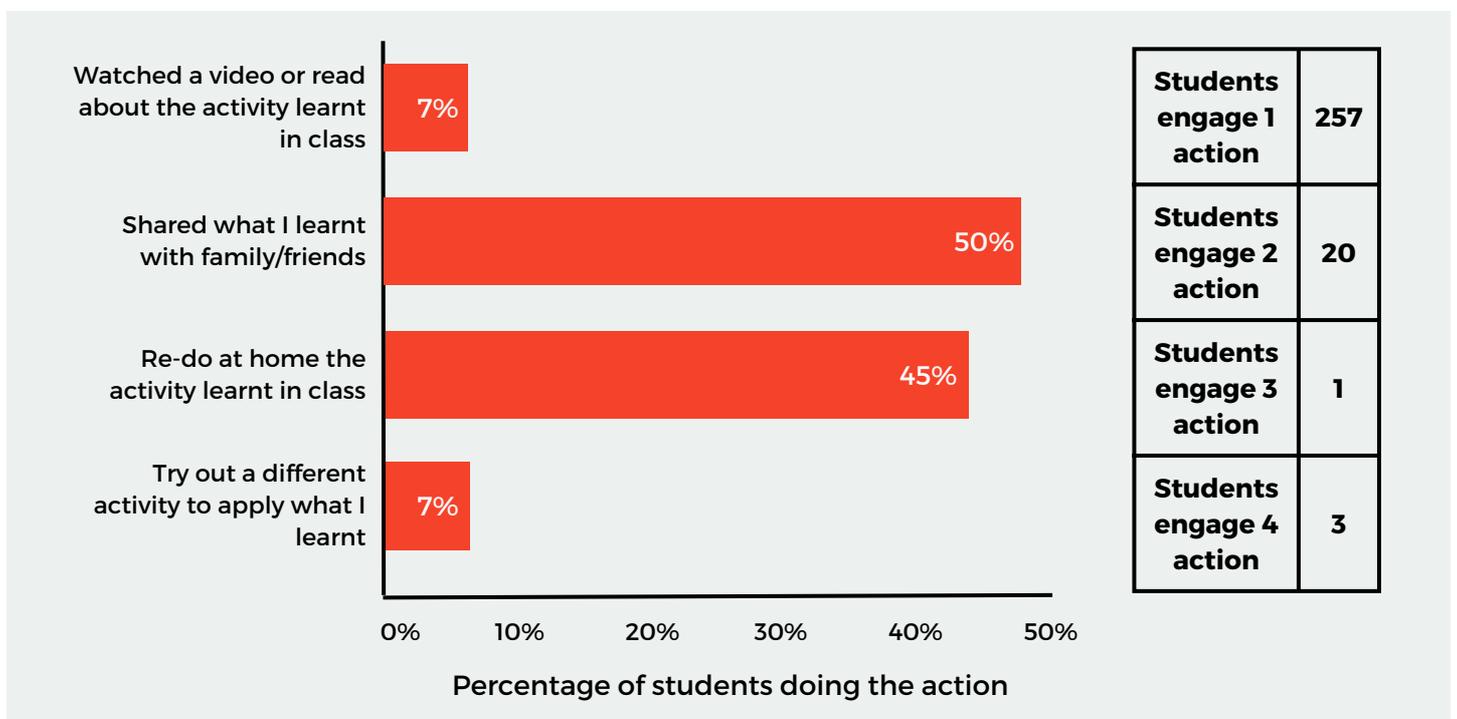- 68% — Students participate in making the activity (Never 1%, In some classes 6%, In most classes 25%, In all classes 68%)

Legend:
- Never
- In some classes
- In most classes
- In all classes

Students engagement post class

Action	Percentage
Watched a video or read about the activity learnt in class	7%
Shared what I learnt with family/friends	50%
Re-do at home the activity learnt in class	45%
Try out a different activity to apply what I learnt	7%

Percentage of students doing the action

Students engage 1 action	257
Students engage 2 action	20
Students engage 3 action	1
Students engage 4 action	3

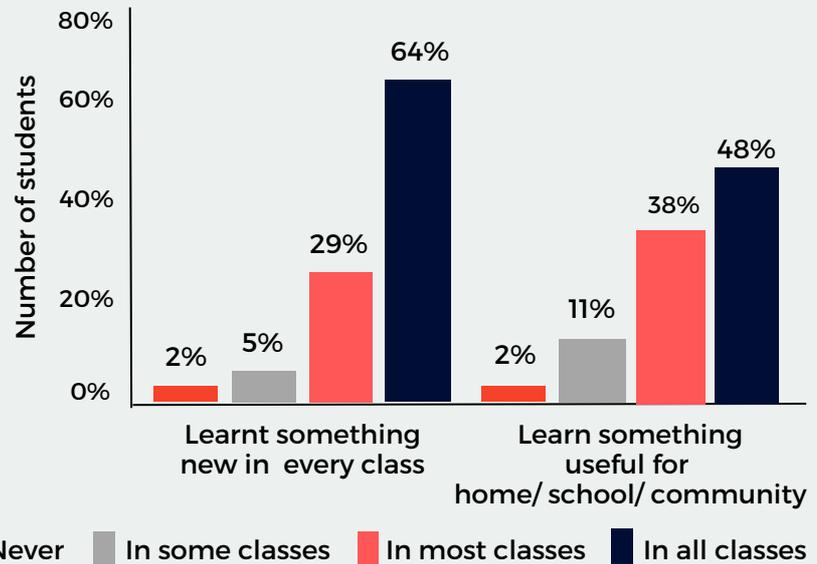**In Class Engagement is high in all or most classes**

Post-class engagement is seen but more in terms of sharing what is learned in class or redoing the same activity back home. However, few students did try out a new activity back home.

Student Learning Experiences:
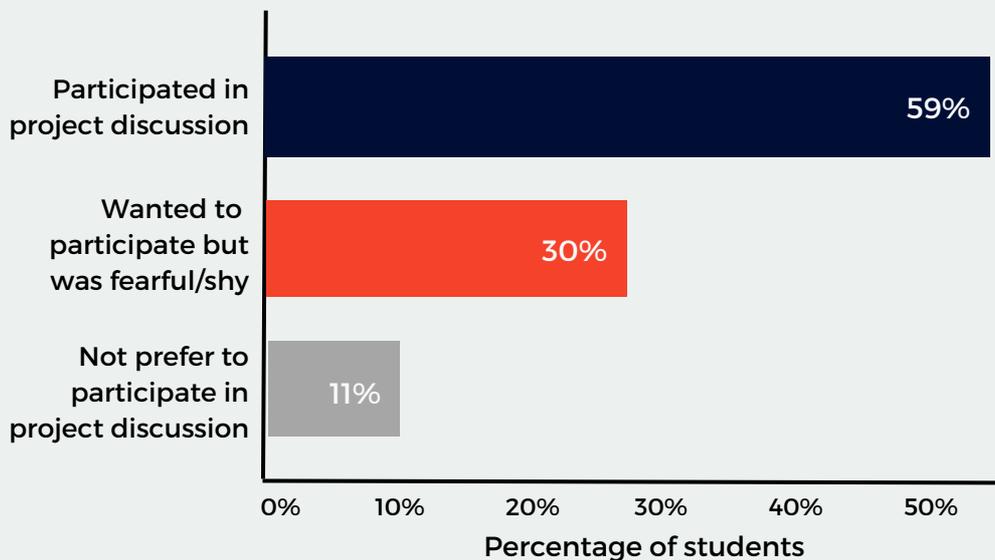## Classroom learning and project work

Student Classroom Learning

Most students learnt something new in almost every class.

80% found what they learnt to be useful.

Chart: Number of students

Learnt something new in every class:
- Never: 2%
- In some classes: 5%
- In most classes: 29%
- In all classes: 64%

Learn something useful for home/ school/ community:
- Never: 2%
- In some classes: 11%
- In most classes: 38%
- In all classes: 48%

Legend:
- Never
- In some classes
- In most classes
- In all classes

Student project work - discussion

Chart: Percentage of students

- Participated in project discussion: 59%
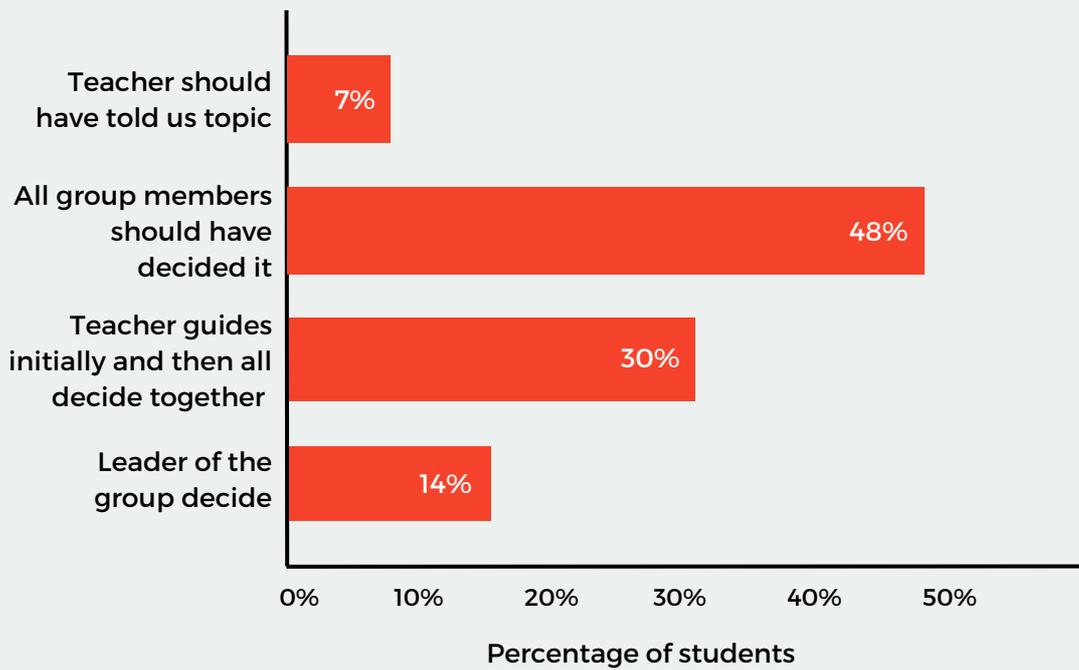- Wanted to participate but was fearful/shy: 30%
- Not prefer to participate in project discussion: 11%

Maximum students participate in project work discussions
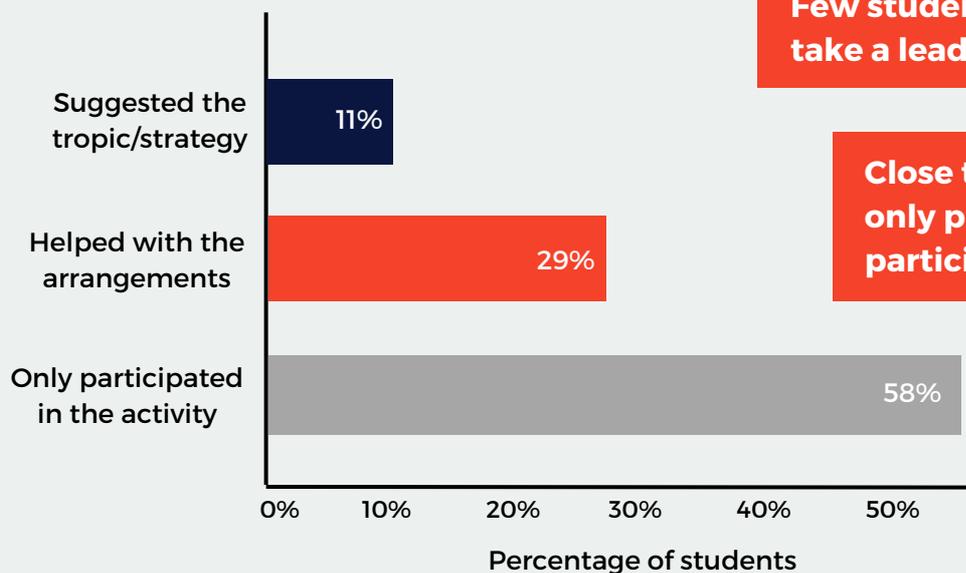
Shyness is one factor that inhibits student participation

Students' thoughts on ideal project work

Percentage of students

- Teacher should have told us topic: 7%
- All group members should have decided it: 48%
- Teacher guides initially and then all decide together: 30%
- Leader of the group decide: 14%

Most students believe that topic should be chosen in consensus

Only a few students believe topic should be dictated by someone else

Student participation in project work

Percentage of students

- Suggested the tropic/strategy: 11%
- Helped with the arrangements: 29%
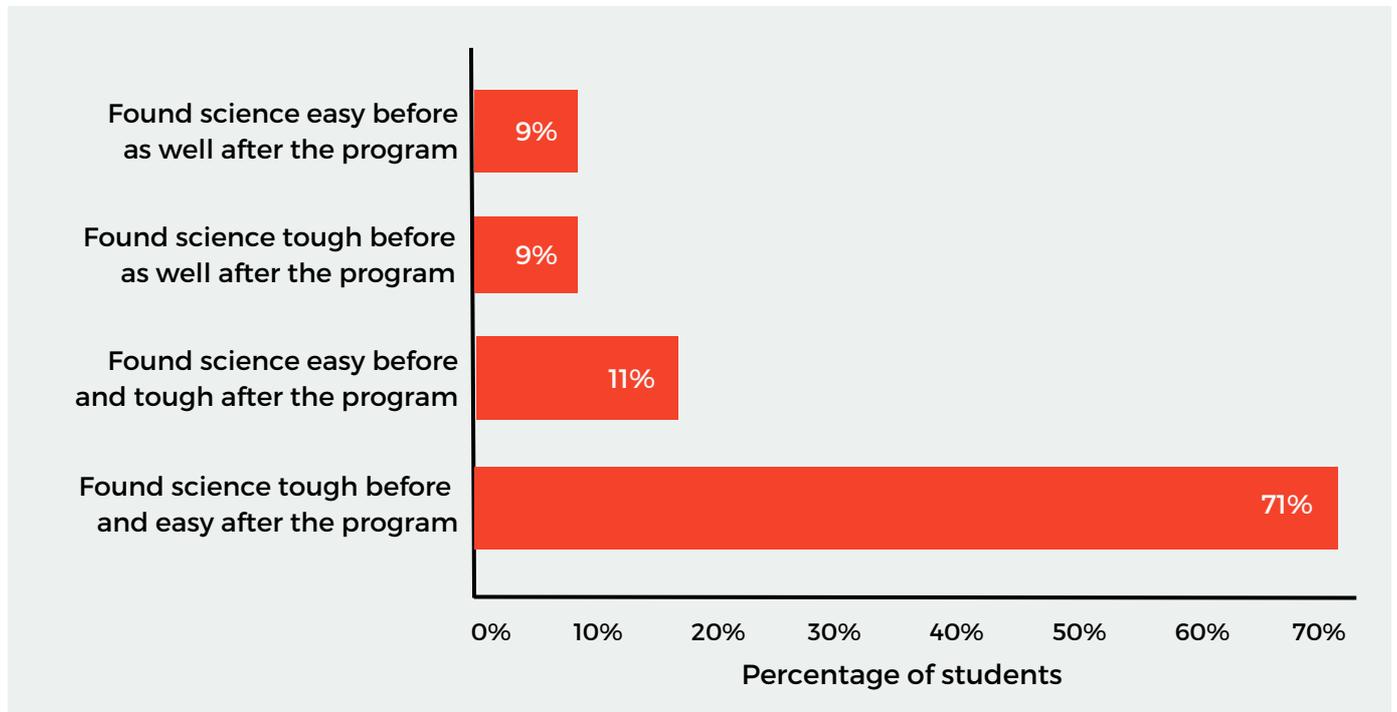- Only participated in the activity: 58%

Few students preferred to take a lead in project work

Close to half the students only preferred to participate as instructed

# Shift in students' perception of science

Perception shift: Find science easy

Found science easy before as well after the program — 9%

Found science tough before as well after the program — 9%

Found science easy before and tough after the program — 11%

Found science tough before and easy after the program — 71%

Percentage of students

Most students find the subject of science easy now as against before the intervention

There were very few students who find science a difficult subject after the program
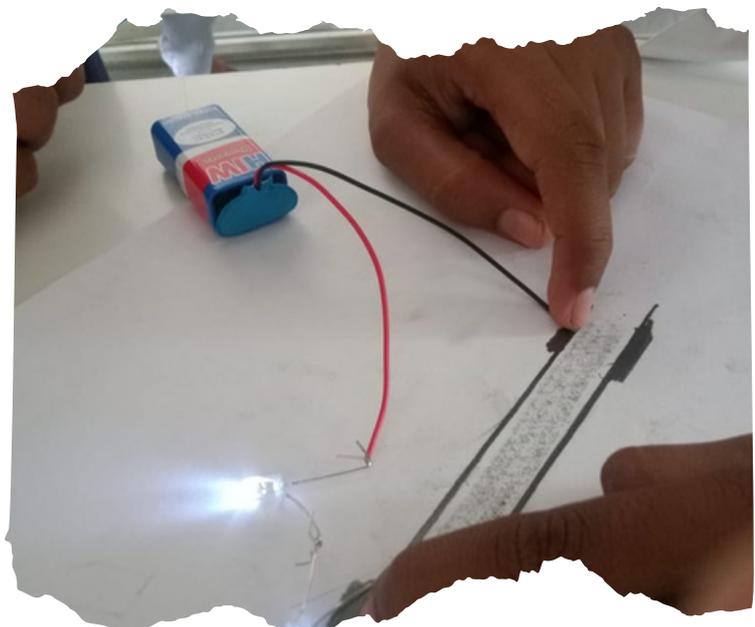
WHAT STUDENTS AND TEACHERS SHARED ABOUT THEIR EXPERIENCES

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Program experiences of teachers and students

Below is a summary of responses shared by teachers and students during observation visits and post-program interviews.

Responses on knowledge enhancement

- Found program to be innovative, interesting, and knowledge enhancing.
- Aids understanding a school science curriculum.
- Activities seemed like 'games' but could connect to real life.
- Helped in increasing confidence.

Program & Activities

Responses on collaboration in classroom

Classroom Collaboration

- Students enjoyed and looked forward to working in groups.
- Teachers saw growth in collaboration skills
- Students saw group work as a chance to mingle and socialize with friends. building community

Responses on community project

- Chose the topic as a group.
- Topics are chosen based on things experienced first-hand by students and their community.
- Going through project work helped me like the subject of science more than earlier

Community Project
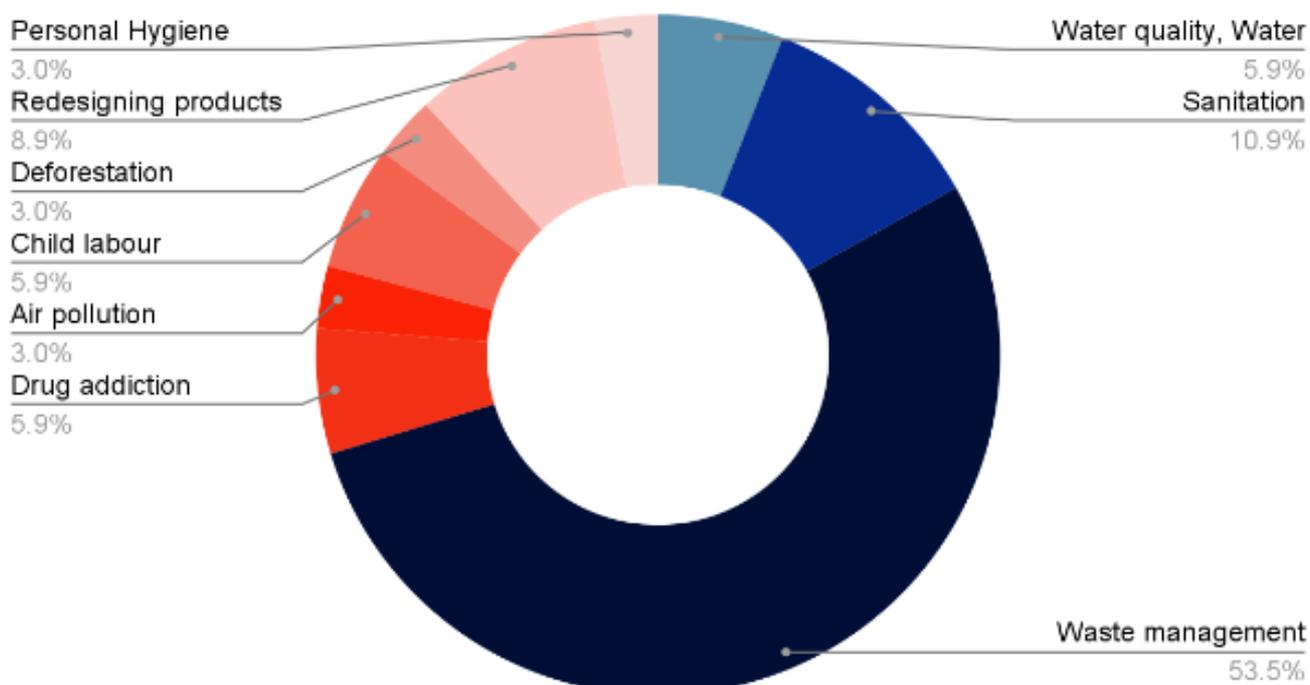
Community projects by students

Students picked a diversity of topics for their community project. Classroom observations and interviews have confirmed that students chose their issues through a discussion and consensus. Some of the awareness creation ideas that students suggested for their respective topics included:

- Poster Making
- Street Play/skits
- Group Discussion
- Community Awareness

Topics explored by students:

35 students were surveyed on their community project and the solutions they discussed. Waste disposal and management was a topic that the maximum groups picked. The students suggested segregation and proper waste disposal with a focus on recycling and upcycling the materials. The second highest topic selected was also closely related to the appropriate management of waste, with students selecting projects that involved messages on reusing, and recycling materials in different ways. Other topics explored by students were also environment and habitat centric like tree plantation, sanitation, water purification, etc. Students also chose many social topics like alcoholism, child labor.

Project topics explored by students

Personal Hygiene — 3.0%
Redesigning products — 8.9%
Deforestation — 3.0%
Child labour — 5.9%
Air pollution — 3.0%
Drug addiction — 5.9%
Water quality, Water — 5.9%
Sanitation — 10.9%
Waste management — 53.5%

Students' Teamwork Experiences from Odisha

> **"I find them to be very enthusiastic and competitive while doing the activities. That is why they are more interested in these activities...."**
>
> Sanjeevani Gartia
> Science teacher
> UGUP Kanbar, Orissa

Team work is an essential element of our activities. In Odisha, here is how we saw students leverage it...

Students have to work in teams while doing their hands-on-making. Sanjeevani Gartia, a science teacher at UGUP Kanbar High school, in Bargarh, Orissa shares how students love the activities and collaborating as teams help students be more engaged in the activity. In our classroom observations in Odisha, we have found in many schools, students while forming and working in teams, take up teamwork and collaboration with extra fervor.

While, usually in our other programs, the teacher forms groups for the students before starting the class, in the case of Odisha, the students themselves form their groups, in many cases a, day in advance. They are very keen to work with their friends and chalk out their team a day before. The students also usually introduce a 'competition,' making the class more enthusiastic."The students would announce a competition, who will do the activity fastest, or which team will have the cleanest looking water after doing a water filter activity.", shares Ms. Gartia.

The students are hooked to the activity, and they are able to be highly engaged. In fact, teachers report during their interviews that the attendance in class on days of the activity is high as compared to other days. Students also appear happy and enthusiastic after the completion of the activity and often ask out loud "the next activity, please." We have observed students derive greater creative joy and satisfaction in the process. We found similar experiences in close to 10 out of 15 schools.

Prototypes developed by our amazing students

"These activities have helped me like mechanics. I want to explore if I can do something related to mechanics more in the future..."

Priya Sakhi
Student
Ranipet, Tamil Nadu
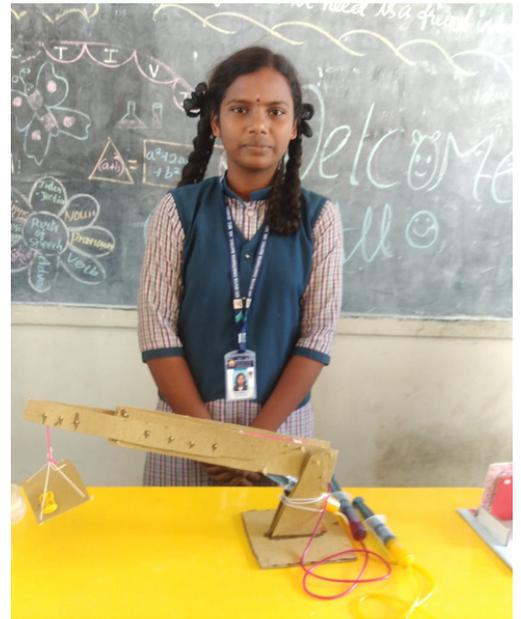
Our program is designed to spark creativity. Here is Priyasakhi, our student from Tamil Nadu who has attempted making prototypes inspired from what she learnt in our program.

Like many of her friends, Priyasakhi was inquisitive about what our program was about Words like 'tinkering', 'hands-on-making', were unheard of in her school or community.

Once she was introduced to making different activities from our modules, she started practicing a few activities independently. As she shares, she would either do them by herself or with her friends in the community. She believes the activities helped her get a more in-depth understanding of concepts in physics and science.

Among all modules that she learnt, she took a special inclination towards robotics and mechanics. She shared that it helped understand concepts like the Pascals law better. With a new-found liking for both mechanics and making, she tried making a model explaining Pascals law and hydraulics.

Priyasakhi shares that not only have the activities helped her in her school science class but also helped her gain better skills and confidence. She shared she used to be very shy and reserved, earlier, but doing the activities in groups, has helped her to speak, communicate and express herself better. "The activities also taught me how to handle problems better.", she shares.

She has participated in science fairs, and owing to her liking for mechanics, she is keen to explore this area of interest more and design more solutions in the future.
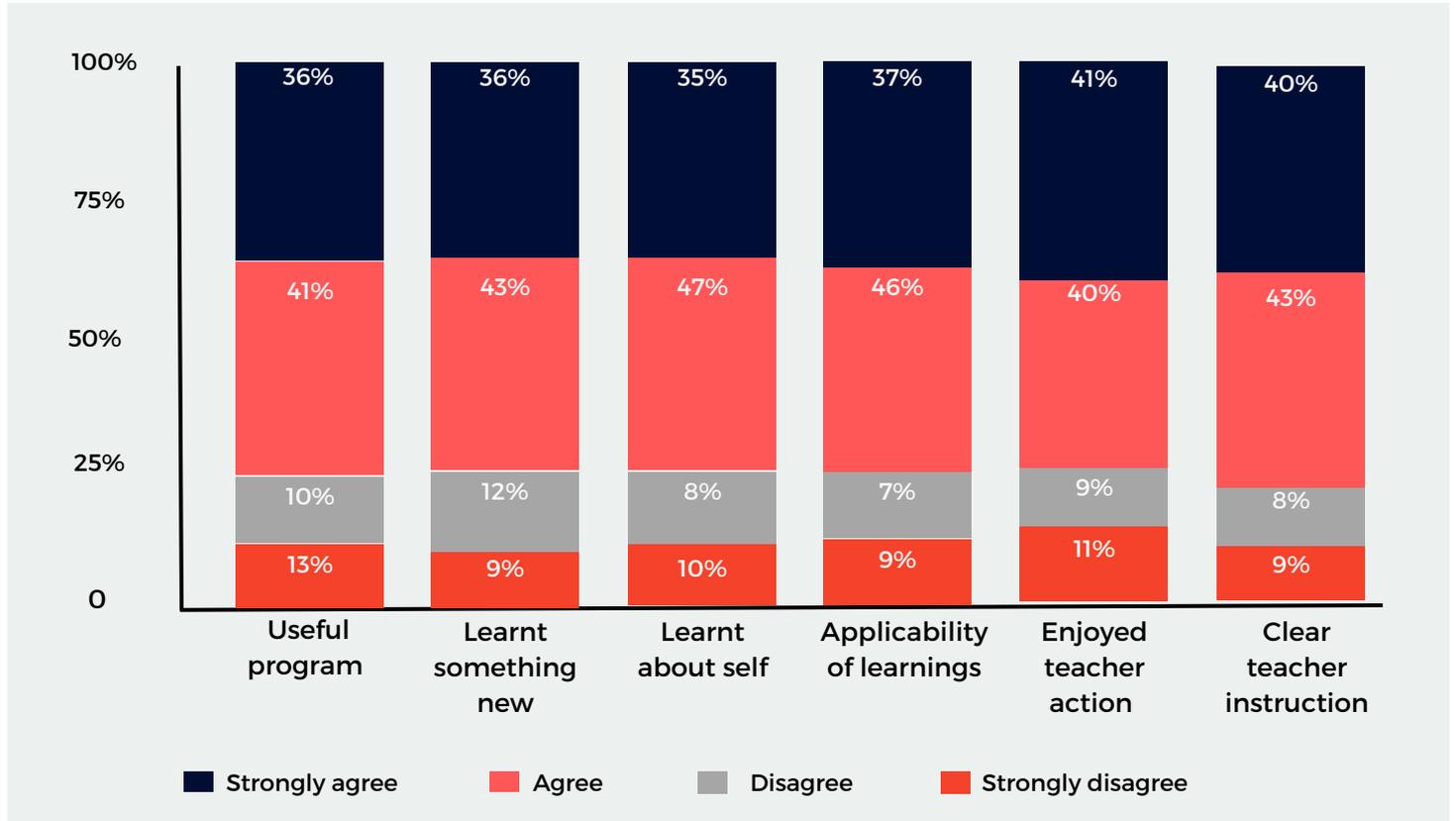
LEARNINGS FROM OUR CONSORTIUM BASED PROGRAMS

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STUDENT FEEDBACK SURVEY

Students were asked feedback on how they found the program and what they learnt at the end of the program

Feedback from students about the program

Chart: Feedback from students about the program

Category	Strongly agree	Agree	Disagree	Strongly disagree
Useful program	36%	41%	10%	13%
Learnt something new	36%	43%	12%	9%
Learnt about self	35%	47%	8%	10%
Applicability of learnings	37%	46%	7%	9%
Enjoyed teacher action	41%	40%	9%	11%
Clear teacher instruction	40%	43%	8%	9%

Most students reported that they learnt something new and useful
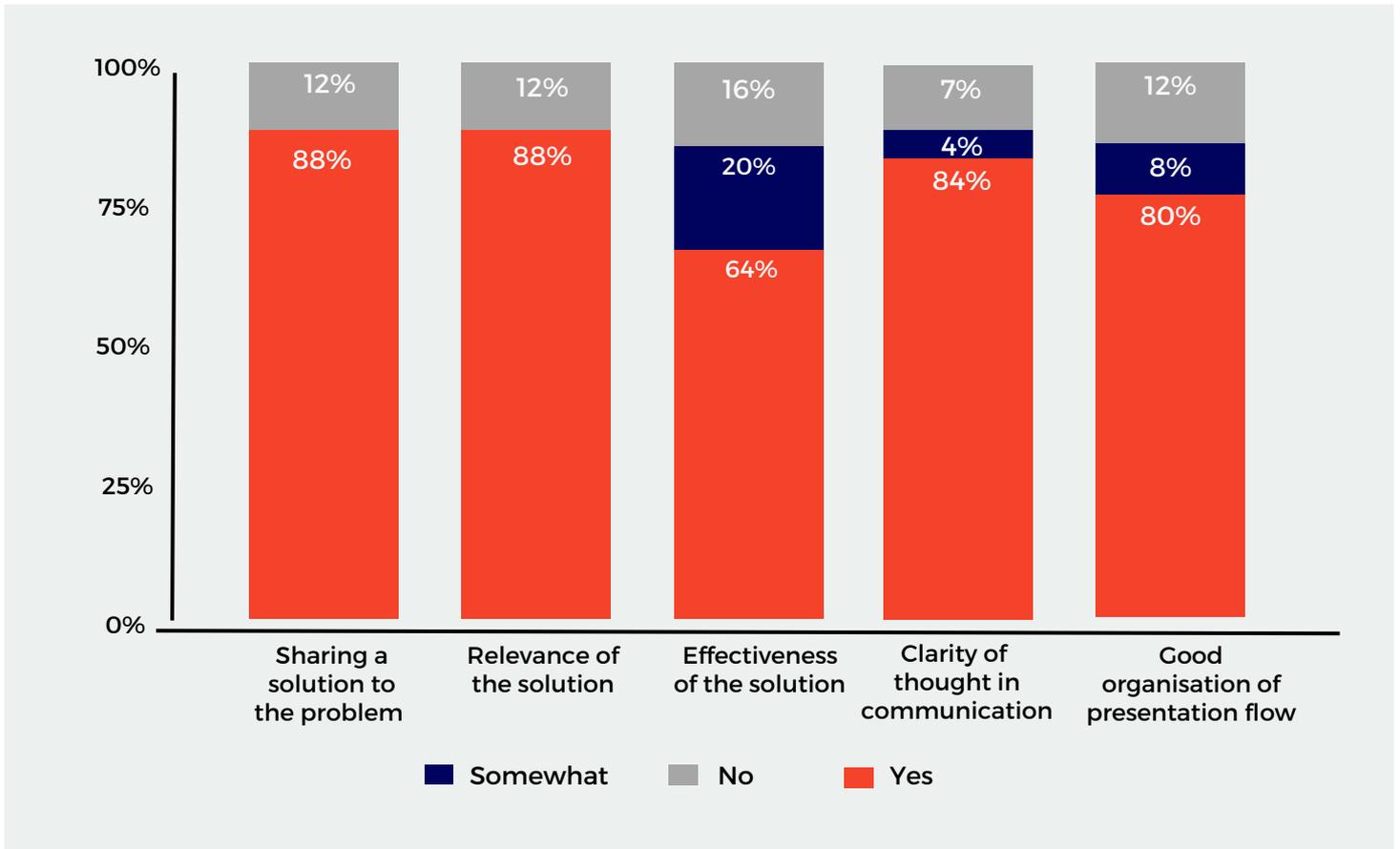
Students also felt they learnt new things about themselves

Students' performance in project work

Towards the end of the program, students' project presentations were observed to understand their learning outcomes.

Student Presentations - Final Project Presentations

Chart: Student Presentations - Final Project Presentations

Category	Yes	Somewhat	No
Sharing a solution to the problem	88%		12%
Relevance of the solution	88%		12%
Effectiveness of the solution	64%	20%	16%
Clarity of thought in communication	84%	4%	7%
Good organisation of presentation flow	80%	8%	12%

Legend: Somewhat, No, Yes

Most students presented a project that shared a solution to a problem and was effective and relevant

Most had a good communication and logical flow

SUMMARY OF LEARNINGS

Piecing together different data points and experiences from the field has helped gain a better understanding of our students, how they respond to our program, and their perceptions of hands-on learning. We have been able to get insights into different aspects of our program to understand what works on the ground and what does not.

01

High Student Engagement

- Students like the program and look forward to coming to class every week.
- The endline and classroom observations confirm that students are engaged in class, understand what is taught, and ask questions to the teacher.
- Students sometimes tried out things they did in class at home.

02

Apply Learnings at Home and School

- Students felt the activities gave them many ideas to address some of their community problems.
- Students felt science was less difficult and found it easy to understand the science school curriculum.
- Teachers and students reported they felt the program influenced the self-confidence and teamwork skills

03

More Collaboration among Students

- Students can align themselves with values of collaborative work. Believe in discussing and working with the group consensus
- There is parity in gender, and girls get to access resources or participate in all activities entailed in making a particular activity
- Students look forward to working in groups but have to hone better group/team work collaboration skills.

NEXT STEPS

Our experience with our programs and the communities we have worked with have been both inspiring and humbling. The potential shifts we observed in students, the feedback we received from them, and the hunger we witnessed among students to learn more and more have propelled us to bring the hands-on making culture and experience to a larger number of students. At the same time, we plan to revisit the gaps that we have identified. In 2023, we hope to strengthen the key program areas mentioned below.

01. Increase both in-class and post-class engagement

- We want to bring more participation and engagement from students in our classes.

- We wish to explore ways in which students would engage with the activities post-class.

02. Help student connect learning to real life problems

- We want to help students bridge their learnings in class with the problems they wish to solve in their community

- We want to guide students to be able to make better prototypes of solutions.

03. Improve classroom culture and teamwork

- We wish to empower our facilitators better to carry out classes in alignment with 21st-century skills and pedagogy.

- We want to help foster a more collaborative style of working, for the students and help students understand how to leverage group work.

We would like to thank our partners for their continued support in our journey.

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