Learning by Doing

A HANDBOOK ON DESIGN THINKING FOR SCHOOLS

Volume I

Learning by Doing

| Volume I |

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Message from Samagra Shiksha, Andhra Pradesh

It is with immense pleasure and a deep sense of commitment to the future of our young learners that I present this handbook for teachers on using the Atal Tinkering Labs to provide a quality experiential learning for children. The ATLs, as we know, offer a unique opportunity for 'learning by doing', decisively moving away from rote-based learning. Learning by doing is the principlethat is at the heart of STEM education. The ATLs, offering access to modern and conventional technology tools to young minds, have been established across the country at a pivotal moment, as we collectively strive to nurture a generation of innovators, problem-solvers and critical thinkers.

To the teacher, I would like to say that this handbook has been meticulously developed to serve as your invaluable companion on this exciting journey of exploration and learning. It is a practical guide that helps you to link the subject curriculum with the activities that can be done at the ATL. The integration of the ATL into your school timetable and routines is essential, and this will lead to an effective use of this innovative space. The handbook is designed to make this integration possible. At the same time, the handbook goes beyond the immediate needs of the syllabus, andoffers a simple and powerful framework for identifying solutions to the myriad problems and challenges of daily life.

The handbook has two main parts – a section on Design Thinking, and a section on sample activity plans for grades 6-10 (40 of them, across the subjects of Physics, Chemistry, Mathematics and Biology), which offer clear guidance on how to integrate curricular concepts with ATL activities, using the tools available at the ATLs. As you implement the activity plans, you will understand how they help to bring key concepts alive, using a variety of tools available in your ATL. Also, use these activity plans to develop your own activity plans. Your aim should be to cover all the key concepts that you teach in science and mathematics.

A word or two must be said about the section on Design Thinking. This idea is at the heart of the Atal Tinkering Lab. It can be called a human centered process, a mindset or an approach to problem solving, with a focus on developing solutions. One can identify many challenges or problems that need to be solved in daily lives. Design thinking offers a framework that can be used by teachers and children to identify these problems and work towards their practical solutions. Increasingly, this is seen as an ability that needs to be developed through the educational

experiences that schools provide. The ATLs offer all the tools for design thinking. The handbook offers a simple and clear introduction to this powerful learning process, and we hope that the case studies presented here will motivate children and teachers to get on to this exciting journey.

Samagra Shiksha, Andhra Pradesh, is deeply committed to supporting all our teachers. The ATL handbook is a concrete step in that direction. We believe that by investing in the professional development of our teachers, we are directly investing in the future of our state.

I urge every teacher to thoroughly engage with this ATL handbook. Do share your experiences and continuously innovate within your labs. Let us collectively strive to transform our schools into hubs of innovation, where every child feels empowered to dream, design and create.Together, let us empower the next generation to be creators of solutions, not just consumers of knowledge and build a brighter, more innovative Andhra Pradesh.

With best wishes,

B. Srinivasa Rao (IAS)
State Project Director
Samagra Shiksha
Andhra Pradesh

Message from Samagra Shikshana, Karnataka

It is with immense pleasure and optimism that I present this *Atal Tinkering Lab Handbook for Teachers.* This is a thoughtfully crafted guide designed to bridge the gap between classroom learning and hands-on innovation. The Atal Tinkering Labs (ATLs) represent a transformative vision for education, fostering creativity, curiosity, and problem-solving among young minds. This handbook serves as a vital resource for teachers, empowering them to integrate core academic subjects–Physics, Chemistry, Biology, and Mathematics–with the dynamic, experiential activities of the ATL.

The activity plans included in this handbook are meticulously designed to be both detailed and are user-friendly, enriched with illustrations, video guidance through QR codes, and thought-provoking questions to spark meaningful discussions. By clearly mapping curricular linkages, these plans enable educators to seamlessly "bring the classroom to the ATL, and the ATL to the classroom." They are not just tools for teaching but invitations to explore, experiment, and connect theoretical knowledge with real-world applications.

Equally significant is the handbook's dedicated section on design thinking, a powerful framework for fostering innovation. ATLs are more than laboratories; they are vibrant spaces where ideas take flight. Design thinking, as outlined in this guide, equips teachers and students with a structured yet flexible approach to problem-solving, encouraging them to step beyond textbooks and embrace the world of innovation. Through engaging examples, this section illustrates how design thinking can ignite creativity and inspire solutions that are both practical and transformative.

This handbook is a testament to the belief that education thrives when it blends structure with imagination, discipline with exploration. It is our hope that teachers will find this resource an inspiring companion in their journey to nurture the next generation of innovators, thinkers, and changemakers. Let the Atal Tinkering Labs be the launchpad for ideas that shape a brighter future.

Dr. Vidya Kumari (IAS)
State Project Director
Samagra Shikshana
Karnataka

Message from Samagra Shiksha, Telangana

It gives me great joy to share with the teachers and students of Telangana the Atal Tinkering Lab Handbook for Teachers, as we take another meaningful step towards transforming education. Atal Tinkering Labs (ATLs), established in schools across the state, are redefining learning through a strong experiential and inquiry-driven approach. I truly believe this handbook will enable teachers to build the necessary skills to transform our schools into vibrant hubs of innovation.

The role of education has always been to nurture curiosity, encourage original thinking, and prepare students to face the challenges of a changing world. This is precisely what ATLs set out to do. They invite both teachers and students to return to the roots of discovery, by asking questions, exploring solutions and learning by doing. ATLs remind us of the true essence of education: a joyful, curious, and purpose-driven journey.

This handbook contains 40 carefully crafted activity plans across science subjects, serving as a reliable guide for teachers. Each activity plan includes detailed instructions, illustrations, and supplementary video explanations. These plans show how key curriculum concepts can be brought to life through hands-on projects. Teachers are encouraged to use these examples not only as blueprints but as inspiration to design their own activity plans tailored to their students' needs and interests.

The handbook also has a dedicated section on Design Thinking, a mindset and process that lies at the heart of the tinkering labs. Design Thinking rests on a fundamental belief: that everyone has the capacity to create change, regardless of how big the challenge, how small the budget, or how limited the time. I am especially proud to note that the handbook includes six inspiring case studies from ATL schools across Telangana, Andhra Pradesh, and Karnataka, where students have developed creative, practical solutions to everyday problems in their community. I hope these stories motivate our students to take on new challenges and turn their ideas into action.

I urge every teacher to engage deeply with this handbook. Encourage your students to experiment, question, and design solutions without restriction. Share your experiences, collaborate with peers, and also support your students to engage with this resource as the content in the handbook is accessible and

student-friendly, especially for those with the interest and curiosity to go further. I appreciate the hard work of all our teachers who played a key role in the design of the handbook, as well as Vigyan Ashram and UNICEF teams for their continuous support in this endeavour.

With our combined commitment and belief, let us make Telangana a model for transformative education - where every child is seen not just as a learner, but as a potential innovator, change-maker, and problem-solver. Let every school become a space where creativity, inquiry, and innovation take centre-stage.

Dr. E. Naveen Nicolas (IAS)
State Project Director
Samagra Shiksha
Telangana

Message from Atal Innovation Mission

It gives me great pride and enthusiasm to present this handbook for teachers—an essential resource developed to support the transformative work happening in Atal Tinkering Labs (ATLs) across India. At its core, the ATL initiative is not just about tools or technology—it is about cultivating a mindset. A mindset that encourages curiosity, creativity, critical thinking, and problem-solving among young learners.

This handbook is a step towards empowering teachers to seamlessly integrate the spirit of innovation into the fabric of everyday classroom learning. By linking theoretical concepts with ATL-based hands-on activities, this resource guides teachers to facilitate experiential learning that is both engaging and purposeful. With a clear structure that includes sample activity plans across STEM subjects and a foundational orientation to design thinking, the handbook equips educators to create vibrant learning experiences that go beyond textbooks.

The section on Design Thinking is particularly noteworthy—it introduces a human-centric approach to problem-solving that is essential in today's rapidly evolving world. Teachers are encouraged to use this section not just as a pedagogical tool, but as a way to inspire students to observe their surroundings, empathize with real-world problems, and develop innovative solutions with confidence and intent.

This handbook reflects our unwavering commitment to supporting educators on this journey. It is our belief that when equipped with the right tools and mindset, teachers can ignite in every child a lifelong passion for exploration and innovation.

Let this handbook be more than a guide—let it be an invitation to transform your ATL into a space where imagination thrives, questions lead to discovery, and every learner is empowered to be a change maker.

With warm regards and best wishes,

Deepali Upadhyay
Program Lead
Atal Innovation Mission, NITI Aayog

Message from UNICEF

The Atal Tinkering Laboratories (ATLs), established under the aegis of the Atal Innovation Mission (AIM) of NITI Aayog (National Institution for Transforming India Commission), represent a transformative initiative in reimagining the way children in middle and secondary grades learn. These innovative learning spaces provide students and teachers with opportunities to explore modern as well as traditional technological tools, engage in hands-on projects, and foster creativity through experiential learning. This aligns closely with the vision of the National Education Policy (NEP) 2020 and the 21st century skills framework, which are guiding schools across India in preparing children for the future.

The work done by the Departments of School Education in Andhra Pradesh, Karnataka, and Telangana to strengthen ATLs in partnership with UNICEF has yielded highly encouraging results. Teachers have responded positively to various capacity-building initiatives, delivered through both face-to-face and digital platforms, while students-girls and boys alike-have shown remarkable enthusiasm in utilizing these spaces. Several innovative ideas and examples of *design thinking in action*, some of which are presented in this handbook, have emerged from government schools in these states. A rigorous study to capture and analyse the outcomes of these initiatives is also being undertaken by UNICEF in collaboration with the respective state governments.

The Government of India's recent announcement to establish an additional 50,000 ATLs across the country is a welcome move which will help expand the reach of this innovative initiative, with one ATL catering to every three or four secondary schools and will also enable ATLs to serve as hubs for neighbouring schools that may not yet have such facilities.

This handbook has been developed as a practical resource for teachers, with the aim of supporting them in further advancing this exciting journey of tinkering, problem solving, discovery, and innovation. The handbook comprises two distinct sections:

- The first section introduces the principles and practice of Design Thinking in an accessible, illustrated format, enriched with case studies from government schools across Andhra Pradesh, Karnataka, and Telangana.

- The second section responds to a frequently expressed teacher concern-the need to meaningfully integrate ATL activities with the school curriculum. To this end, 40 sample activity plans are included, demonstrating how STEM (Science, Technology, Engineering, and Mathematics) concepts can be effectively reinforced through ATL resources and materials.

We believe that the implementation of these approaches and activity plans will not only provide children with engaging, but hands-on learning experiences that build their confidence, creativity, and problem-solving skills but also enhance the quality of education to enable better learning outcomes across the states.

It is my earnest hope that this handbook will complement the Government's efforts to make middle and secondary grades vibrant spaces of learning and innovation, equipping students with the skills and mindset required to contribute to the goals and aspirations of a developed nation by 2047.

With best regards,

Dr. Zelalem Birhanu Taffesse
Chief of Field Office
UNICEF Field Office for Andhra Pradesh, Karnataka and Telangana

Message from Vigyan Ashram

"Learning by doing" plays a vital role in nurturing understanding, creativity, and entrepreneurial skills in children. However, until recently, most schools lacked the necessary tools, equipment, and workshops to effectively implement this approach. The establishment of Atal Tinkering Labs (ATLs) has now made such opportunities accessible to schools.

Over the past three years, Vigyan Ashram, with the support of UNICEF and Samagra Shiksha, has conducted more than hundred online sessions for ATL teachers in Andhra Pradesh, Karnataka, and Telangana. In addition, several in-person training programs have been organized to help teachers effectively utilize ATL resources. Apart from this, we guided several schools in developing projects using the design thinking methodology to address challenges within their communities. During these programs, teachers developed projects that are useful for their classroom sessions and for their community, many of which form the basis of this manual. This manual is therefore a collaborative outcome, created in consultation with school teachers.

Tinkering extends far beyond electronics, 3D printing, coding, or mechanical projects—it is about fostering unstructured learning. Students are encouraged to explore ideas through experiments with food, waste materials, farming, biodiversity, and more. The projects compiled here are illustrative examples, intended to spark ideas and inspire teachers to guide students beyond the activities suggested. These projects serve as examples to inspire teachers about the many ways ATLs can be utilized.

In line with the National Education Policy (NEP) 2020, vocational education has been introduced from Grade 6 onwards. ATL labs provide the perfect platform for implementing vocational projects using the available tools and equipment. In fact, ATLs are not limited to STEM subjects; they are meant to support teachers across all disciplines in making their subjects more engaging and interactive.

We express our gratitude to UNICEF and the Samagra Shiksha teams of Andhra Pradesh, Karnataka, and Telangana for the continuous support they provided during the program. We look forward to many more innovative projects emerging from ATLs—projects that not only build on the examples provided here but also set new benchmarks in creativity and learning.

Dr Yogesh Kulkarni
Director
Vigyan Ashram

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Note for the Teacher

The Atal Tinkering Labs, with various technology tools, both traditional and modern, provide children and teachers a wonderful opportunity to learn by doing and through experience. This is emphasized in the NEP 2020 as an approach that should replace rote memorization.

Design Thinking is a powerful idea that is at the heart of this learning by doing. The Atal Tinkering Labs are perfectly placed to help teachers and students master and use the design thinking process to make learning enjoyable, meaningful and useful. This book is designed as a simple guide to help you explore the world of design thinking through real stories of students. It is not meant to be followed in a rigid way, but rather to encourage flexible, creative and hands-on engagement. At its heart, design thinking is about approaching problems with a wonderful curiosity, empathy and imagination. This book invites you to do just that, by stepping beyond conventional classroom methods and discovering learning through making, experimenting and reflecting.

The opening section of the book explains the importance and need for design thinking and why it matters in education today. It introduces the key steps of the process, illustrating it with simple examples that show how each stage works. The section also highlights the non-linear, iterative (meaning, doing something repeatedly to improve it) nature of design thinking and its essential features. Together, these pages give readers a clear foundation before moving into the next part of the book that features six detailed case studies (two each from the government run schools of AP, Telangana and Karnataka) that bring the process alive through real student projects.

Each of the six case studies in this book, some of which have been presented at competitions like Seed the Future Entrepreneur and ATL Marathon, follows the journey of students who identified challenges in their everyday lives and worked through the design thinking process to find solutions. The case studies follow a simple structure with the following sections – *How It Began, Empathise, Define, Ideate, Prototype, Test, Impact and Meet the Team.* These stages mirror the design thinking process and show how problems can be broken down and solved creatively. Alongside the main narrative, you will also find quotes, facts and reflective questions in the margins, as well as photos and illustrations that bring each journey to life.

At the end of each case study, you will find the actual design thinking formats that the students filled out. This shows in their own words how they understood the problem, explored possible solutions, built prototypes and reflected on what they learned. These filled formats provide a transparent look at the creative process and can serve as concrete examples for both teachers and students. These six case studies can also be taken forward as a way of extending the learning journey that started with design thinking and to explore their practical application. *A blank design thinking format has been included at the end of the book for the readers to use and create their own projects with solutions.*

For students, these examples are meant to spark confidence and inspiration showing that innovation is possible at any age, and that small efforts can lead to meaningful change. For teachers, the book can serve as a resource for practice-based learning, offering a way to bring creativity, critical thinking and collaboration into the classroom. Whether you are teaching, studying or simply curious, we hope you will use these stories as a starting point to design your own ideas and solutions, and to experience how creativity and empathy can shape real change.

Design Thinking

CHILDREN AS PROBLEM SOLVERS

DRYING SMARTER, SAVING BIGGER

In Penamaluru, grains often get spoiled due to rains or insects and pests. This causes severe losses to the farmers as it spoils their crops. Six students from Zilla Parishad High School, Penamaluru built a low-cost paddy dryer in their school's tinkering lab. How did a simple school project make such a big difference?

PEELING AWAY THE STRUGGLE

In many homes, peeling peanuts is a slow and tiring chore, often done by hand for hours. Seeing this daily effort, two students from Zilla Parishad High School, Karmanghat set out to create a simple, low-cost peanut peeler to save time and energy. How did such a small machine really simplify a tedious household task?

WHEN HANDS SPEAK

Moved by the daily struggle of a paralyzed elderly person, students from Government Girls High School, Basapattana built smart-hand gloves that enabled them to communicate their needs with simple finger gestures. How can a simple pair of gloves help in communication?

Wow! These real-life examples are truly impressive. It's inspiring to see how everyday challenges were solved through creative and innovative thinking. They highlight the power of fresh ideas in tackling problems that we often overlook.

BUT READING THESE STORIES HAS ALSO RAISED MANY QUESTIONS IN MY MIND...

How do I solve a problem that I have never faced before?

How can I think of new ways to solve problems I see every day?

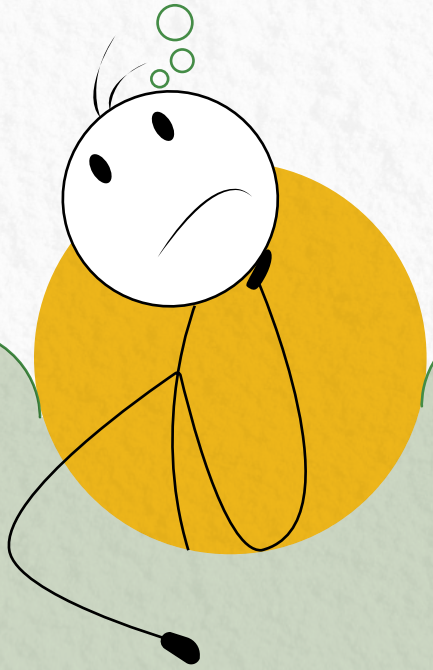
What are the different steps that I must follow if I want to come up with innovative solutions for a problem?

How can I teach this effectively to my students?

Is there a way in which I can turn my ideas into reality?

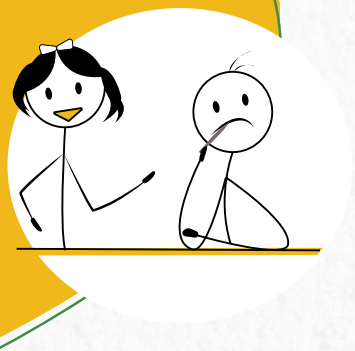
Do I have the right attitude and skills to innovate?

How do I make sure that the solution I design is useful for those who need it the most?



These questions mean you're already thinking like a problem solver!

You've started noticing issues around you and that's the first step. **DESIGN THINKING** isn't just about finding quick answers. It's also about following a process: staying curious, exploring ideas, testing them and improving them along the way.



"Design Thinking is a creative problem-solving approach that starts with understanding human needs and leads to innovative solutions. It encourages empathy, collaboration and curiosity. Instead of focusing only on the final outcome, Design Thinking builds a mindset of exploration, experimentation and continuous learning, helping us create solutions that are sustainable, meaningful and impactful."

DID YOU KNOW?

Design Thinking began in the 1960s and 70s with pioneers like Herbert Simon and the Stanford Design School. It started in fields like architecture and industrial design, but quickly evolved into a powerful tool for solving all kinds of problems.

By the 1980s and 90s, companies like IDEO were using it for product design and innovation. In the 2000s, it spread into healthcare, education, and technology due to its extensive focus on empathy, collaboration and human-centered solutions.

WHY DO WE NEED DESIGN THINKING?

Students noticed that many plants in their school were dying during summer or long holidays. How can we design a simple watering system to keep them alive even when no one is around?

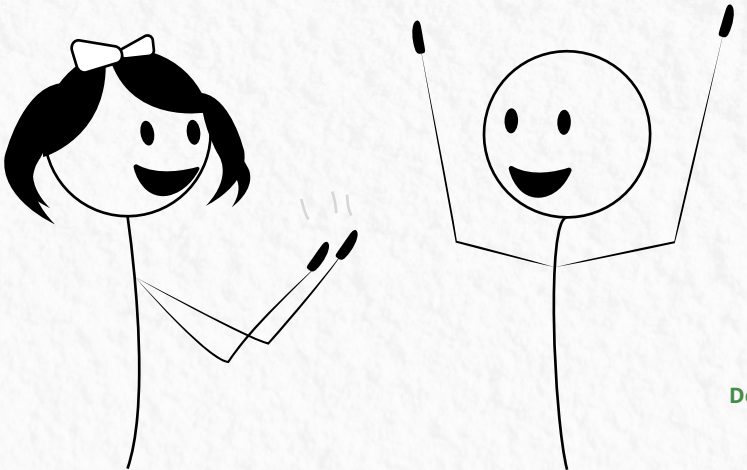
Students noticed that the classroom often gets cluttered with scattered supplies and materials. How can we design a simple, easy-to-use system to keep things organized and easy to find?

WE NEED DESIGN THINKING TO SOLVE PROBLEMS LIKE THESE!

How does design thinking help students?

- Helps students deal with new and unexpected challenges.
- Encourages thinking, not just memorizing.
- Teaches teamwork and collaborative thinking.
- Nurtures creativity, resilience, and innovation.

DESIGN THINKING is the belief that anyone can create change, no matter how big the problem, how little the time, or how limited the resources.



KEY FEATURES OF DESIGN THINKING

HUMAN CENTRIC
Focuses on understanding the needs, emotions and experiences of people

CHALLENGES BIASES & ASSUMPTIONS
Pushes us to think beyond assumptions and explore bold, new ideas by thinking outside the box

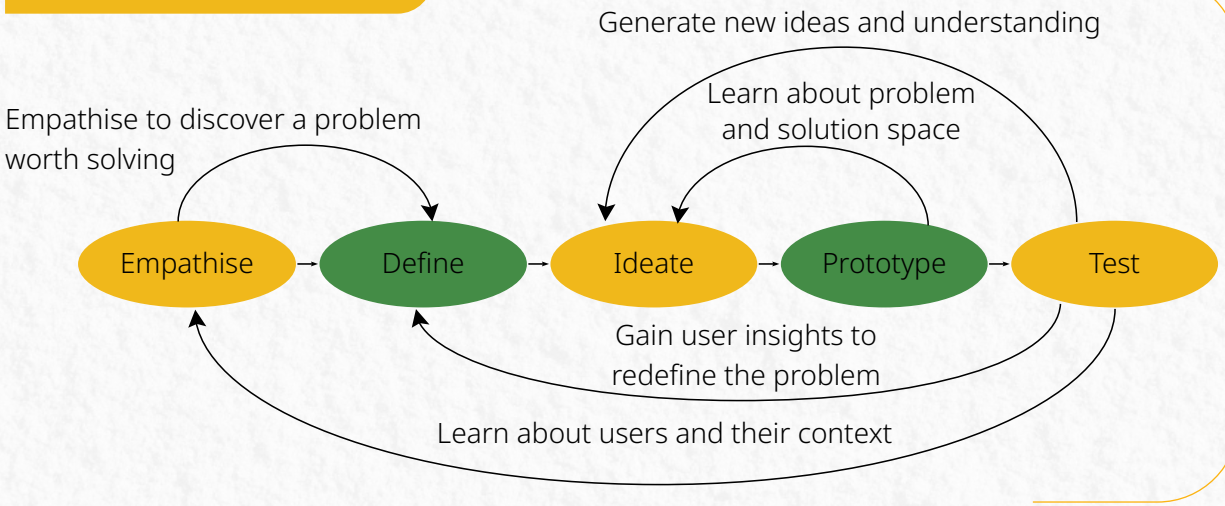
VALUES FEEDBACK
Uses feedback continuously to refine and improve solutions that truly work

ITERATIVE
Involves testing, learning and improving repeatedly, at all stages

INCLUSIVE
Brings in diverse voices to design solutions that work for everyone

NONLINEAR
Allows flexible movement between stages as new ideas and insights emerge

STAGES IN DESIGN THINKING



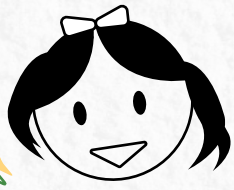
This flexibility is one of the biggest strengths of the Design Thinking framework.

Design Thinking isn't a straight line - you can move back and forth between the different stages, using new insights to rethink the problem and refine your ideas.

HOW TO ENGAGE IN THE PROCESS OF DESIGN THINKING?

So far, I have understood what Design Thinking is, how it became popular, and some of its key features.

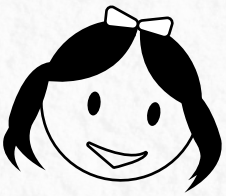
That is great!



But how do I actually use Design Thinking? Are there steps to follow?

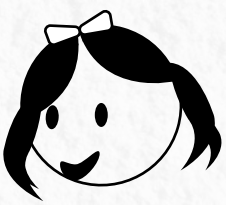
Yes! Design Thinking follows a step-by-step process. Let me explain with an example.

Imagine your teacher asks you to plan a fun day of activities for your entire class. Would you come up with the plan on your own?



Of course not! All my classmates might not enjoy the same things as me. Everyone has different likes and dislikes.

Exactly. So instead of guessing, you would first talk to your classmates to understand what they enjoy. Then you would create a rough plan, brainstorm ideas with your teacher and friends. You would then try out a few activities and improve the plan based on what worked.



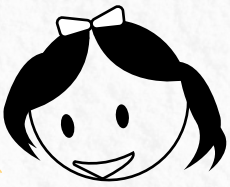
Yes! That is similar to what I did!

1. I spoke to my classmates to understand what they like and included their opinions.
2. I developed an outline of the plan based on that.
3. Together with my teacher and classmates, I came up with ideas for different activities.
4. I tried out some of these activities so that I can improve them based on feedback.
5. I have my final plan ready!

Wonderful! But what if your classmates did not enjoy the activities when you tested them? What will you do then?

Then I would go back, get more feedback, and try again. I remember Design Thinking is a non-linear process.

Wow, you are already thinking like a designer! It's all about involving people at every stage and building better ideas with them.



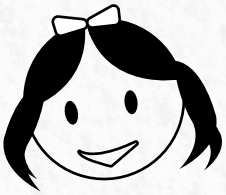
But wait! I have a doubt. Where is the product here in this example? I thought Design Thinking is only used to make things.

Good question! Design Thinking is used to create products but more than anything, it's a mindset to solve problems creatively and thoughtfully.

Now let's look at the five key steps of Design Thinking:

Empathise, Define, Ideate, Prototype and Test.

Don't be afraid of these big words. We will learn more about them together.



Okay. I am excited to learn!

5 KEY STEPS IN THE PROCESS OF DESIGN THINKING

1 EMPATHISE

Understand the needs, emotions and challenges of people you are designing for by observing, listening and engaging with them

2 DEFINE

Articulate the problem statement clearly based on observations and insights during the Empathise phase

3 IDEATE

Generate a wide range of ideas and solutions through collaboration and creativity

4 PROTOTYPE

Build simple, cost-effective models of solutions to check whether they work and to receive feedback

5 TEST

Evaluate the prototype to gather feedback from real-time testing and make required improvements to make the design solution ready

It is important to keep in mind that DESIGN THINKING is non-linear. This means you can move from one step to the other at any time depending on how the process is unfolding.

EMPATHISE

Empathy is the first step in design thinking and it helps us understand the people we are designing for.

> Very few things in life are as meaningful as seeing our innovation being used by the people who genuinely need it.
>
> *K. Nandini, Student*
> *ZPHS Bhiknoor, Kamareddy*
> *Telangana*

GOAL

To connect deeply with users and understand their feelings, experiences, and the impact the problem has on their lives.

WHAT TO DO

Through empathy, place yourself in the position of others, and understand their wants, needs and experiences. Develop insights into what moves and motivates them and what troubles them. Understand how the problem is affecting their daily life and the challenges they are facing everyday because of it.

METHODS

- Conduct observations and analysis.
- Undertake photo and video studies.
- Interview users.
- Experience the problem by being a user yourself.
- Create empathy maps to structure all the information based on how users think, feel, say and do, including their needs, wants, obstacles and fears.

REMEMBER !

- Have an open mindset and set aside your assumptions and biases.
- Listen carefully, and engage fully without judgement.
- Probe further by asking questions to get deeper insights.

DEFINE

The next step is Define, wherein we define the problem as clearly and in as much detail as possible.

> Defining the problem statement clearly gave us the confidence that we are one step closer to solving the problem.
>
> *Venkanna Pujar, ATL Teacher*
> *GGHS Basapattana, Koppal*
> *Karnataka*

GOAL

To recognize core challenges and clearly define the problem statement.

WHAT TO DO

Organize and analyze all the information gathered. Look for recurring patterns, such as user pain points and unmet needs. Using this, write a clear problem statement that captures the most important challenge to solve. A well-defined problem brings focus to the team, ensures everyone is aligned from the start, and sets the stage for creative solutions.

METHODS

- Synthesize insights and find patterns.
- Create problem statements that summarize the key issues.
- Develop user personas (user profiles) to represent key segments (characteristics, needs and behaviours) of the target audience.
- Build journey maps to visualize the user's experience, highlighting pain points and opportunities.
- Define clear design challenges that focus on the user's needs, rather than just features or solutions.

REMEMBER !

- Be clear and specific in defining the problem statement. Do not be vague.
- Focus on user needs by always linking the problem back to the user's experiences.
- Involve the whole team to include different perspectives and understanding of the problem.

iDEATE

The next step is Ideate, which is the most creative phase of Design Thinking, where we find solutions to the problem by letting our imagination run wild.

> All of us had such wonderful ideas! Discussing these ideas brought us closer as a team.
>
> *Shilpa, Student*
> *GHS Kombettu, Dakshina Kannada*
> *Karnataka*

GOAL

To generate as many innovative ideas as possible without any restrictions or limitations.

WHAT TO DO

During the phase of ideation, bring together different perspectives and build on each other's strengths. Do not focus on finding the one "right" idea, but on thinking beyond the obvious. Challenge each other's assumptions. It is very important to ask better questions, explore different angles, and push creative boundaries together. Ideation thrives in an open, judgment-free space where everyone feels safe to share.

METHODS

- Brainstorm to generate as many ideas as possible, no matter how big or small.
- Build mindmaps to visually connect and explore different aspects of the problem.
- Sketch or doodle to quickly visualize ideas and concepts.
- Use reverse thinking to approach the problem from a different angle by considering opposite or impossible ideas.

REMEMBER !

- Never settle on the first idea and keep generating as many ideas as possible.
- Be open to all possibilities and out-of-the-box ideas.
- Do not criticise any idea or anyone for coming up with an idea, even if it seems like it will not work.

PROTOTYPE

The fourth step of Design Thinking is Prototype, which is where all ideas become real, as we move from thinking to doing.

> In my opinion, the hands-on experience during the Prototype phase teaches students much more than several days of teaching in the classroom.
>
> *BLVN Anand Babu, ATL Teacher*
> *GHS Korukonda, East Godavari*
> *Andhra Pradesh*

GOAL

To build a quick, inexpensive and scaled down version of the design for the solution identified in the previous phases.

WHAT TO DO

In this phase, start with a rough version of your design just enough to try it out and get feedback. This phase is all about experimenting, learning what works and what doesn't, and making improvements. Prototypes can help identify problems early, improve user experience, and guide the next version. Each round of feedback is one step closer to a better solution.

METHODS

- Paper prototyping for quick, low-cost models that allow easy changes.
- 3D modeling or rapid prototyping using simple materials or technology (e.g., 3D printers) to create more advanced models.
- Storyboarding to visualize the user experience and key interactions through illustrations.
- Role-playing to act out scenarios and better understand user interactions with the design.

REMEMBER !

- Build the first design quickly and with very few resources.
- Focus on key aspects of the design and make a rough prototype.
- Get feedback from users as early as you can, to be able to incorporate their comments.

TEST

The Testing phase is where ideas meet the real-world. It gives us the chance to check whether the solution effectively solves the problem.

"The testing day is still in front of my eyes! I remember the farmer's face lighting up with joy as our design addressed all his concerns!"

Mohammad Razak, Student
ZPHS Penamaluru, Krishna
Andhra Pradesh

GOAL

To test the designed solution in real world with real users.

WHAT TO DO

The testing phase is an invaluable opportunity to gain insights into who we are designing for, and to check whether our design meets the purpose. The testing phase gives us information on whether the end users like the product, and if the solution solves their problem, and what improvements can be further made.

METHODS

- Real-time user testing to get real users to interact with prototypes and identify pain points.
- Surveys and questionnaires to gather quantitative and qualitative feedback on the product.
- Observation and shadowing techniques to understand how users interact with the prototype in real contexts.

REMEMBER !

- Gather feedback from the actual end-users.
- Have an open mindset to make required changes, even if they are significant ones.
- View testing as an opportunity to improve your ideas and designs.

Case Studies: Stories That Inspire

Case Study 01

Paddy Dryer

A Sustainable Solution for Protecting Crops in Rural India

Zilla Parishad High School
Penamaluru
Krishna, Andhra Pradesh

Penamaluru, a farming region in Andhra Pradesh, is home to families that depend entirely on agriculture for their livelihood. But frequent rains during harvest season often spoil grains, causing major crop losses and financial stress. On top of that, pests like rats and insects make it even harder for farmers to protect their grains.

What did the students of ZPHS Penamaluru do to solve a problem this big?

How it All Began

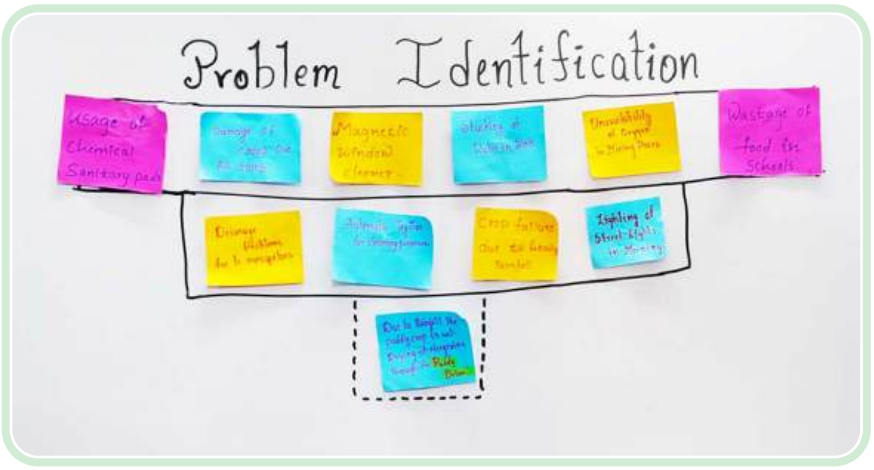
Background and Context

Their journey began with a simple question: "What problem do we want to solve?"

At ZPHS Penamaluru, six students who were curious, creative and eager to learn found themselves drawn to the school's Atal Tinkering Lab. The space, equipped with tools and materials, became their playground for ideas. What began as simple tinkering soon turned into focused problem-solving. Every day after school, they gathered in the lab to learn, experiment and imagine new possibilities.

As they spent more time together, their casual discussions grew into deeper conversations about real problems in their surroundings. With encouragement from their teacher, each student spent a week observing their community and listing issues they felt needed

attention. Their ideas included an automatic reading machine for hospital patients, oxygen supply devices for miners, and sensor-based streetlights.



But one challenge stood out: the struggles of farmers in their own families and neighborhoods, who lost crops every year due to rain and pests.

The students realized that this was the problem they wanted to solve. Not just to build something, but to make a difference.

If you could solve one problem in your school or community, what would it be?

You can start by observing what is around you, just like these students.

Empathise

Understanding the Struggles

The students knew that they had to fully understand the problem before solving it. This meant that they needed to know the current processes used by the farmers, their struggles and pain points. So, they set out to meet the farmers in their community.

"Empathy is about feeling someone else's problem like it's your own."

They spoke to five local farmers and keenly listened to their stories. They discovered that the farmers usually spread their crops on the ground to dry. This process was slow, inefficient and risky. With the constant threat of rain, drying grains on the open fields was not feasible as it exposed the crops to pests that would ruin the crops further. The farmers also told the students that wet grains not only meant spoilage, but also loss of quality and resulted in lower market prices.

In those conversations and observations, the students could feel the weight of the farmers' struggles, and they realised the urgency of finding a solution that would protect the crops from both the weather and pests.

Define

Framing the Problem

After listening closely to the farmers and observing their daily challenges, the students worked together to clearly define the problem they wanted to solve.

Design Tip

A good problem statement is like a compass: it shows your team exactly where to go and why.

They discussed what they had seen and heard, identifying common pain points and recurring issues. They clearly defined the challenge through a problem statement.

Problem Statement

> **Farmers in Penamaluru lose crops due to moisture from rain, which causes the grains to spoil, leading to financial losses and food wastage. There is a need for an affordable, effective and sustainable way to dry grains quickly and efficiently after rainfall.**

This shared understanding through the problem statement helped align their efforts and set the direction for all the work ahead.

Ideate

Brainstorming Solutions

With a clear problem in front of them, all the students agreed that their design should be affordable, practical and easy to use for farmers.

They held multiple brainstorming sessions, where every idea was welcomed. From simple sketches to detailed concepts, they built on each other's thoughts and challenged themselves to think beyond the obvious. Finally, they settled on the idea of an eco-friendly grain dryer.

As a first step, they began sketching possible designs. They first sketched a round bowl-like shape but after discussions, they realised a rectangular structure was better as it allowed for better stability, airflow and moisture removal. With each new sketch, they discovered newer ways to improve their idea - adding fans, adjusting the size, and even including a transparent sheet to protect the grains.

Did You Know?

The word brainstorming was coined in 1942 and it is still one of the best ways to generate bold new ideas!

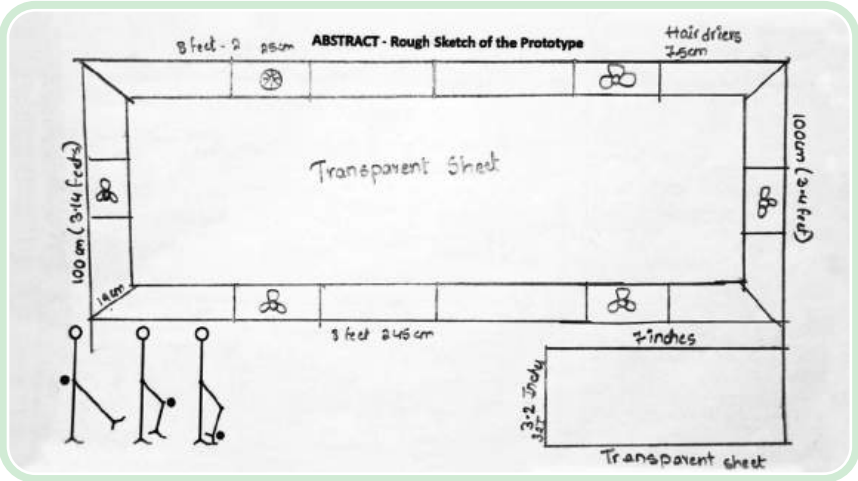
Prototype

Turning Ideas into Reality

Once they finalised their idea, the students moved to the prototyping stage, turning their concept into a working model. Using simple materials like pipes, sheets and fans, they built the first version of their grain dryer on a rectangular frame.

But as they tested it, problems began to emerge. Grains would fly out without a cover, and moisture wasn't being removed effectively. Still, this early version gave them crucial feedback.

Using these insights, the students made many improvements. They added a transparent cover to keep grains inside, installed adjustable vents for better moisture control and placed fans on all four sides to improve airflow. With every change, their design became more practical and effective.



Design Tip

Don't wait to build something perfect. A rough model is better than a perfect idea stuck in your head.

Test

Trying the Solution in the Real World

"Seeing farmers use the design we built made us feel like we were using our education to help others."

Finally, the moment the students had been working toward arrived. They could test their final prototype with real users in real conditions.

They took the grain dryer to the fields and worked closely with local farmers to see how it performed. The farmers were initially unsure about the design but soon they watched with growing interest as the device began to show promising results. Encouraged by the outcome, they shared valuable feedback and suggestions for improvement.

The students used this input to make further refinements and also tested the dryer on different types of grains to check its versatility. Seeing the device in action, the farmers appreciated both the practicality of the solution and the students' deep involvement in addressing a real community problem.

What curricular topics did the students learn through the project?

Maths:
Practical Geometry, Surface Areas and Volumes

Science:
Crop Production and Management, Matter in our Surroundings, Sustainable Management of Food Resources, Heat

Impact

Making a Difference in the Community

The grain dryer helped farmers reduce crop loss and dry grains more efficiently, even during unpredictable weather. For the students, it proved that real change can start right from the classroom.

Meet the Team

Students' Names from ZPHS Penamalaru, Krishna, Andhra Pradesh

Teacher
(extreme left):

- D. V. Subbarao

Students
(from left to right):

- Nandam Manoj Sai
- Mohammad Razak
- Gunti Tarun Sai Ram
- Nadipineni Tejasri
- Rachapalli Pavani
- Chintha Loka Sai Sree Nandini

What did the students find most exciting?

Seeing all our hard work come to fruition was the most exciting part of the journey for us!

What did the students find most difficult?

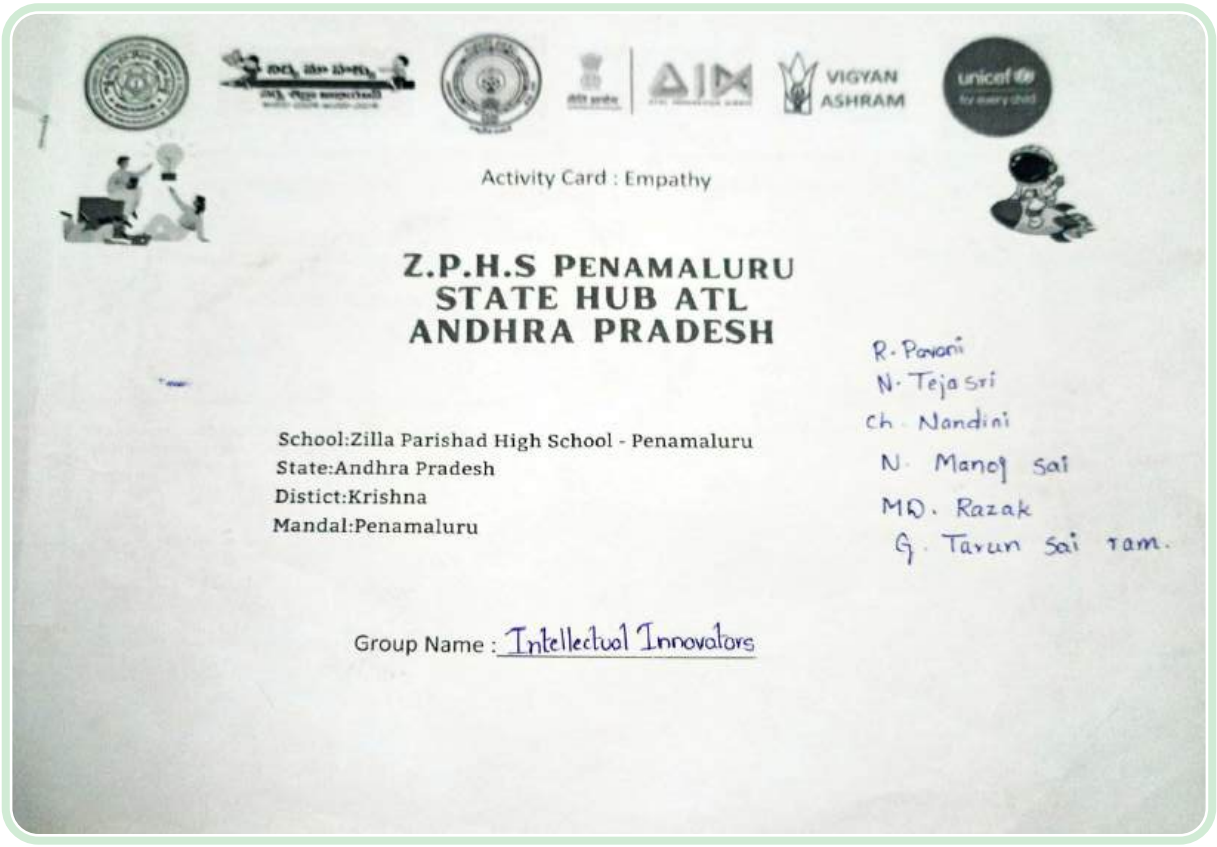
The repeated iterations and improvements to the design made us feel that we would never be able to finish the design. That felt frustrating.

What did the students learn through this process?

We learnt how important communication and teamwork are. The real purpose of education is to solve problems and make life easy for others.

Note: This project was undertaken in the year 2023.

Design Thinking Format



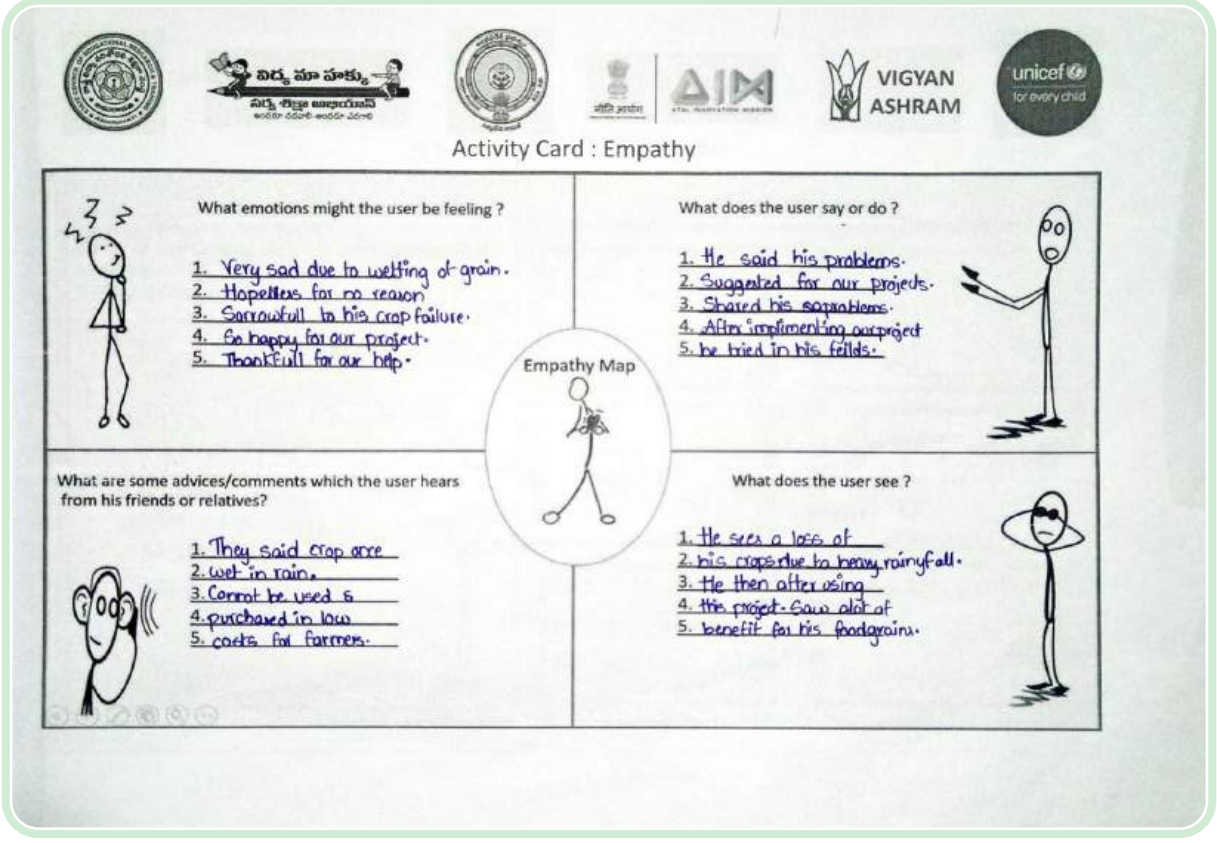
Activity Card : Empathy

Z.P.H.S PENAMALURU
STATE HUB ATL
ANDHRA PRADESH

School:Zilla Parishad High School - Penamaluru
State:Andhra Pradesh
Distict:Krishna
Mandal:Penamaluru

R. Pavani
N. Tejasri
Ch. Nandini
N. Manoj Sai
MD. Razak
G. Tarun Sai ram.

Group Name : Intellectual Innovators



Activity Card : Empathy

What emotions might the user be feeling ?

1. Very sad due to wetting of grain.
2. Hopelless for no reason
3. Sorrowfull to his crop failure.
4. So happy for our project.
5. Thankfull for our help.

What does the user say or do ?

1. He said his problems.
2. Suggested for our projects.
3. Shared his sorrowproblems.
4. After implimenting our project
5. he tried in his fields.

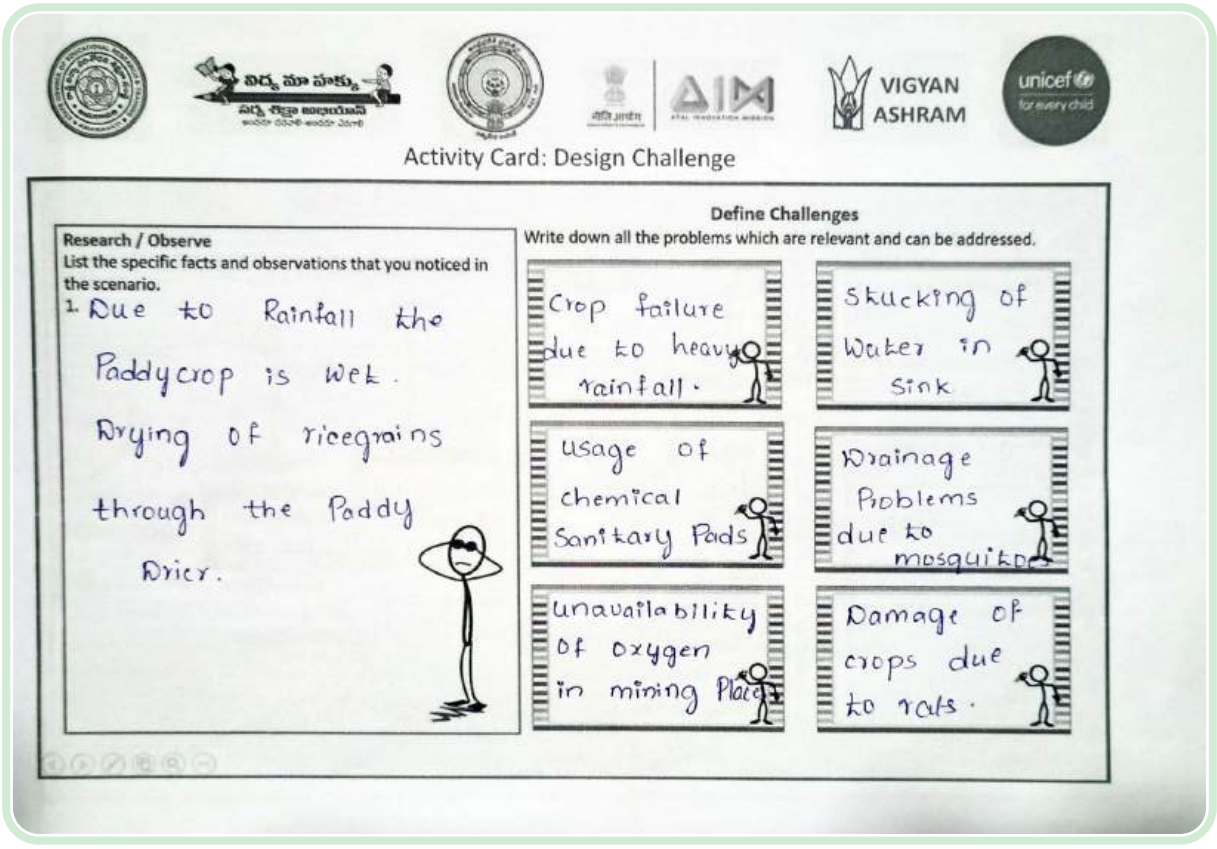
Empathy Map

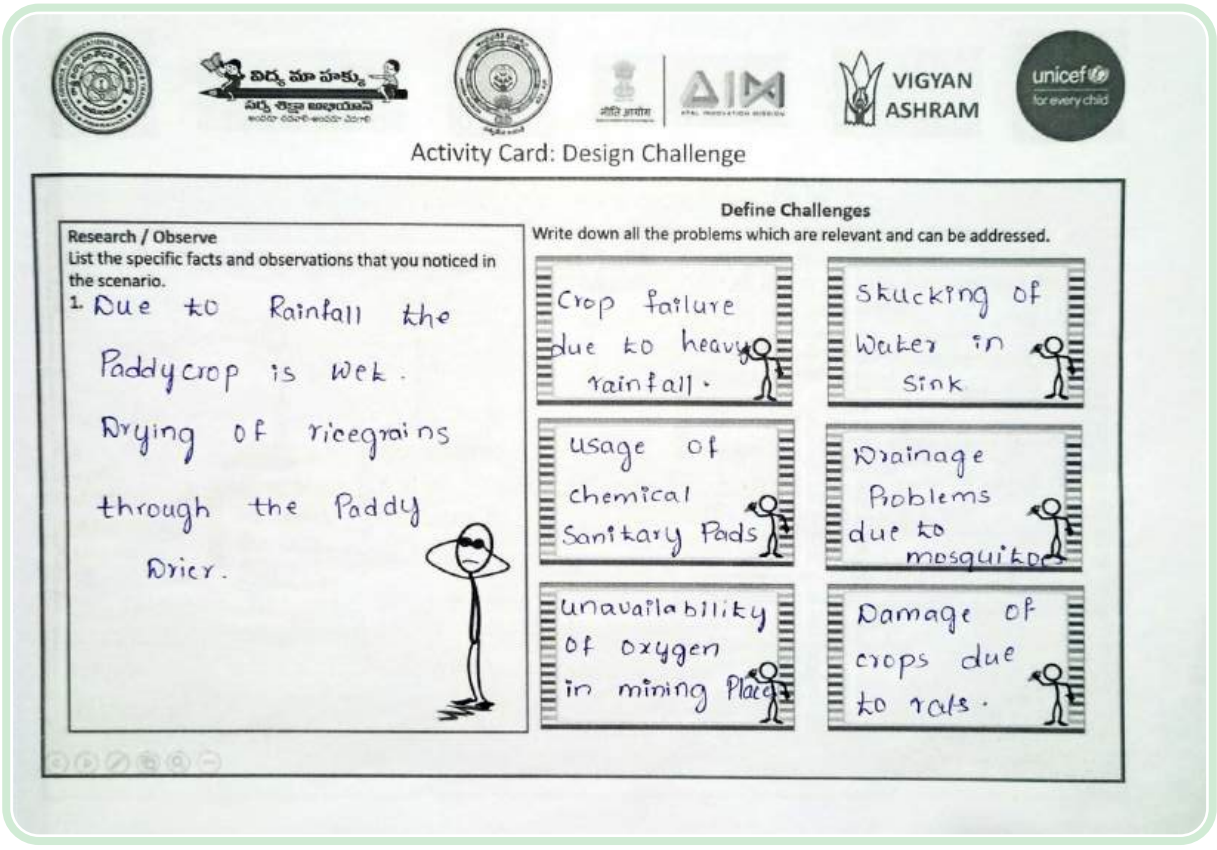
What are some advices/comments which the user hears from his friends or relatives?

1. They said crop once
2. wet in rain.
3. Cannot be used 6
4. purchased in low
5. costs for farmers.

What does the user see ?

1. He sees a loss of
2. his crop due to heavy rainyfall.
3. He then after using
4. the project. Saw alot of
5. benefit for his foodgrains.


VIGYAN ASHRAM
unicef
for every child
Activity Card: Design Challenge
Research / Observe
List the specific facts and observations that you noticed in the scenario.
1. Due to Rainfall the Paddycrop is wek.
Drying of ricegrains through the Paddy Drier.
Define Challenges
Write down all the problems which are relevant and can be addressed.
Crop failure due to heavy rainfall.
Skucking of Water in Sink
usage of chemical Sanitary Pads
Drainage Poblems due to mosquitos
unavailability of oxygen in mining Place
Damage of crops due to rats.


VIGYAN ASHRAM
unicef
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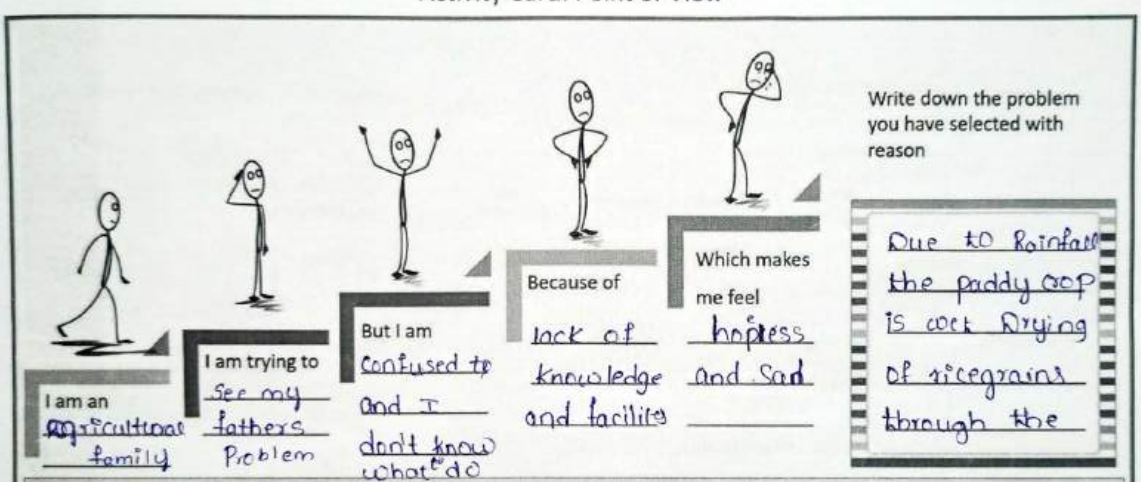
unavailability of oxygen in mining Place
Damage of crops due to rats.

Activity Card: Point of View



I am an agricultural family

I am trying to See my fathers Problem

But I am confused to and I don't know what to do

Because of lack of knowledge and facilities

Which makes me feel hopless and Sad

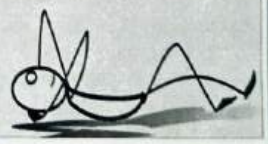
Write down the problem you have selected with reason

Due to Rainfall the paddy crop is wet Drying of rice grains through the

Point of View Statement

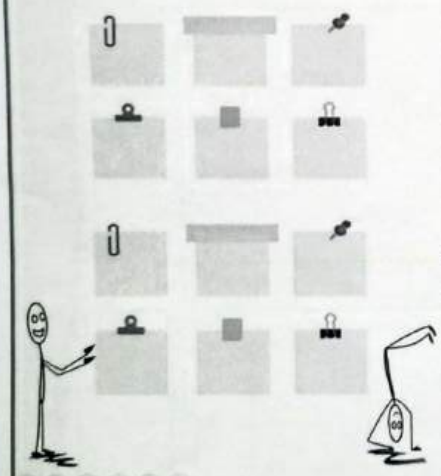
Write a sentence that summarizes the problem you want to solve

By making a project named Paddy drier.



Activity Card: Ideate

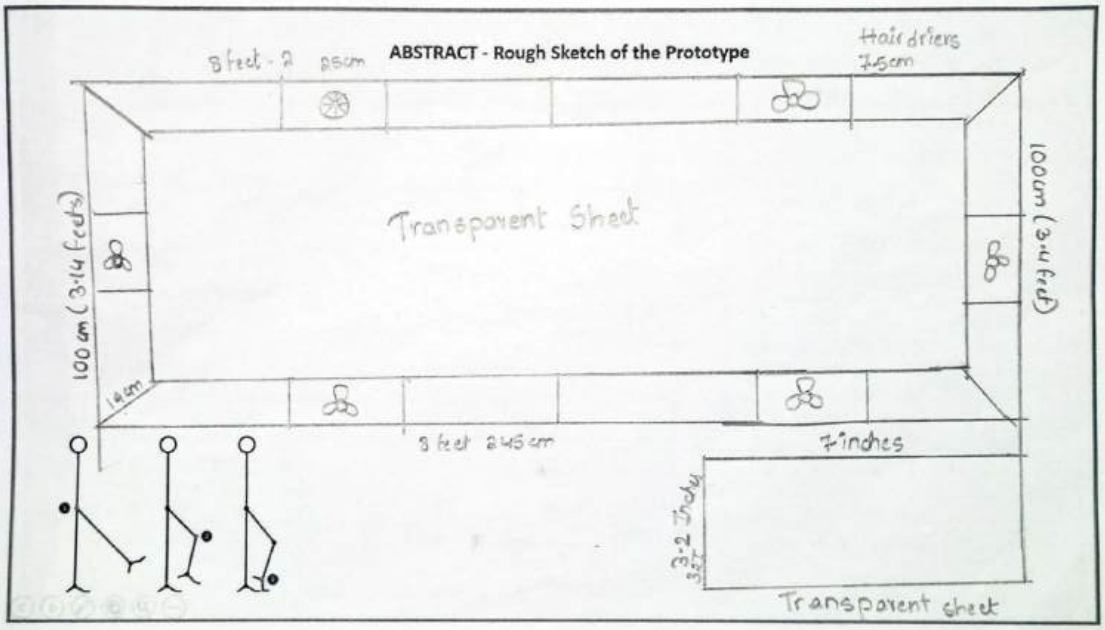
Generate ideas to solve the problem



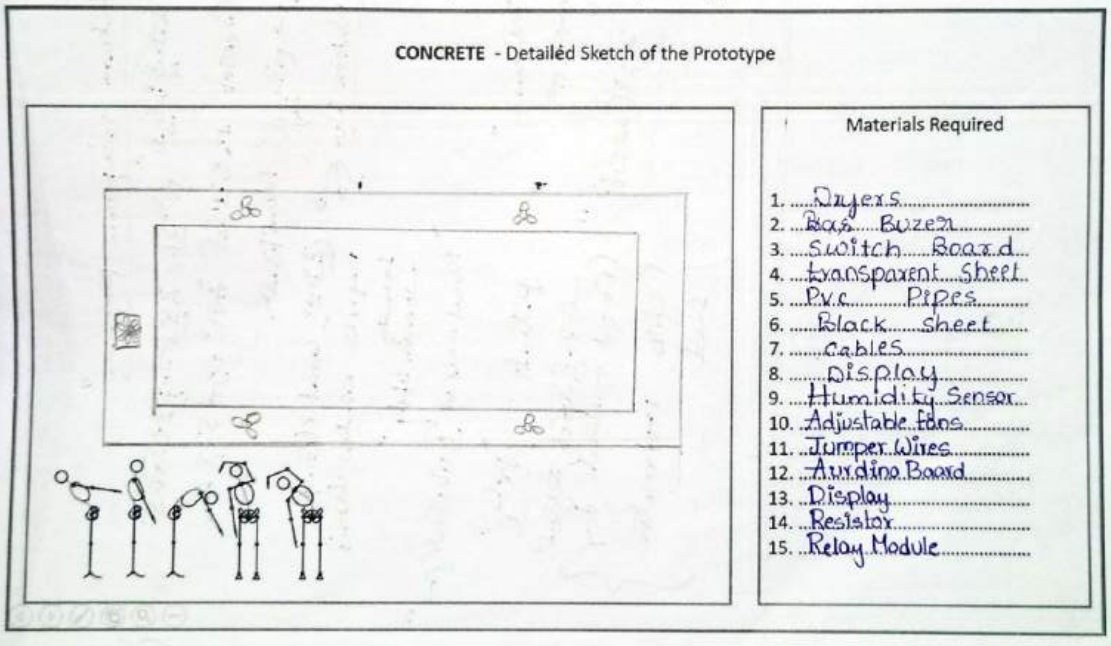
Arriving at the right design

Ideas Generated	Uniqueness	Ease of use	Ease of design	Durability	Feasibility
from young framers daughter	✓ Not copied	✓	✓	2 year 9 months	Easy to carry.

Activity Card: Abstract prototype



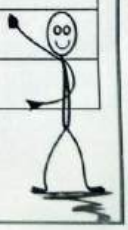
Activity Card : Concrete prototype



Activity Card : Test – Questions

USER TESTING QUESTIONS

Sl.No	User Testing Questions	Remarks
1.	What do you like and dislike about this prototype?	I like this project as it helps to dry the paddy grains. Nothing to dislike.
2.	What could be done to make "you want" to use this prototype more?	Because of my father is a farmer. I see my father Problem. so I design this Protype
3.	What do you think of how the prototype looks (the aesthetics)?	look like Cuboid.
4.	Is this prototype efficient, safe, and comfortable to use? If not, how could it be improved to make it user friendly ?	Safe, comfortable to us. less cost in money.
5.	What are the problems with this prototype?	Nothing.
6.	What can be done to solve these problems?	Nothing.



Activity Card : Test – Observations

USER TESTING OBSERVATIONS

Observations

1. What does the user do with this prototype?

The user can dry any thing

2. What are the user's perceptions of the prototype?

It can be used in multiple purpose like

3. How successful or unsuccessful does the user think the prototype is?

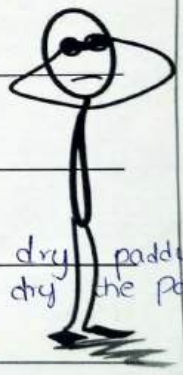
The user think the prototype is successful.

4. How does it meet or fail the user's needs?

wet paddy can't be purchased anyone. only dry paddy can be purchased. So, this project dry the paddy

5. How safe is the prototype?

Time saving.



Case Study 02

Smart Sprayer

A Lightweight, Long-Lasting Solution for Farmers

Government High School Korukonda
East Godavari, Andhra Pradesh

Farmers in Korukonda struggle with heavy, inefficient pesticide sprayers that strain their backs and cause them exhaustion. Short battery life, long charging times, and sudden failures make their work even harder.

What did a group of students from GHS Korukonda do to make the lives of farmers better?

How it All Began

Background and Context

When the Atal Tinkering Lab was first set up at GHS Korukonda, it sparked instant curiosity among students. For many, it was their first time seeing such tools, machines and materials up close. The lab became a place where they were free to imagine solutions to any problem. As students started experimenting, building and testing small ideas, they realised they could use this space to solve real problems around them.

Most students at the school come from farming families. From an early age, they had watched their parents and relatives toil in the fields, using outdated tools and hard physical labour. One such tool was the pesticide sprayer, a heavy device that needed to be carried for atleast 6-8 hours every day. On top of that, this device had a very short battery life. After discussing with their ATL teacher, the students realised the immediate need to improve the design of the pesticide sprayer.

"We were shocked to know that such a common device used by farmers everyday in the field was still so uncomfortable and difficult to use."

Empathise

Understanding the Struggles

The students started by talking to relatives and local farmers who used the pesticide sprayers every day. They listened carefully to the physical strain that came with carrying such heavy devices on their backs across large fields everyday for almost 8 hours. Most of that weight came from the battery alone, which could weigh up to 1.5 kg. The battery often failed without warning, forcing farmers to pause work or carry a backup, adding to their stress.

They also realised that farmers still used old lead-acid batteries for the pesticide sprayer, despite the availability of better technology. These lead-acid batteries with a lifespan of just 1.5 to 2 years, discharged quickly during the day, and could short-circuit if water seeped into the device. When the students asked why farmers still relied on them, the answer was simple: cost. Farmers accepted these limitations not because the technology was better, but because it was more affordable.

Did You Know?

Imagine carrying three bricks in your school bag for 8 hours straight. That's how heavy pesticide sprayers feel for many farmers every day!

Define

Framing the Problem

Based on their conversations and observations, the students identified a serious gap in the existing pesticide sprayer. They framed a clear design challenge based on this.

"The real challenge wasn't building something new. It was improving something that already existed."

Problem Statement

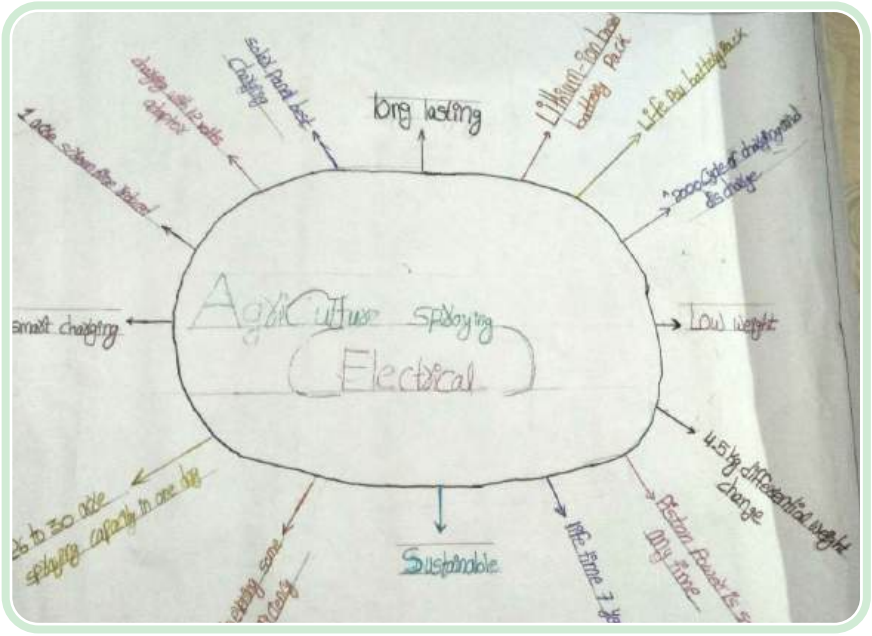
> **Farmers are forced to carry heavy, outdated pesticide sprayers with poor battery performance, which leads to physical strain, inefficiency and safety risks. A new solution is needed to reduce the weight, improve reliability, and make the sprayer safer and easier to use.**

They listed out all the problems that the farmers were facing currently: the sprayers were too heavy, the lead-acid batteries had a short lifespan, charging took too long, and unexpected shutdowns created major issues in the middle of fieldwork.

They realised that what farmers needed was not just a new battery, but a smarter, safer and more efficient system.

Ideate

Brainstorming Solutions



Armed with insights from their community, the students gathered in their lab to brainstorm. They asked bold questions: *What if the battery was lighter? What if it lasted longer? What if it could charge while farmers worked?* The idea of replacing the old batteries with something newer, safer, and more efficient became their focus. They researched different battery types and consulted their teachers to understand the pros and cons.

After much deliberation, they settled on lithium iron phosphate ($LiFePO_4$) batteries known for being lightweight, longer-lasting and safer. They added a Battery Management System (BMS) to regulate the energy flow and prevent overheating. Realising that farmers spent hours under the sun, they even added solar charging as a bonus feature. Their mission wasn't just to invent – it was to upgrade an existing tool so it worked better for the people who relied on it every day.

Did You Know?

Lithium iron phosphate ($LiFePO_4$) batteries are up to 3 times lighter and can last nearly 7 years, compared to just 1.5–2 years for traditional lead-acid batteries.

Prototype

Turning Ideas into Reality

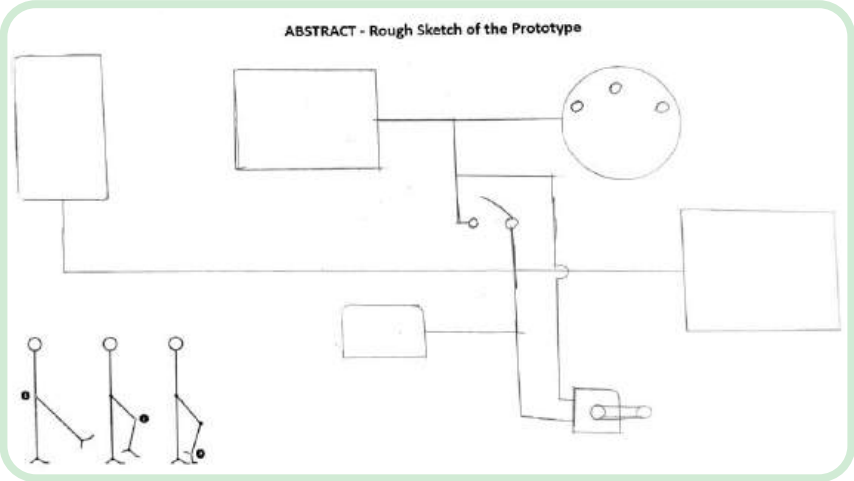
The students underwent hands-on training at a local workshop to better understand battery components and circuitry. With this foundational knowledge, they began constructing the battery pack themselves. They carefully tested various series and parallel combinations to achieve optimal power output. Using lightweight materials, they assembled the packs with protective outer layers, wiring strips, and integrated a Battery Management System (BMS) for safety and efficiency. To make it even more farmer-friendly, they added solar charging capability so the sprayer could be recharged using sunlight in the fields.

Design Tip

When something doesn't work the first time, don't give up! Every version teaches you what to improve next.

Early trials, however, were far from perfect. The students encountered several technical issues such as uneven energy distribution, heat buildup in certain sections, and unstable output. Each setback pushed them back to the drawing board. They reconfigured layouts, adjusted battery arrangements, and fine-tuned the BMS setup until the performance stabilised. It took patience, collaboration and repeated testing, but eventually, the prototype ran smoothly and delivered consistent power.

What's the biggest challenge farmers face in your area and how would you solve it?



Test

Validating the Solution

Once the students had a working prototype, they asked a local farmer to try it out in the field. The response was encouraging as the farmer immediately noticed how much lighter it was compared to the usual sprayer, and appreciated that the battery lasted longer.

As word spread, more farmers in the area grew interested and were happy to see what the students were building. The students, in turn, felt proud that their effort could ease the everyday burdens of their own families and community.

What curricular topics did the students learn through the project?

Science:
Electricity, Renewable Energy, Sources of Energy, Work and Energy, Physical and Chemical Changes, Acids, Bases and Salt, Light, Chemical Effects of Electric Current

Impact

Making a Difference in the Community

The new pesticide sprayer reduced physical strain on farmers and made spraying faster, safer and more reliable. It empowered students to directly improve the lives of their families and communities through innovation.

Meet the Team

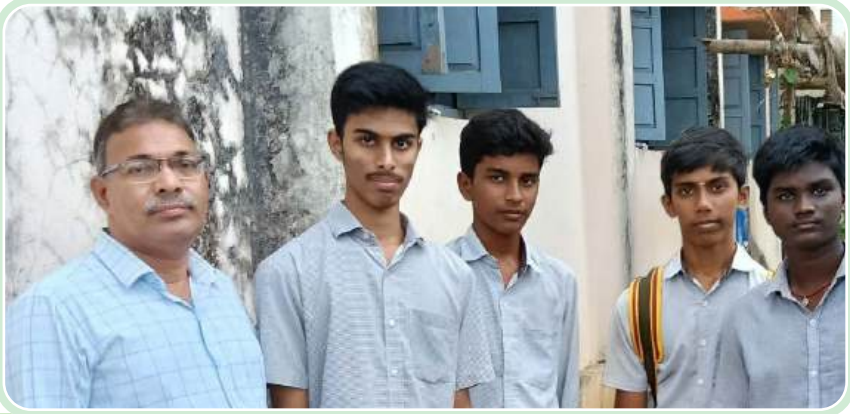
Students' Names from GHS, Korukonda, East Godavari, Andhra Pradesh

Teacher
(extreme left):

- BLVN Anand Babu

Students
(from left to right):

- I. Venkat Charan
- B. Lalithendra
- M. Venkat
- G. Vasu



What did the students find most exciting?

Learning new things in the workshop, and building the battery ourselves was actually the best part!

What did the students find most difficult?

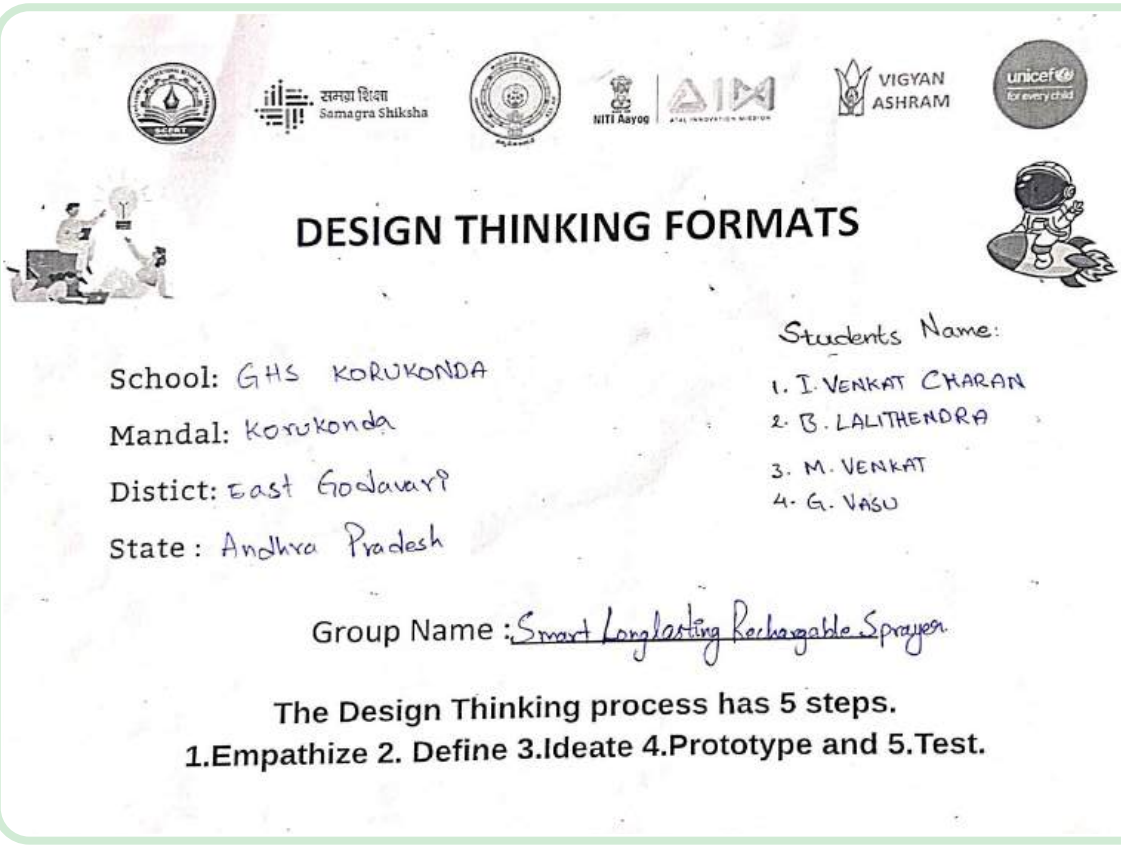
There were so many problems during testing — like how to balance the batteries and stop overheating. We had to keep changing the setup again and again!

What did the students learn through this process?

There is so much difference in our communication and confidence levels now. We never knew that learning can be so much fun.

Note: This project was undertaken in the year 2023.

Design Thinking Format



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DESIGN THINKING FORMATS

School: GHS KORUKONDA

Mandal: Korukonda

Distict: East Godavari

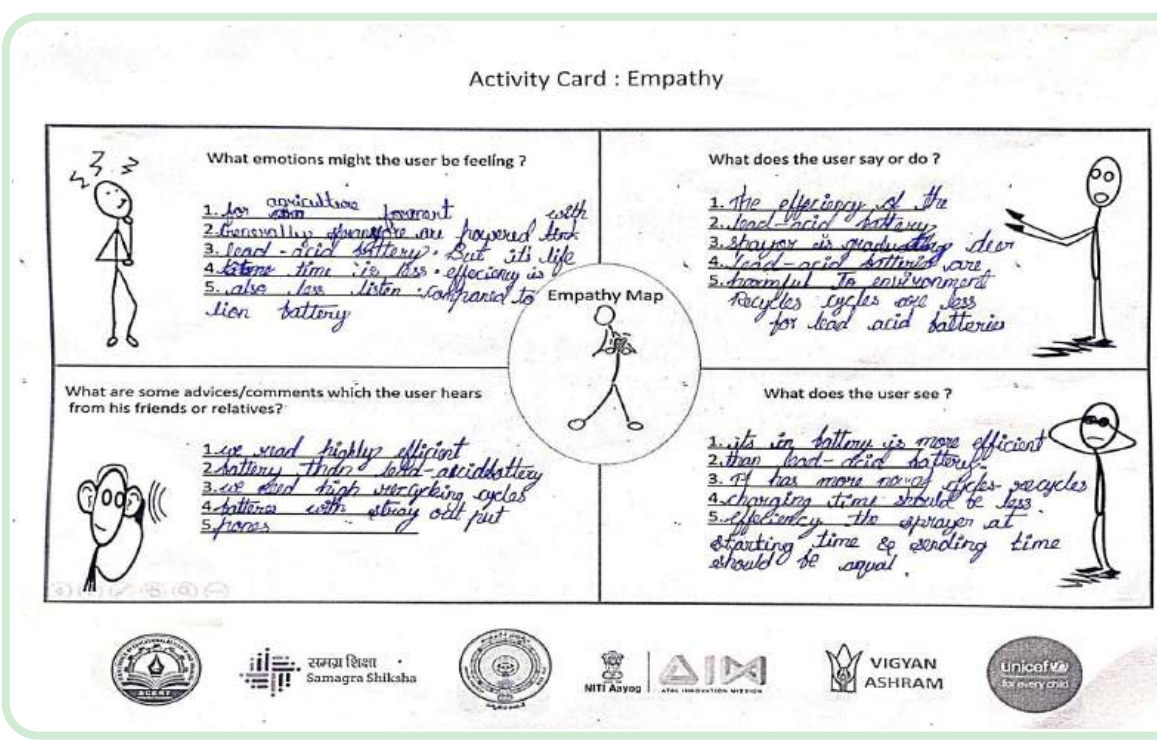
State : Andhra Pradesh

Students Name:

1. I. VENKAT CHARAN
2. B. LALITHENDRA
3. M. VENKAT
4. G. VASU

Group Name : Smart Longlasting Rechargable Sprayer

The Design Thinking process has 5 steps.
1.Empathize 2. Define 3.Ideate 4.Prototype and 5.Test.



Activity Card : Empathy

What emotions might the user be feeling ?

1. for agriculture farmers
2. Generally farmers are worried with
3. lead - acid battery. But its life
4. time is less. efficiency is
5. also less listen compared to lion battery

What does the user say or do ?

1. the efficiency of the
2. lead acid battery
3. sprayer is gradually decr
4. lead-acid batteries are
5. harmful to environment
recycles cycles are less
for lead acid batteries

Empathy Map

What are some advices/comments which the user hears from his friends or relatives?

1. use must highly efficient
2. battery than lead-acidbattery
3. use must high recycling cycles
4. batteries with steady out put
5. forces

What does the user see ?

1. its in battery is more efficient
2. than lead-acid batteries
3. it has more no of cycles recycles
4. charging time should be less
5. efficiency the sprayer at
starting time & ending time
should be equal

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Activity Card: Design Challenge

Research / Observe
List the specific facts and observations that you noticed in the scenario.

1. we need highly efficient battery supported Agricultural sprayer.
2. lead-acid battery based sprayers are now a days generally available in the market but they are low efficient.
3. their rechargable cycles are very low. so, lead-acid battery life is low.
4. stand by efficiency of spraying strength is lowering from moving to evening with lead-acid battery.

Define Challenges
Write down all the problems which are relevant and can be addressed.

battery efficiency of agriculture sprayer should be increased

to lower the battery weight so that it is easy to carry the sprayer

Rechargable cycles of the battery. should be improved

stand by efficiency of spraying strength should be improved

Activity Card: Point of View

I am an farmer

I am trying to make my electric sprayer smarter.

But I am faces problem with efficiency of the sprayer charging time and charging cycles

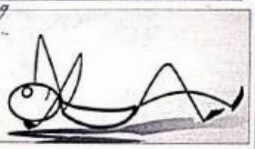
Because of the lead acid batteries present in sprayer since nowa days sprayer is less efficient & less charging cycles of more charging cycles.

Which makes me feel to improve the agriculture sprayer since with high efficiency

Write down the problem you have selected with reason

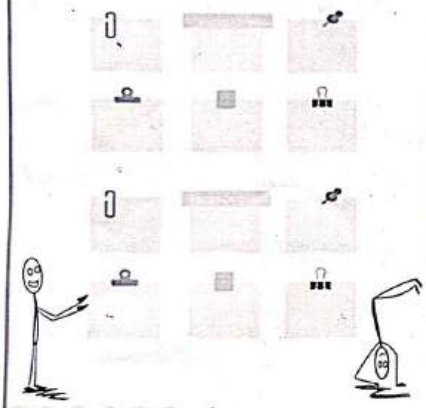
improvise to sprayer efficiency, charging time, charging cycles, and stand by spraying strength.

Point of View Statement
Write a sentence that summarizes the problem you want to solve



Activity Card: Ideate

Generate ideas to solve the problem

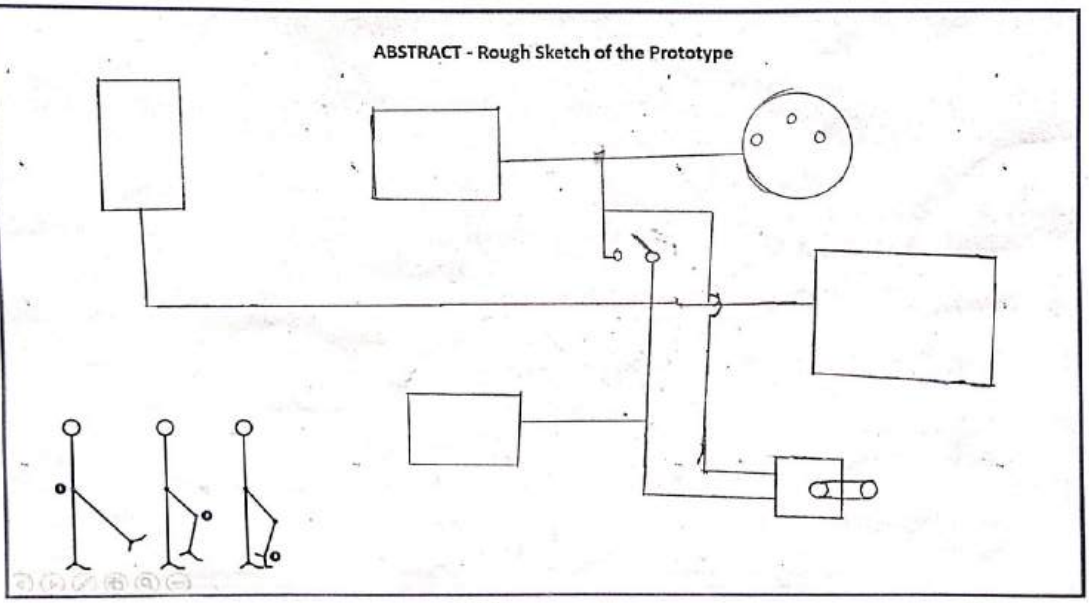


Arriving at the right design

Ideas Generated	Uniqueness	Ease of use	Ease of design	Durability	Feasibility
Li-fet 04	Yes	Yes	Yes	7-10 years	available
Litium-ion phosphate battery supported to sprayer with rechargable module added.	Yes	Yes	Yes	3-4 years	available
solar charing module	Yes	Yes	Yes	10 years	available

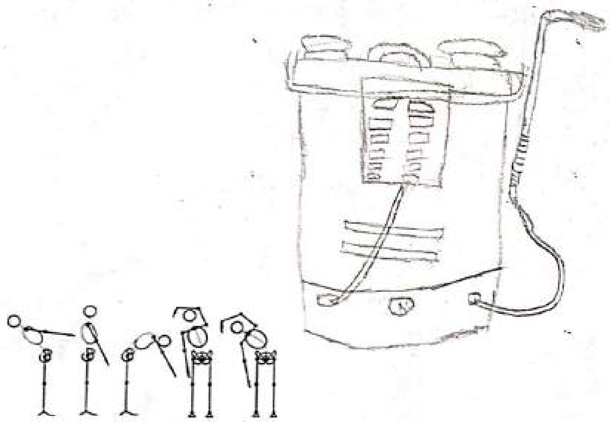
Activity Card: Abstract prototype

ABSTRACT - Rough Sketch of the Prototype



Activity Card : Concrete prototype

CONCRETE - Detailed Sketch of the Prototype



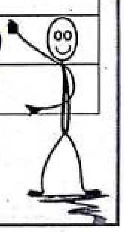
Materials Required

1. sprayer set
2. water tank level indicator
3. Li-Fe Po4 battery pack
4. Battery magnetic system
5. speed controller
6. charging port
7. L.E.D. indicator
8. switch on/off
9. solar panel
10.
11.
12.
13.
14.
15.

Activity Card : Test – Questions

USER TESTING QUESTIONS

Sl.No	User Testing Questions	Remarks
1.	What do you like and dislike about this prototype?	like- Highly efficient battery pack for sprayer. dislike.
2.	What could be done to make "you want" to use this prototype more?	want to improvise with solar panel.
3.	What do you think of how the prototype looks (the aesthetics)?	Nice, Good looking ..
4.	Is this prototype efficient, safe, and comfortable to use? If not, how could it be improved to make it user friendly ?	Yes it is efficient, comfortable, low weight (comparing to lead acid battery)
5.	What are the problems with this prototype?	LiFe-Po4 battery is costlier battery than Li-ion battery No.
6.	What can be done to solve these problems?	—



Activity Card : Test – Observations

USER TESTING OBSERVATIONS

Observations

1. What does the user do with this prototype?

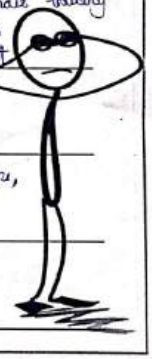
2. What are the user's perceptions of the prototype? by attaching the lithium ferro phosphate battery to the agricultural sprayer it is safe and light weight, highly efficient

3. How successful or unsuccessful does the user think the prototype is?

good efficiently works

4. How does it meet or fail the user's needs? successful in light weight arranging time, charging efficiang charge cycles

5. How safe is the prototype? get meets the all the needs of users
It is more safetion litiums ion batteries



Case Study 03

Smart-Hand Gloves for People with Paralysis

Giving Voice to Basic Needs

Government Girls High School Basapattana
Koppal, Karnataka

Millions of people with paralysis cannot speak or move, leaving them unable to express their most basic needs. This often leads to frustration, delays in care and emotional strain for both patients and their families.

What did a team of students from GGHS Basapattana build to help the patients communicate their needs with just a simple touch of their fingers?

How it All Began

Background and Context

The Atal Tinkering Lab at GGHS, Basapattana quickly became a favourite space for curious minds of the school. Students found the lab full of tools and materials that helped them turn imagination into reality. Many of them began staying back after school, testing components and working on new ideas, with the encouragement of their teacher.

"We wanted to build something that lets people say what they need, even when they can't speak or move."

One day, as they walked to school, the students passed by a house they had seen many times before. Inside lived an elderly man, paralyzed and unable to move or speak. He had to depend on his family members for the most basic tasks. The sight of him, day after day, stuck in a cycle of dependence, deeply moved the team. They couldn't stop thinking about how difficult life must be for him and for others who faced such challenges.

This experience sparked a new question: How could they help him and others like him? They knew it would be hard, but they believed they could build something meaningful.

Empathise

Understanding the Struggles

The students began their journey by revisiting the home of the elderly man. They spoke with his family, eager to understand what exactly he struggled with and how he managed to communicate. His family shared how challenging it was to understand his needs. Sometimes they guessed correctly, but often they didn't. This made them feel very sad and helpless.

Wanting to learn more, the students reached out to other caregivers and patients in the community facing similar conditions. They saw a clear pattern: patients were unable to express basic needs and family members were left to guess. This caused emotional strain on both patients and caregivers. The students realised that even a small step toward enabling communication could bring immense relief and restore dignity to the patients.

Did You Know?

India has over 1.8 million people living with paralysis, and many rely on family members for basic care and communication.

Define

Framing the Problem

After gathering insights from the elderly man and others in similar situations, the students framed the issue clearly. One key insight stood out from all their observations: patients retained some finger movement. The students decided to use this as a means to develop an easy and reliable mode of communication.

Design Tip

A good design always starts with one simple idea!

Problem Statement

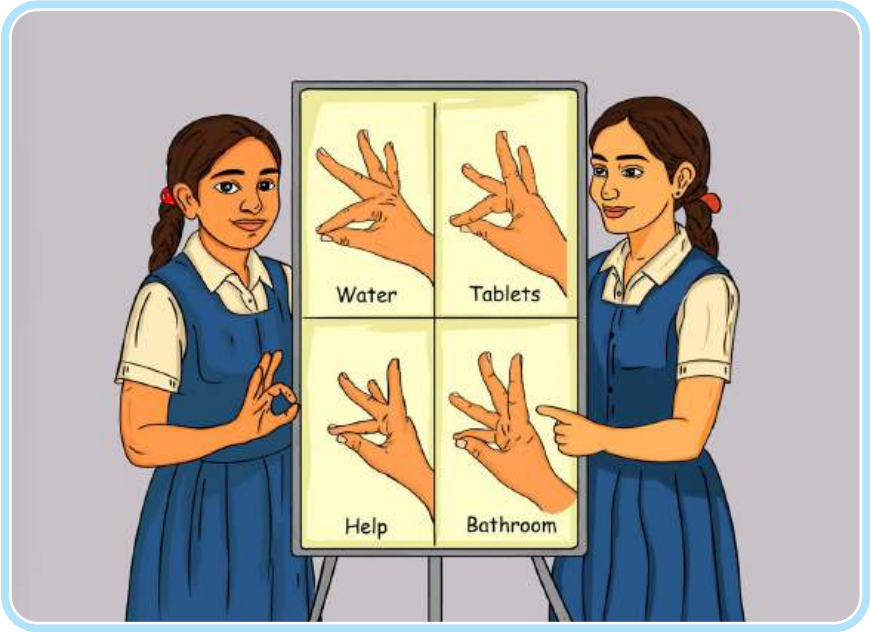
> **People with paralysis are unable to express their basic needs, which causes distress and dependency. There is a need for a simple, wearable device that can convert small finger movements into messages.**

Ideate

Brainstorming Solutions

The students already knew they wanted to build a wearable device that relied on finger movements. Their first step was to list the most common needs that a person with paralysis might struggle to communicate. These included basic but essential requests such as food, water, tablets and using the bathroom.

Once they finalised this list, they began brainstorming how these needs could be conveyed. They referred to various sources for ideas. After much discussion, they agreed that pre-recorded audio messages would be the simplest and most effective way to enable communication. They



decided to design a system based on simple thumb-to-finger touches, where each thumb to finger combination would say out loud a different message.

They mapped each such combination to a specific need:

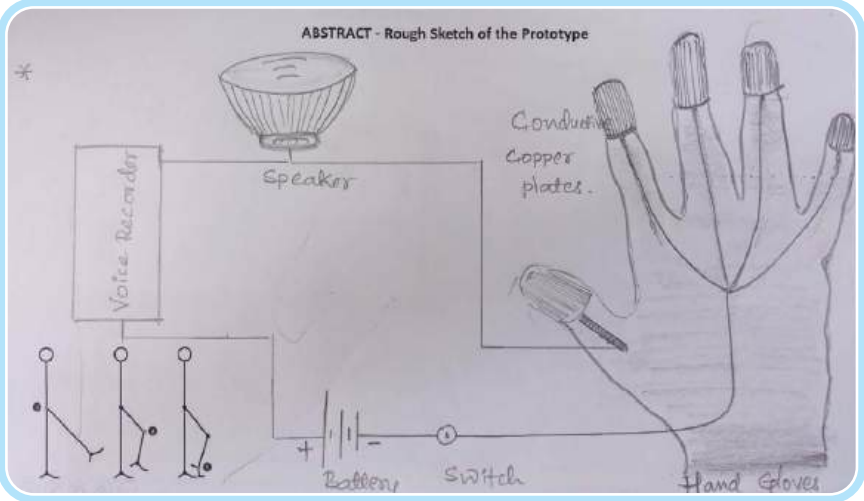
- Thumb to index finger: "I want water."
- Thumb to middle finger: "I want tablets."
- Thumb to ring finger: "It's an emergency, I need help."
- Thumb to little finger: "I want to go to bathroom."

Did You Know?

Copper electrodes are widely used in medical devices because they're safe, sensitive and fast to respond.

Prototype

Turning Ideas into Reality



To build their first prototype, the students used materials they already knew how to work with like gloves, copper wires, IR sensors and a small voice recorder kit. They stitched the copper wires into the gloves and connected them to the voice recorder. When the thumb touched a finger, it would complete a circuit and play a pre-recorded message like "I want water" or "I need help." The IR sensor helped detect finger movements, making the glove more responsive.

The first version worked, but it wasn't perfect. Sometimes the wires came loose, the sound wasn't clear or the glove didn't feel comfortable. But the students didn't give up. They fixed the wiring, adjusted the placement of sensors and made the glove easier to wear. Each time they made changes, the glove got better. Slowly, their design became more stable and ready for real use.

Design Tip

Use materials you're already familiar with. It speeds up the process of trial, error and improvement.

Can you think of a small design change that could solve a big daily challenge?

What curricular topics did the students learn through the project?

Science:
Electricity and Circuits, Sound, Tissues, Force and Pressure, Body Movements

Test

Validating the Solution

The students tried the glove with elderly patients with paralysis. With a little practice, they patients were able to activate the voice clips. It was emotional for them to ask for something without waiting or struggling to be understood, for the first time.

The family members said they finally felt less helpless too. The glove gave both sides a new way to connect. The students continued to refine the glove, hoping to add more phrases and improve comfort.

Impact

Making a Difference in the Community

The Smart Gloves helped patients regain a basic human right - to ask for what they need. It showed how empathy and innovation, even with low-cost materials, can restore dignity and independence.

Meet the Team

Students' Names from GGHS Basapattana, Koppal, Karnataka

Teacher
(extreme left):

- Venkanna Pujar

Students
(from left to right):

- Deepa Sharanappa
- Priyanka Mallappa
- Bhoomika
- Saniya Bashasab

What did the students find most exciting?

When the glove actually said 'I want water' for the first time, we all clapped! It felt magical.

What did the students find most difficult?

Getting the thumb-finger touch to trigger the exact matching audio took lots of trial and error.

What did the students learn through this process?

At first, we were just excited to build something. But when we saw how emotional the families got, we understood what empathy really means. It changed how we think. Now, we truly believe we can make a difference in the world.

Note: This project was undertaken in the year 2023.

Design Thinking Format

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Samagra Shiksha

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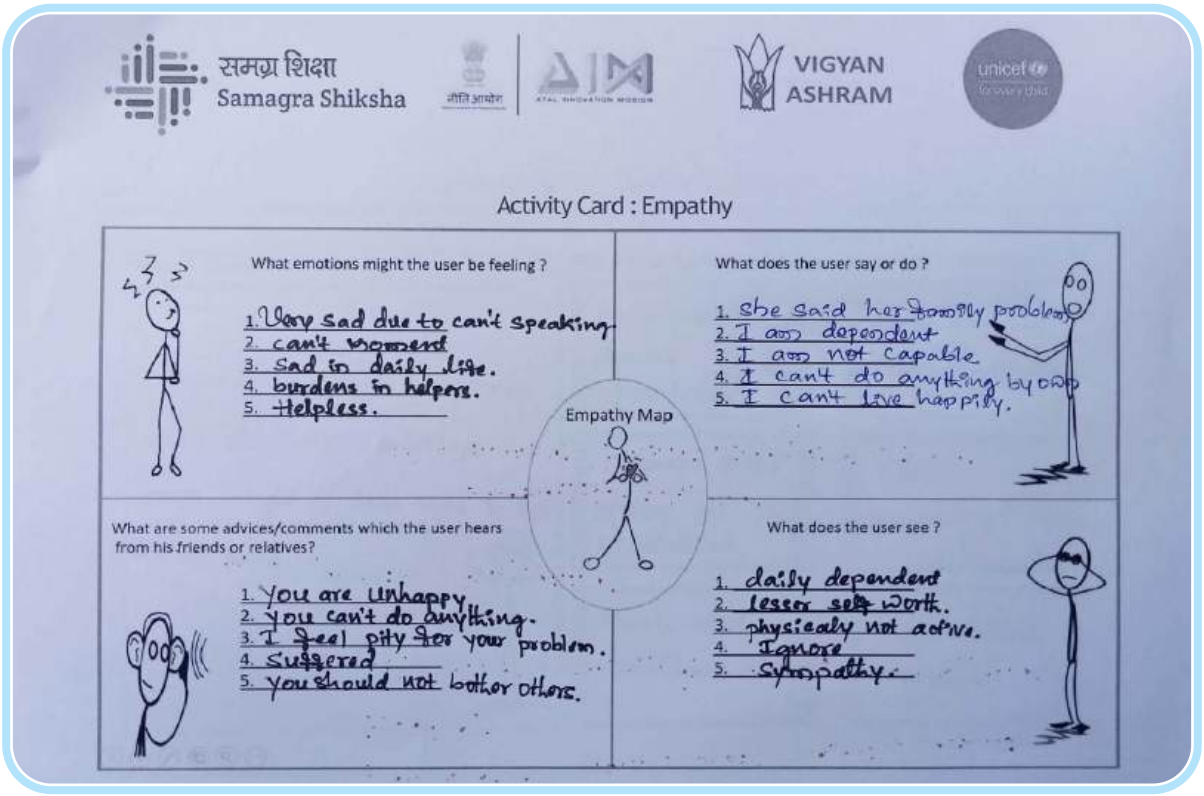
Design Thinking Template

Student Names :- priyanka. Saniya. Bhoomika. Deepa. Divyajyothi. Keerthana.

Mentor Name :- Venkanna.

School: Girls Government High School Basapattana.
District: Koppal.
State: Karnataka. PIN: 583235. cell No: 7829643073.



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Activity Card : Empathy

What emotions might the user be feeling ?

1. Very sad due to can't speaking.
2. can't women
3. Sad in daily life.
4. burdens in helpers.
5. Helpless.

What does the user say or do ?

1. She said her family problem
2. I am dependent
3. I am not capable
4. I can't do anything by own
5. I can't live happily.

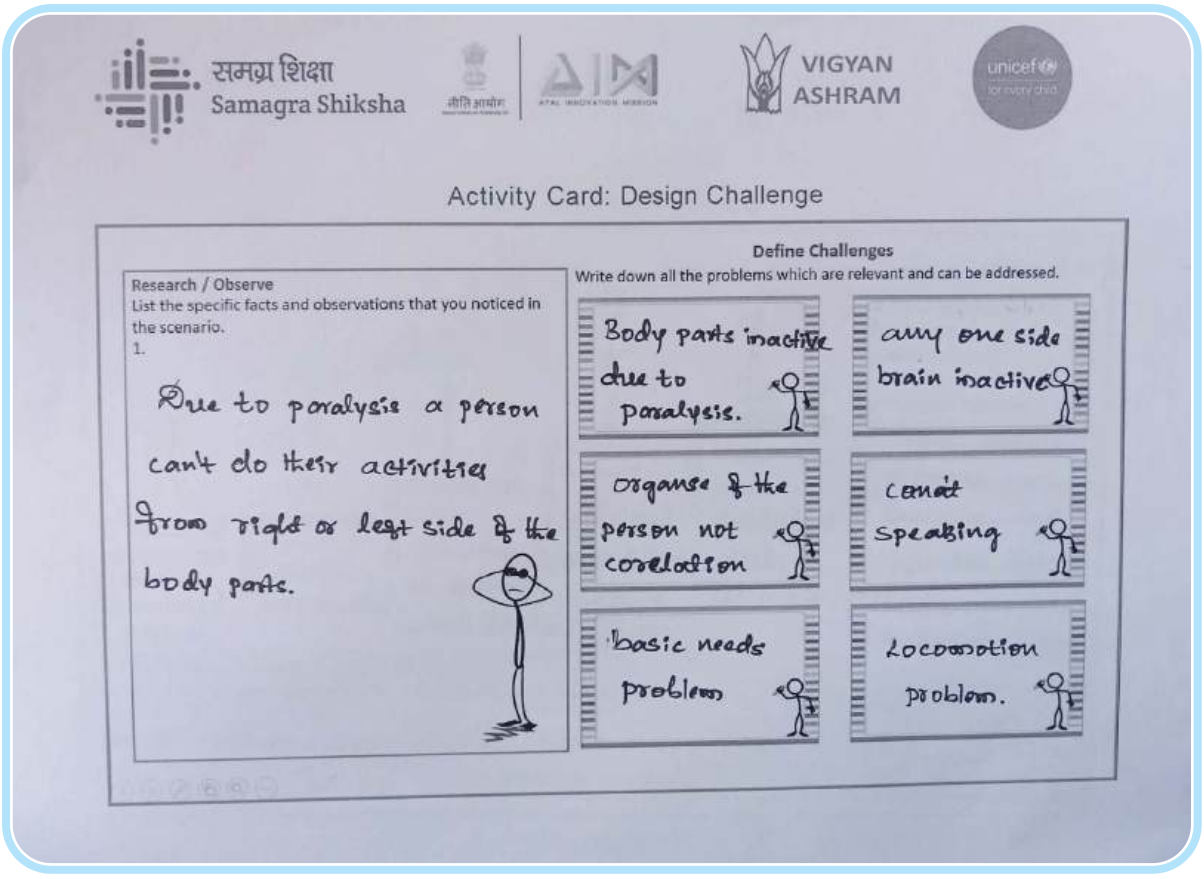
Empathy Map

What are some advices/comments which the user hears from his friends or relatives?

1. You are unhappy
2. You can't do anything.
3. I feel pity for your problem.
4. Suffered
5. You should not bother others.

What does the user see ?

1. daily dependent
2. lesser self worth.
3. physicaly not active.
4. Ignore
5. Sympathy.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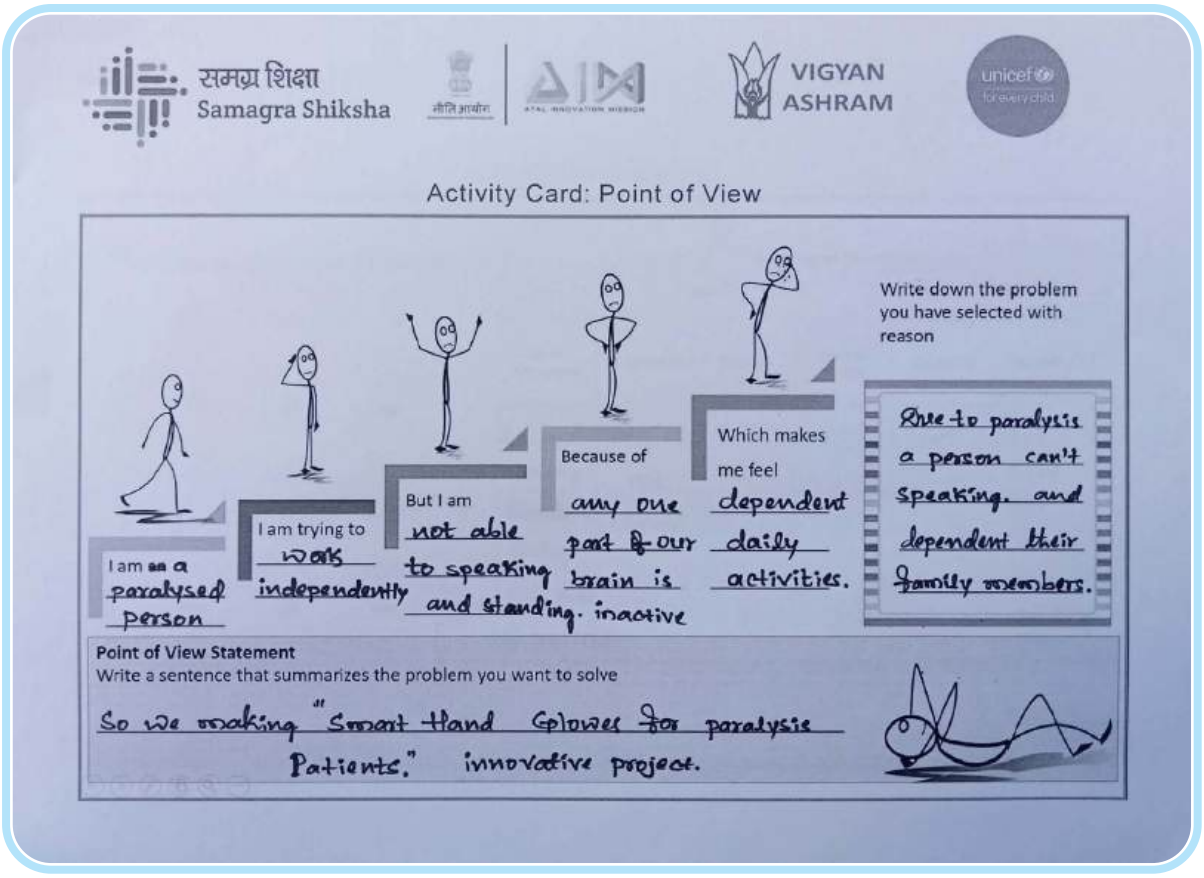
VIGYAN ASHRAM
Activity Card: Design Challenge
Research / Observe
List the specific facts and observations that you noticed in the scenario.
1.
Due to paralysis a person can't do their activities from right or left side of the body parts.
Define Challenges
Write down all the problems which are relevant and can be addressed.
Body parts inactive due to paralysis.
any one side brain inactive
organse of the person not coreloation
can't speaking
basic needs problem
Locomotion problem.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Activity Card: Point of View
I am as a paralysed person
I am trying to work independently
But I am not able to speaking and standing.
Because of any one part of our brain is inactive
Which makes me feel dependent daily activities.
Write down the problem you have selected with reason
Due to paralysis a person can't speaking. and dependent their family members.
Point of View Statement
Write a sentence that summarizes the problem you want to solve
So we making "Smart Hand Gloves for paralysis Patients." innovative project.

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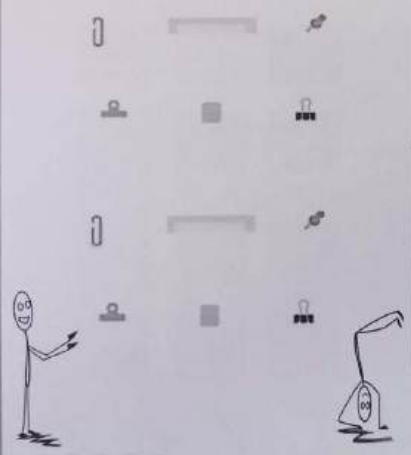
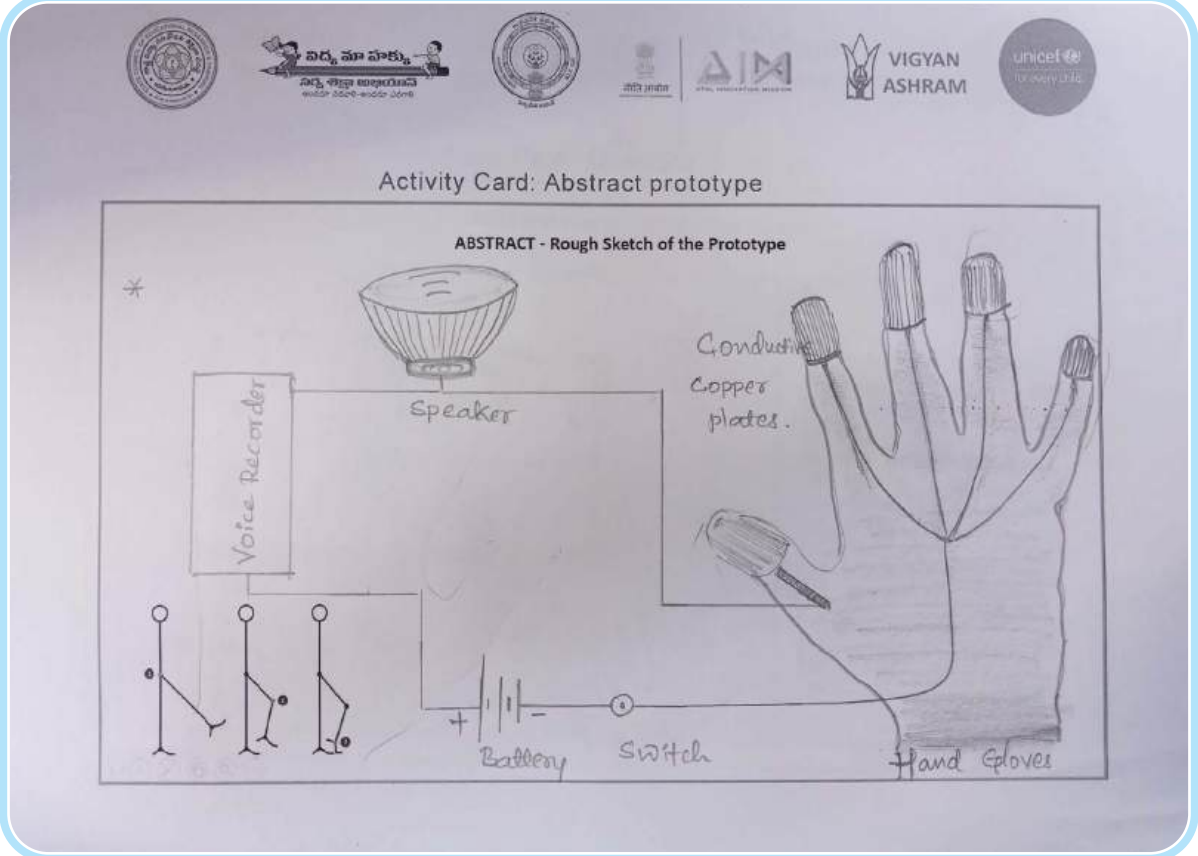
Activity Card: Ideate

Generate ideas to solve the problem



Arriving at the right design

Ideas Generated	Uniqueness	Ease of use	Ease of design	Durability	Feasibility
from young Students living their area of patient	✓ not copied.	✓	✓	✓	Very easy to carry and Waring



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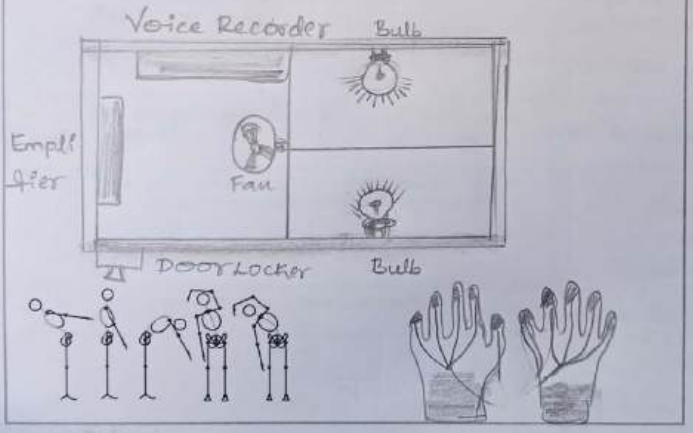
Activity Card : Concrete prototype

CONCRETE - Detailed Sketch of the Prototype



Materials Required

1. 2-hand gloves.
2. Voice recording kit.
3. copper conductive plates.
4. IR sensor
5. electrods
6. bulbs
7. door locker
8. voice reciever
9. Amplifier
10. Megnets.
11. Fan
12.
13.
14.
15.

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Activity Card : Test – Questions

USER TESTING QUESTIONS

Sl.No	User Testing Questions	Remarks
1.	What do you like and dislike about this prototype?	I like this project because very useful for paralysed persons.
2.	What could be done to make "you want" to use this prototype more?	Waireless and realistic looking.
3.	What do you think of how the prototype looks (the aesthetics)?	It is smart so it is smart hand gloves
4.	Is this prototype efficient, safe, and comfortable to use? If not, how could it be improved to make it user friendly ?	Safe
5.	What are the problems with this prototype?	Make it waireless
6.	What can be done to solve these problems?	Using bluetooth it is affordable.

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Activity Card : Test – Observations

USER TESTING OBSERVATIONS

Observations

1. What does the user do with this prototype?

   We use it has communicodion.

2. What are the user's perceptions of the prototype?

   It is more convenient doing or getting basic needs.

3. How successful or unsuccessful does the user think the prototype is?

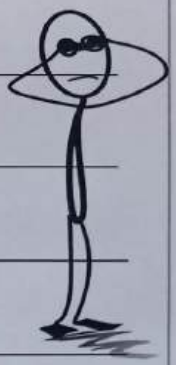
   It's successful.

4. How does it meet or fail the user's needs?

   It is helpful every paralysed persons.

5. How safe is the prototype?

   It is most safe.



Case Study 04

Hope Arm

A Functional, Affordable Prosthetic for Amputees

Government Pre-University College [High School Section] Kombettu
Dakshina Kannada, Karnataka

Millions of people lose their limbs due to illness or accidents every year. Despite that, quality prosthetics remain expensive and out of reach. This leaves many amputees highly discouraged and dependent on others.

What did a group of students at GPUC [HS] Kombettu do to change this?

How it All Began

Background and Context

One of the most exciting features introduced by the ATL teacher at GPUC [HS] Kombettu was the "Idea Box." Students could anonymously drop in their ideas, no matter how big or small. Once every week, the teacher and students would gather after school to open the box, read each suggestion aloud and discuss its potential. They debated the practicality of each idea, checked for existing solutions online, identified gaps and voted collectively on what to take up.

Did you Know?

Only about 5% of amputees in India have access to professionally made prosthetic limbs.

One day, a student submitted an idea that immediately struck a chord with the group: "Can we come up with an affordable solution for amputees?" Her grandmother, an amputee due to diabetes, faced daily struggles with basic tasks and commercial prosthetics were very expensive for their family. The team saw not only the emotional weight of the problem but also how widespread the issue was. Without hesitation, they chose this idea to work on, hoping they could bring some comfort and independence to people like their friend's grandmother.

Empathise

Understanding the Struggles

What tools would you use to understand someone's experience?

Interviews, observations or surveys? List all of them.

The students began their journey by visiting the home of their classmate's grandmother. She had lost her arm due to diabetes and struggled with simple everyday tasks. The students observed how she depended on others for basic things, and understood why she couldn't afford the currently available prosthetic models. They asked questions and listened carefully to what made her daily life harder.

Encouraged by their ATL teacher, the students expanded their research. They visited a local limb centre, spoke with orthopaedics and interviewed more amputees and caregivers. They prepared simple questionnaires to ask users what they needed most, what existing devices lacked and what additional features would actually help. This process helped them identify major gaps and made one thing clear: any real solution had to start with empathy and be shaped directly by the people who would use it.

Define

Framing the Problem

After gathering deeper insights from amputees as well as orthopaedic professionals, the student realised that the existing prosthetic arms were too expensive, too heavy and were not functional. Based on this, they framed the problem statement.

Problem Statement

> **Commercial prosthetic arms are often unaffordable, uncomfortable and lack basic functionality. There is a need for a lightweight, low-cost and user-friendly prosthetic arm that can support simple hand movements like gripping and lifting objects.**

Framing the challenge clearly helped the team set specific goals. They now had a shared purpose - not just to build an arm, but to make it accessible, functional and meaningful for users that needed it.

Design Tip

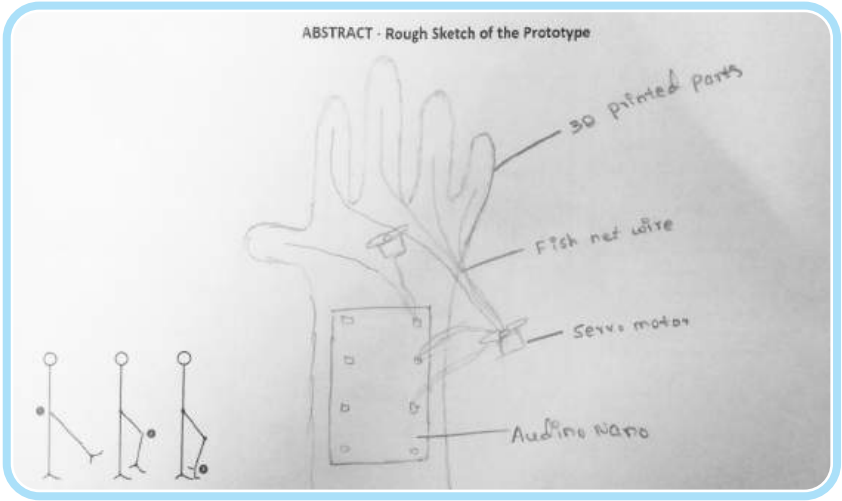
When defining your problem, list all the user needs like cost, comfort, usability. Aim to tick as many boxes as possible in your final design.

Ideate

Brainstorming Solutions

The students approached the ideation process with openness and excitement. Each team member was encouraged to suggest ideas freely and no idea was considered too simple or too complex. They discussed everything from basic plastic moulds to advanced robotic arms. Their ATL teacher played a key role in facilitating discussions and helping them evaluate which ideas were practical, safe and within their skill level.

Initially, they imagined making a static artificial hand. But then they challenged themselves - what if they could make it functional? Could they design something that actually moved? That's when they began researching advanced prosthetic arms. They identified that many relied on silicone or muscle sensors. But silicone was too expensive and muscle sensors were hard to use without medical expertise.



"Every idea mattered. Even if it didn't work, it led us to something better and brought us closer as a team."

Finally, they came up with the idea of using force sensors near the upper arm to detect muscle movement, paired with servo motors and fishing wire to move the fingers. They also decided to use 3D printing to make the arm lightweight and affordable. Instead of one person deciding, the whole group voted on the final plan as each member's ideas had helped shape the solution.

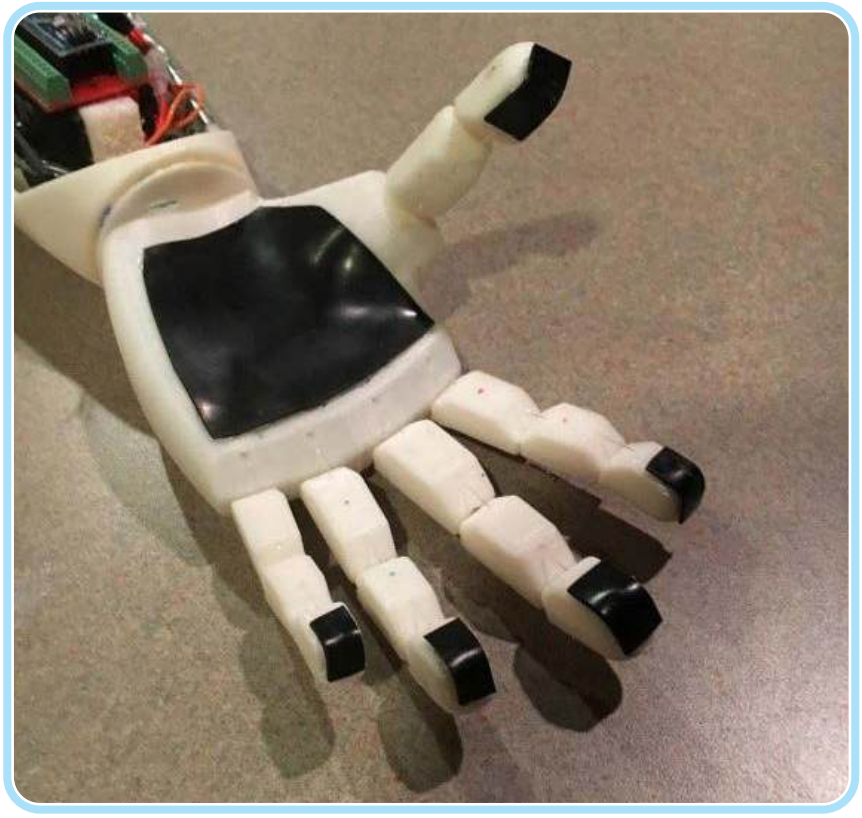
Prototype

Turning Ideas into Reality

For the first prototype, the students began with the simplest material they had access to – thermocol. It helped them shape the structure of a hand, but it broke too easily and couldn't support any electronics. Then they moved to plaster of Paris, which gave better strength, but made the arm too heavy and uncomfortable to wear. Their third attempt used clay, which allowed for more detailing, but they found cracks and realised it posed the risk of breaking with use.

"First we used thermocol, then plaster, then clay, then 3D printing and finally, we got it right! Every version taught us what to fix next and to try harder the next time."

Despite setbacks, they kept learning. After talking to expert mentors and doing online research, the students discovered the potential of 3D printing. With the support of ATL facilitators and external guidance, they designed and printed a lightweight plastic version of the prosthetic arm. This fourth prototype could now house the components more securely and was far more durable.



Using this, they resolved coding challenges and refined its fit and functionality. They developed the fifth and the final prototype, which was a success. It used five servo motors (one per finger) controlled by force sensors placed on the upper arm near the biceps. Fishing wire linked the motors to each finger, enabling basic movements like holding or releasing an object.

Design Tip

There is scope for improvement even at the testing phase! It is important to approach this with a sense of curiosity and not disappointment.

Test

Validating the Solution

The students tested their final prototype with their friend's grandmother and a few other amputees. At first, they were thrilled to see the fingers move and the arm respond to commands. It was functional, lightweight and actually worked. But based on the feedback, they realised that the arm felt rough and uncomfortable in certain areas, especially where it touched the skin.

This feedback made them pause and reflect. They understood that even if something works technically, it still needs to feel right for the user. They noted the gaps and began thinking about new materials like silicone for smoother finishes, and are committed to improving the arm further and making it truly ready for everyday use.

What curricular topics did the students learn through the project?

Science:
Body Movements, Synthetic Fibres and Plastics, Tissues, Force and Pressure, Electricity

Impact

Making a Difference in the Community

The Hope Arm helped amputees perform daily tasks with greater ease and confidence at a very affordable cost. For the students, it showed that meaningful innovation can begin with simple ideas and deep empathy.

Meet the Team

Students' Names from GPUC [HS] Kombettu, Dakshina Kannada, Karnataka

Teacher
(extreme right):

- Sindhu V.K

Students
(from left to right):

- Shravanya
- Avanthi Sharma
- Shriya R.V.
- Shivani Rai
- Shilpa
- Madhushree

What did the students find most exciting?

We loved having so many discussions! It felt like real teamwork. Honestly, we wish all our learning in every class happened like this. Making our own posters and presentations also made us feel more confident.

What did the students find most difficult?

Designing the prototype was the hardest. The 3D prints would come out wrong, sometimes we lost out on our progress due to power cuts and nothing matched our expectations. When we finally tested it, in the first round of feedback the users said it hurt. That really shook us.

What did the students learn through this process?

We realised failure doesn't mean the end. If we keep trying, we'll reach our goal. We also learnt how important it is to work as a team and to have empathy at every step of the process. We picked up many new skills such as logical thinking, leadership, presentation and even editing our own videos. Most of all, we now believe we can take on any big challenge.

Note: This project was undertaken in the year 2023.

Design Thinking Format

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Design Thinking Template

Student Names
Mrs.Sindhu.V.K. [Mentor]
Avanthi Sharma
Madhushree
Shriya.R.V.
Shilpa
Shivanya & Shivani

School: GPUC [HS] KOMBETTU. PUTTUR.

District: Dakshina Kannada

State: Karnataka

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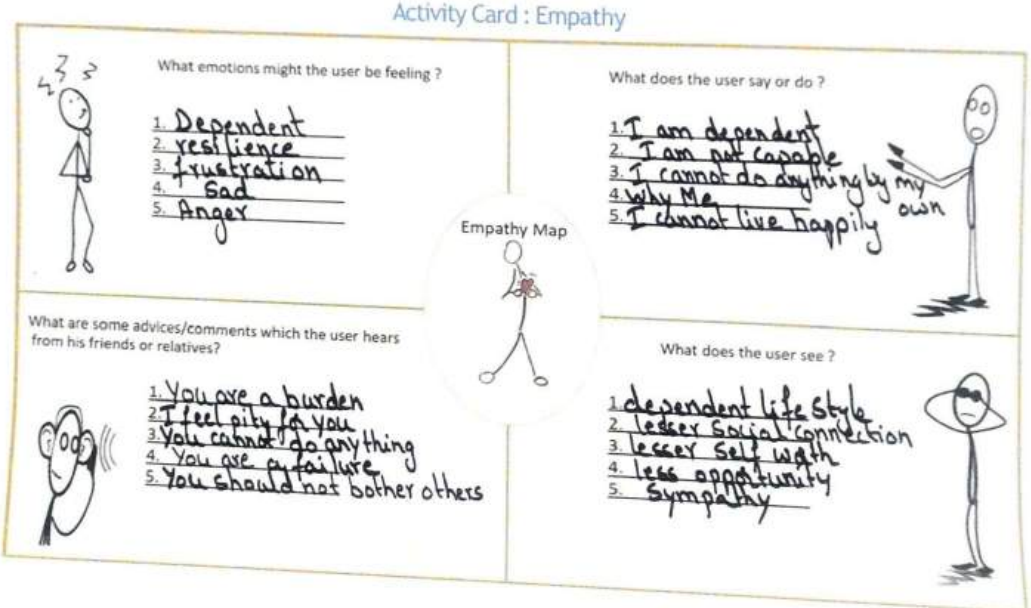
Activity Card : Empathy



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Activity Card: Design Challenge

Research / Observe
List the specific facts and observations that you noticed in the scenario.

1. Disability is a barrier

Define Challenges
Write down all the problems which are relevant and can be addressed.

- Expensive solution
- lesser social connection
- mental problems
- under confidence
- common man back ground
- lesser opportunities

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Samagra Shiksha

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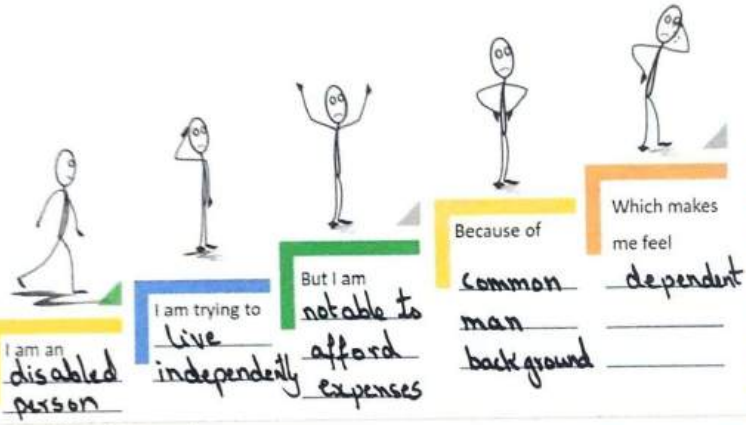
Activity Card: Point of View



I am an disabled person

I am trying to live independently

But I am notable to afford expenses

Because of common man back ground

Which makes me feel dependent

Write down the problem you have selected with reason

Expensive solution can solve all the Problems.

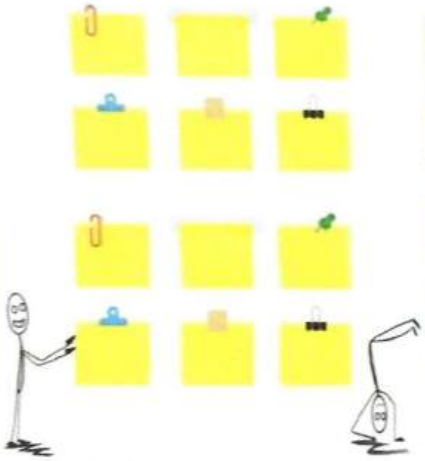
Point of View Statement
Write a sentence that summarizes the problem you want to solve

Expensive prosthetic arms cannot be afforded by common people.

Activity Card: Ideate

Generate ideas to solve the problem

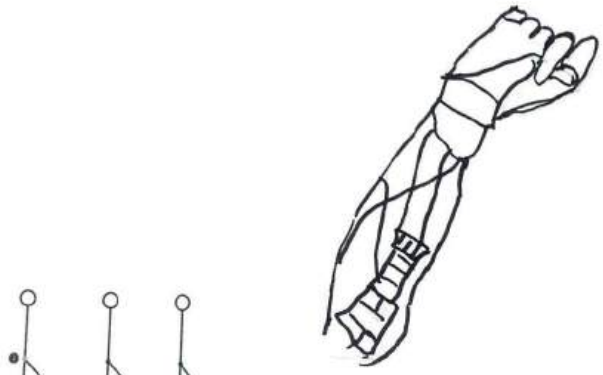
Arriving at the right design



Ideas Generated	Uniqueness	Ease of use	Ease of design	Durability	Feasibility
POP prosthetic arm	Yes	no	no	no	no
3d printed prosthetic arm	Yes	Yes	Yes	Yes	Yes

Activity Card: Abstract prototype

ABSTRACT - Rough Sketch of the Prototype



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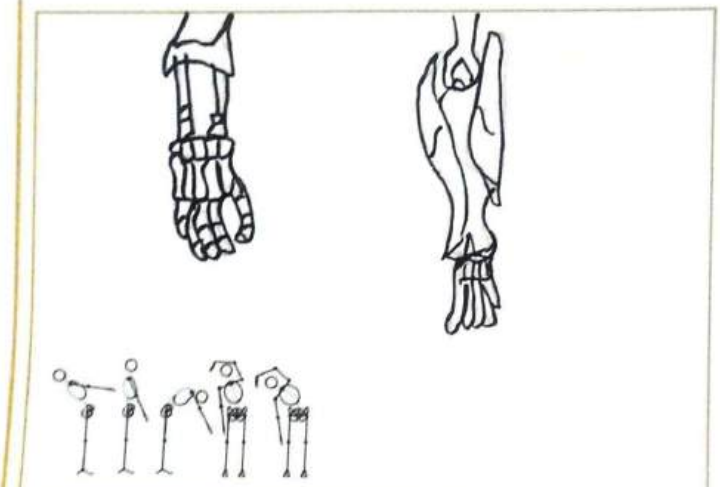
Activity Card : Concrete prototype

CONCRETE - Detailed Sketch of the Prototype



Materials Required

1. Arduino Uno
2. Muscle sensor
3. Servo motor
4. force sensor
5. fishing wire
6. Push button
7. .....
8. .....
9. .....
10. .....
11. .....
12. .....
13. .....
14. .....
15. .....

समग्र शिक्षा
Samagra Shiksha

VIGYAN ASHRAM

Activity Card : Test – Questions

USER TESTING QUESTIONS

Sl.No	User Testing Questions	Remarks
1.	What do you like and dislike about this prototype?	It is affordable and has many features
2.	What could be done to make "you want" to use this prototype more?	Make it more realistic looking
3.	What do you think of how the prototype looks (the aesthetics)?	It's decent looking
4.	Is this prototype efficient, safe, and comfortable to use? If not, how could it be improved to make it user friendly ?	Yes
5.	What are the problems with this prototype?	It is not comfortable from inside
6.	What can be done to solve these problems?	add a silicon layer

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Activity Card : Test – Observations

USER TESTING OBSERVATIONS

Observations

1. What does the user do with this prototype?

they use it has a limb

2. What are the user's perceptions of the prototype?

it's affordable and convenient

3. How successful or unsuccessful does the user think the prototype is?

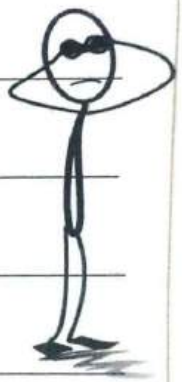
It's successful

4. How does it meet or fail the user's needs?

It is helpful

5. How safe is the prototype?

It's safe.



Case Study 05

The Farmers' Baton

A Satefy Guide for Night-Time

Zilla Parishad High School Bhiknoor
Kamareddy, Telangana

Farmers in Telangana often need to visit their fields at night, where snake bites and animal attacks are a real danger. With limited visibility and high risk, these night-time visits can be life-threatening.

What simple solution did a group of students from ZPHS Bhiknoor design to keep farmers safe, without harming animals?

How it All Began

Background and Context

At ZPHS Bhiknoor, students had always shown an interest in science and innovation. Some of them had already participated in local science fairs, experimenting with projects like water purification. Their curiosity soon led them to the Atal Tinkering Lab in their school. Encouraged by their teacher, they began to explore what was possible within this space.

నమస్తే తెలంగాణ April 2, 2024

వార్తలు | సినిమా | స్పోర్ట్స్ | ఎడ్యుకేషన్ & కెరీర్ | బతుకమ్మ | బిజినెస్ | లైఫ్‌స్టైల్ | ఫొటోలు | కార్టూన్

Home Telangana Young Farmer Dies Due To Snake Bite

Snake bite | ఖమ్మం జిల్లాలో విషాదం.. పాము కాటుతో యువ రైతు మృతి

Snake bite | పొలం వద్దకు విద్యుత్ మోటర్ ఆఫ్ చేయడానికి వెళ్లిన రైతు పాము కాటుకు(Snake bite) గురై మృతి చెందాడు(Farmer died).

While brainstorming ideas for their next project, they were inspired by a news article their teacher shared about a tragic snakebite incident involving a farmer from a neighbouring district in their state. Many of the students came from farming families and knew how common and dangerous night-time visits to the field could be.

This article moved them deeply and gave them a clear direction: they would find a way to protect farmers.

Empathise

Understanding the Struggles

The students spoke with two local farmers and their families to understand the specific dangers they faced during night-time work. They learned that farmers often had to rush into the fields late at night and were usually distracted or preoccupied. This made them more vulnerable to snakebites and animal attacks.

From these conversations, the students realised that farmers needed a solution that could protect them without requiring too much effort or attention. It had to be simple, non-harmful and effective.

Did You Know?

Snakebites cause nearly 50,000 deaths in India every year. Many happen at night in rural farming areas where visibility is low and access to hospitals is far.

Define

Framing the Problem

The students were all aligned in terms of their intent and approach after talking to the farmers. They then framed the problem statement clearly.

Problem Statement

> **"Farmers often face threats from snakes and wild animals during night-time field visits. There is a need for a simple and safe tool that alerts nearby animals and helps farmers avoid danger."**

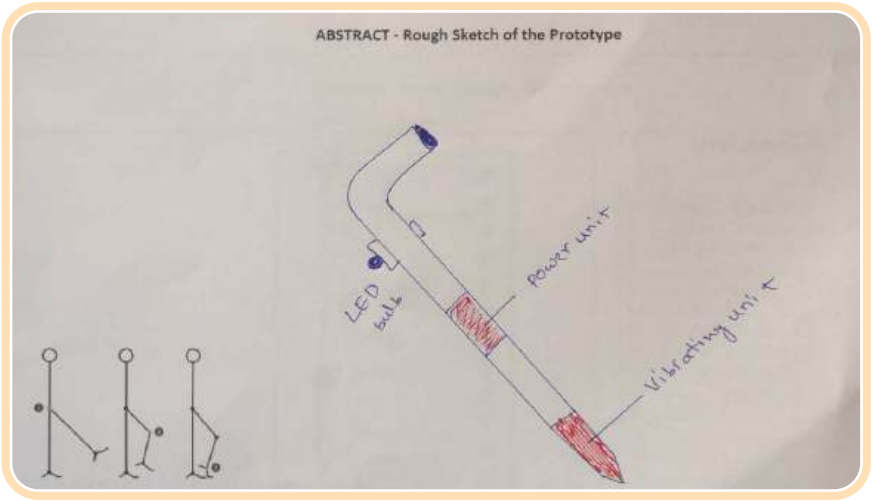
"We didn't want to hurt animals. We only wanted to alert them and keep the farmers safe."

Defining the problem helped the team find clarity - not just in the problem they were solving, but also in why it mattered. This shared purpose kept them focused throughout their design journey.

Ideate

Brainstorming Solutions

The students discussed all the possible solutions with their teacher. Each idea was written on the board. Some suggested whistles, others recommended powerful torchlights or ultrasonic sound emitters. The teacher encouraged them to think about what a farmer could actually carry and use easily at night. After multiple rounds of discussion, they agreed that a stick or baton was the most practical device, as it is familiar and easy-to-carry by a farmer of any age.



Once everybody agreed on the idea, the team began imagining all the features it should have. Firstly, it had to provide light and give physical support. For this, they envisioned a light source at the top for visibility. Next, it had to include an alert system that was not harmful. For this, they decided to add a sensor that could detect nearby motion, and a vibration motor that would alert the animals.

Design Tip

The best designs come from deeply understanding people's fears and wants, not just their words.

Prototype

Turning Ideas into Reality

Based on their idea, the students started to create a prototype. From their earlier lessons in the lab, they already knew what components would fit their requirement: vibration motors, ultrasonic sensors, and LEDs. They selected a sturdy 3.5-foot plastic pipe as the body of the baton and began assembling their first version. They inserted a vibration motor of a mobile phone at the bottom, connected an ultrasonic sensor at the top and attached a torchlight. The baton vibrated continuously, but they soon realised this would drain the battery.

Design Tip

The design should always aim to be multi-purpose. One tool serving many purposes is easier for users to adopt.

"We thought it would just keep vibrating and were disheartened, but then we realised that all it needed was just a switch."

They knew their device would become unreliable if the battery drained out. They discussed this amongst themselves and with their teacher and added a switch that allowed the farmer to turn the device on and off as needed. They also added a handle for better grip and ease of use. The sensor ensured that vibrations were triggered in a 5–10 meter radius around the user.

Test

Validating the Solution

Once the final version was ready, the students tested it on their school grounds to ensure the light and vibrations worked as expected. Then, they gave it to a farmer to test in the field. The results were encouraging. The vibrations successfully alerted animals who moved out of the farmer's way, and the farmer felt safer and more confident.

The team was thrilled to see their idea working in the real world. They made a few more adjustments for durability and comfort before finalising the baton.

Did You Know?

More than 60% of innovations fail because they aren't tested in real-world settings.

What curricular topics did the students learn through the project?

Science:
Light, Conservation of Plants and Animals, Forests: Our Lifeline, The Living Organisms - Characteristics and Habitats

Impact

Making a Difference in the Community

The Farmers' Baton designed by the students gave farmers a sense of safety during night-time field visits. It helped prevent harm to both people and animals, using a tool that was affordable, easy to carry and effective.

Meet the Team

Students' Names from ZPHS Bhiknoor, Kamareddy, Telangana

Teacher
(extreme left):

- Raju Tammala

(Extreme right):

- Saritha Manda

Students
(from left to right):

- G. Sai Shreyas
- B. Vishwak Raj
- D, Chandra Shekar
- B. Shivaraj Kumar
- SD Mahek
- K. Nandini

What did the students find most exciting?

For the first time we felt like we were applying our classroom knowledge to solve real issues. That felt thrilling!

What did the students find most difficult?

Staying patient through the entire process was harder than we thought. Even a small failure can make the whole thing seem pointless and make us feel demotivated.

What did the students learn through this process?

Our biggest lesson was that just because something fails the first time doesn't mean it's a bad idea. We learnt that failure is just a step and that it shows us what to improve. We feel like we will be able to face failures better in life. And try harder the next time.

Note: This project was undertaken in the year 2024.

Design Thinking Format

समग्र शिक्षा
Samagra Shiksha

VIGYAN ASHRAM

unicef for every child

Design Thinking Template

Student Names

1) SD. Mahek
2) K. Nandini
3) B. Shivaraj kumar
4) D. Chandra shekar
5) B. Vishwak Raj
6) G. Sai Shreyas

School: ZPHS (B) Bhiknoor

District: Kamareddy

State: Telangana

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Samagra Shiksha

VIGYAN ASHRAM

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Activity Card : Empathy

What emotions might the user be feeling ?

1. Fear & anxiety
2. Worry about safety
3. Helpless due to snakes
4. Looking for solution
5.

What does the user say or do ?

1. Carry a stick while working
2. Avoiding work at night
3. Tries to clear bushes
4.
5.

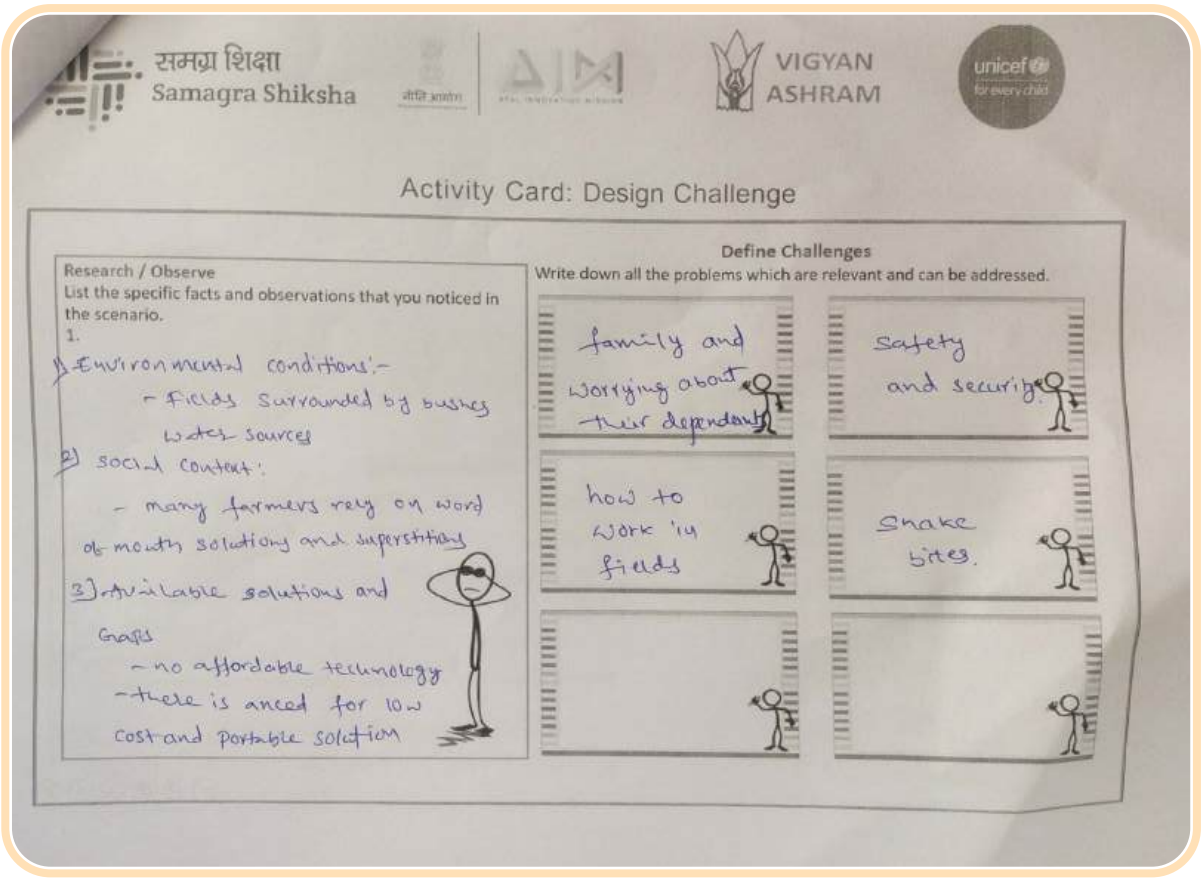
Empathy Map

What are some advices/comments which the user hears from his friends or relatives?

1. Use phynyl or kerosene,
2. keeps snakes away
3. use torch, boots (footwear)
4.
5.

What does the user see ?

1. traditional methods to keep away
2.
3. hiding crops and near waters
4.
5. Snake holes and slithering trails in soil.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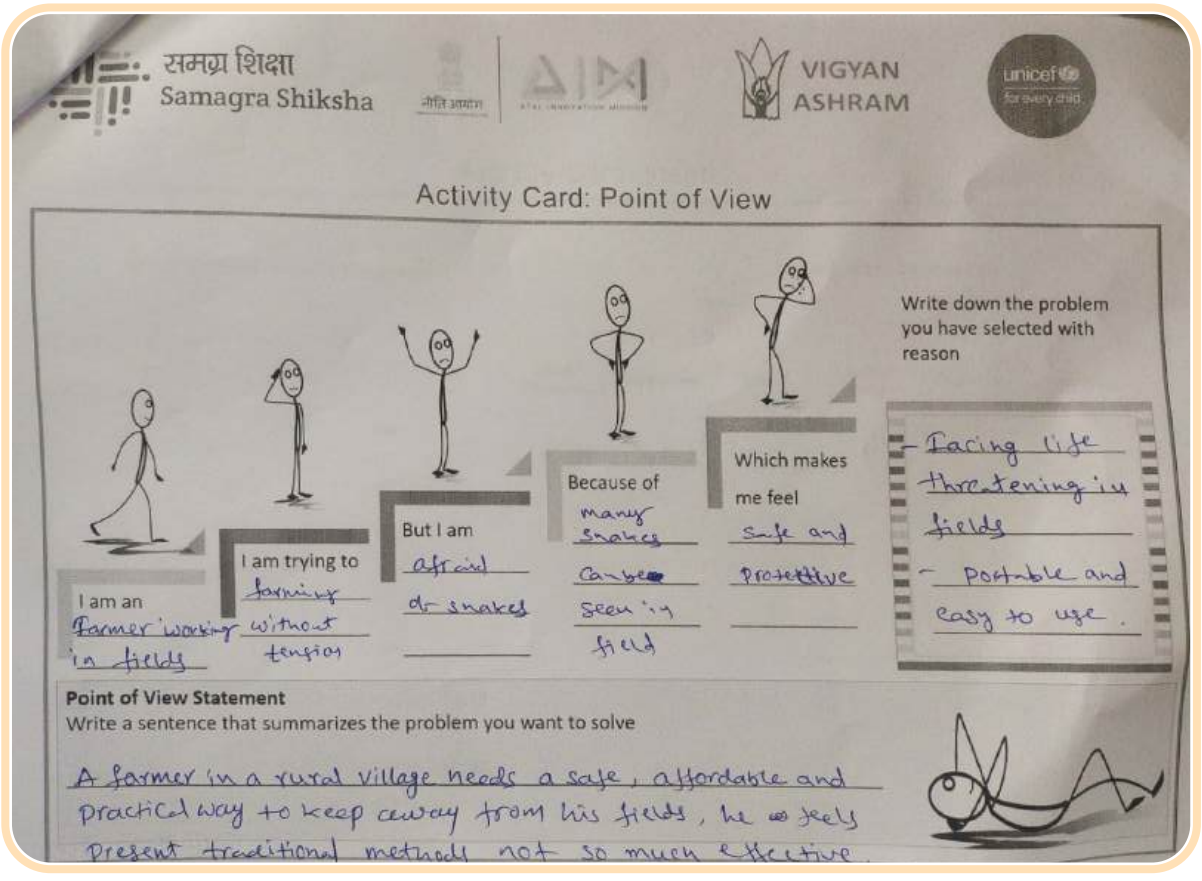
Samagra Shiksha
VIGYAN ASHRAM
unicef
Activity Card: Design Challenge
Research / Observe
List the specific facts and observations that you noticed in the scenario.
1.
1) Environmental conditions:-
- Fields surrounded by bushes
Water sources
2) Social Context:
- many farmers rely on word of mouth solutions and superstitions
3) Available solutions and Gaps
- no affordable technology
- there is need for low cost and portable solution
Define Challenges
Write down all the problems which are relevant and can be addressed.
family and worrying about their dependents
Safety and security
how to work in fields
Snake bites.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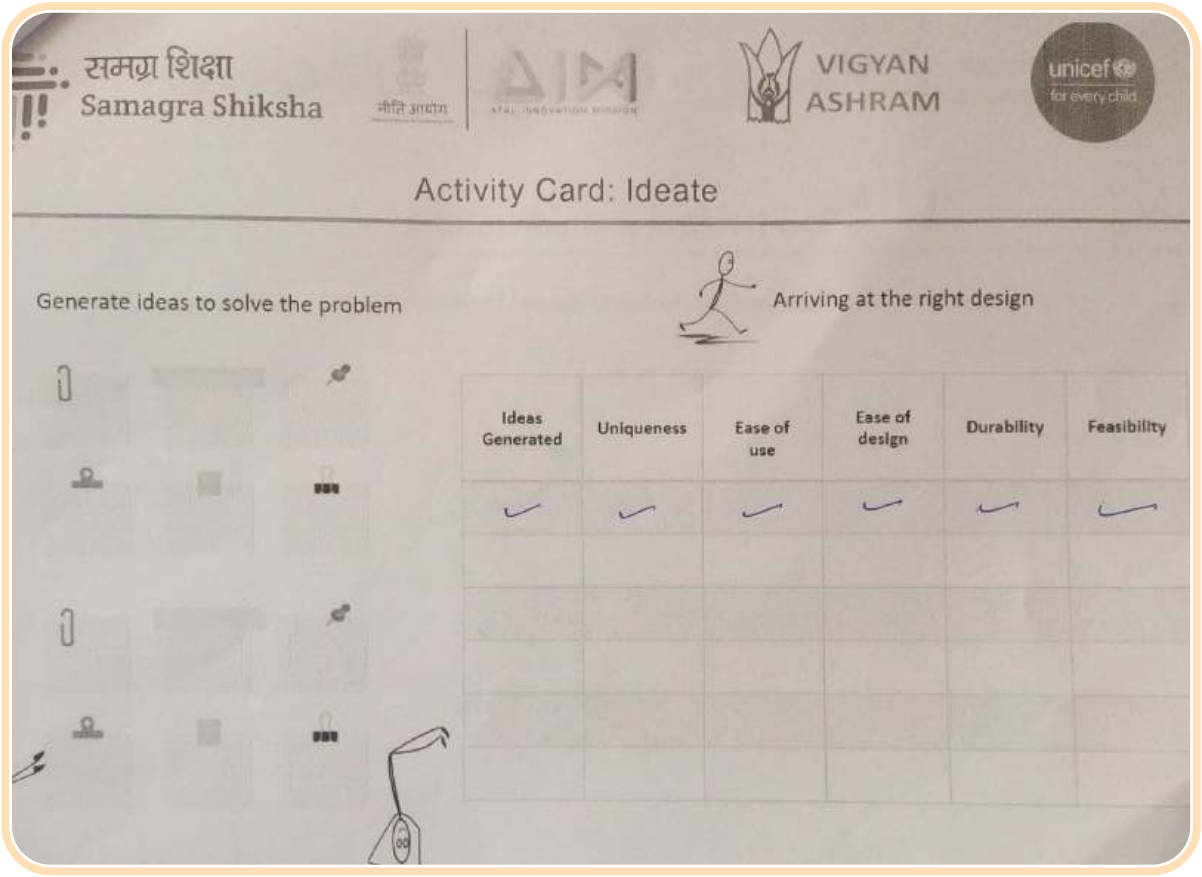
Samagra Shiksha
VIGYAN ASHRAM
unicef
Activity Card: Point of View
I am an farmer working in fields
I am trying to farming without tension
But I am afraid of snakes
Because of many snakes can be seen in field
Which makes me feel Safe and Protective
Write down the problem you have selected with reason
- Facing life threatening in fields
- Portable and easy to use.
Point of View Statement
Write a sentence that summarizes the problem you want to solve
A farmer in a rural village needs a safe, affordable and practical way to keep away from his fields, he feels present traditional methods not so much effective.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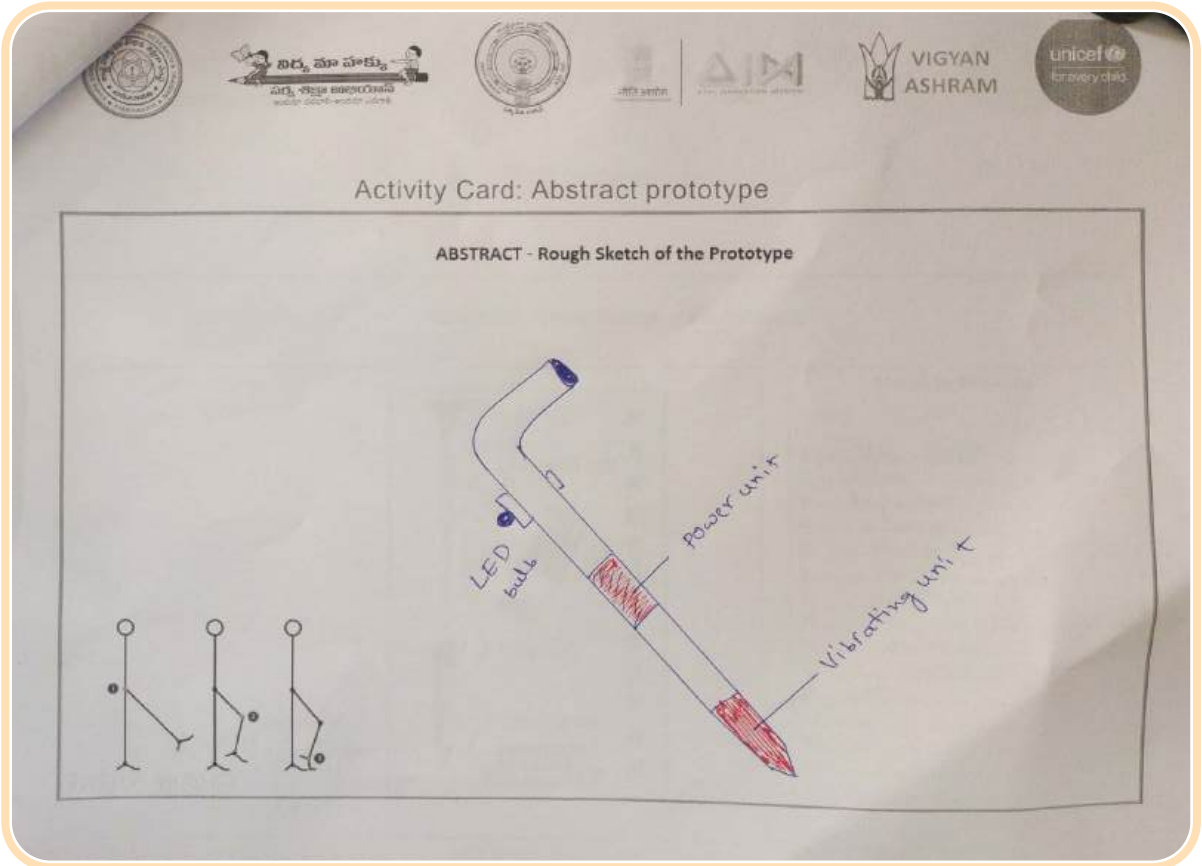
unicef
Activity Card: Ideate
Generate ideas to solve the problem
Arriving at the right design
Ideas Generated
Uniqueness
Ease of use
Ease of design
Durability
Feasibility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unicef
Activity Card: Abstract prototype
ABSTRACT - Rough Sketch of the Prototype
LED bulb
Power unit
Vibrating unit

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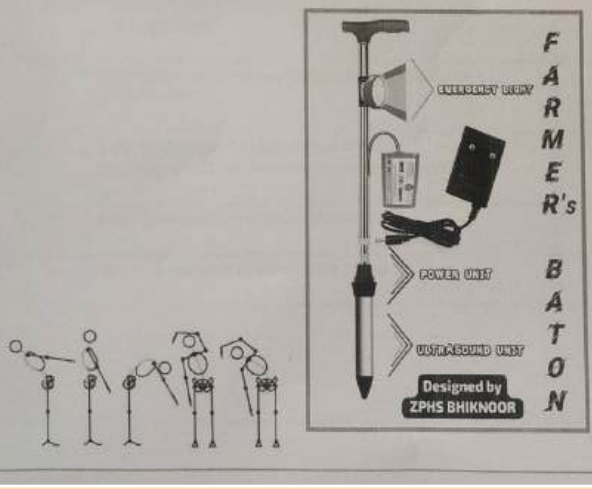
Activity Card:Concrete prototype

CONCRETE - Detailed Sketch of the Prototype



Materials Required

1. PVC Pipe
2. Ultra Sound Vibrator
3. Arduino
4. Charger
5. Battery (solar panel)
6. Stick
7. L.E.D torch
8. Sharpended iron or plastic
9. Switches
10. buzzer
11.
12.
13.
14.
15.

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VIGYAN ASHRAM

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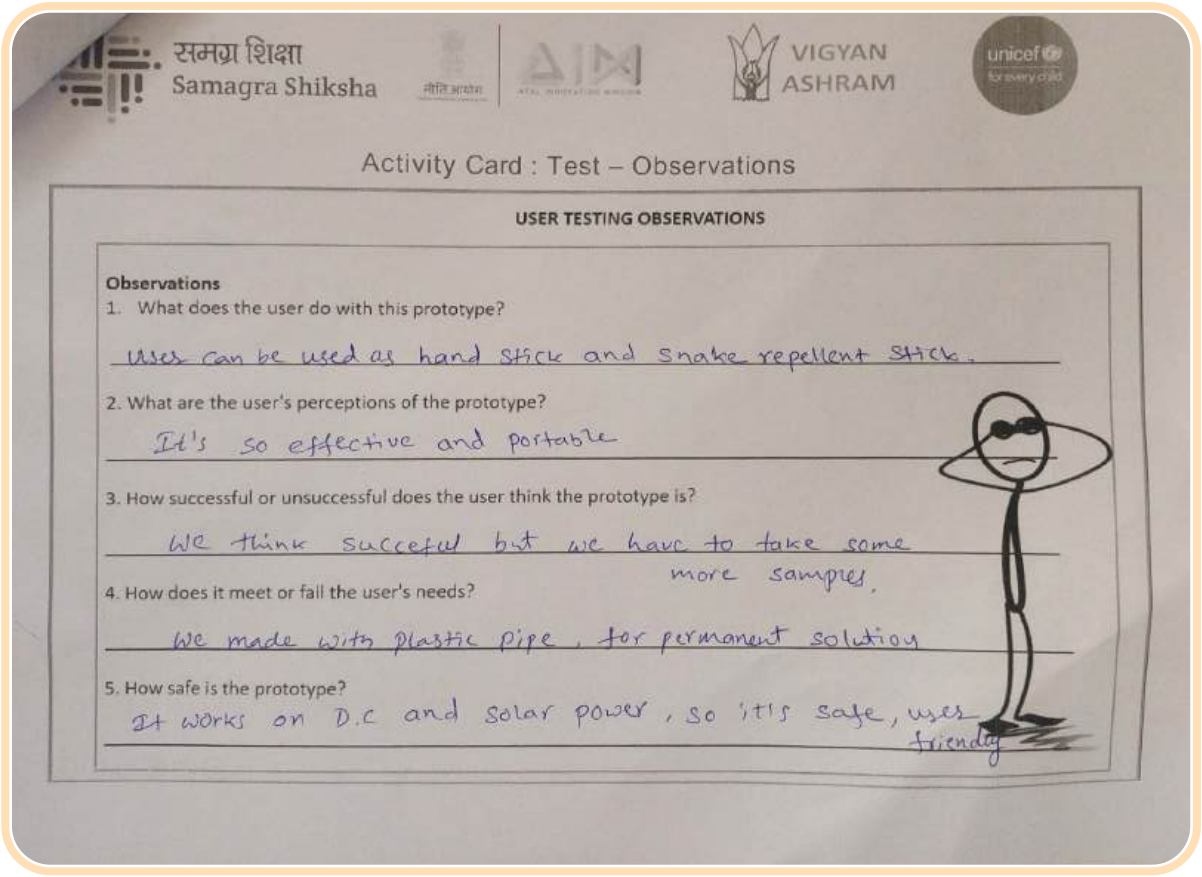
Activity Card : Test – Questions

USER TESTING QUESTIONS

Sl.No	User Testing Questions	Remarks
1.	What do you like and dislike about this prototype?	It's so effective and works solar power also
2.	What could be done to make "you want" to use this prototype more?	we draw a design on papes then make a prototype.
3.	What do you think of how the prototype looks (the aesthetics)?	It is designed as hand stick with snake repeller devic
4.	Is this prototype efficient, safe, and comfortable to use? If not, how could it be improved to make it user friendly ?	efficient and portable
5.	What are the problems with this prototype?	some times vibrator not responding,
6.	What can be done to solve these problems?	so we used Arduino - Nano



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Activity Card : Test – Observations

USER TESTING OBSERVATIONS

Observations

1. What does the user do with this prototype?

Users can be used as hand stick and snake repellent stick.

2. What are the user's perceptions of the prototype?

It's so effective and portable

3. How successful or unsuccessful does the user think the prototype is?

We think succeful but we have to take some more samples.

4. How does it meet or fail the user's needs?

We made with plastic pipe, for permanent solution

5. How safe is the prototype?

It works on D.C and solar power, so it's safe, users friendly

Case Study 06

The Peanut Peeler

Cracking the Challenge

Zilla Parishad High School Karmanghat
Ranga Reddy, Telangana

Peeling peanuts can be a slow, finger-burning chore especially when they are hot. The wait, the heat and the repetitive effort make a simple snack time-consuming to prepare.

What did two students of ZPHS Karmanghat design to solve this everyday kitchen challenge, by making peanut peeling quicker, safer with far less effort?

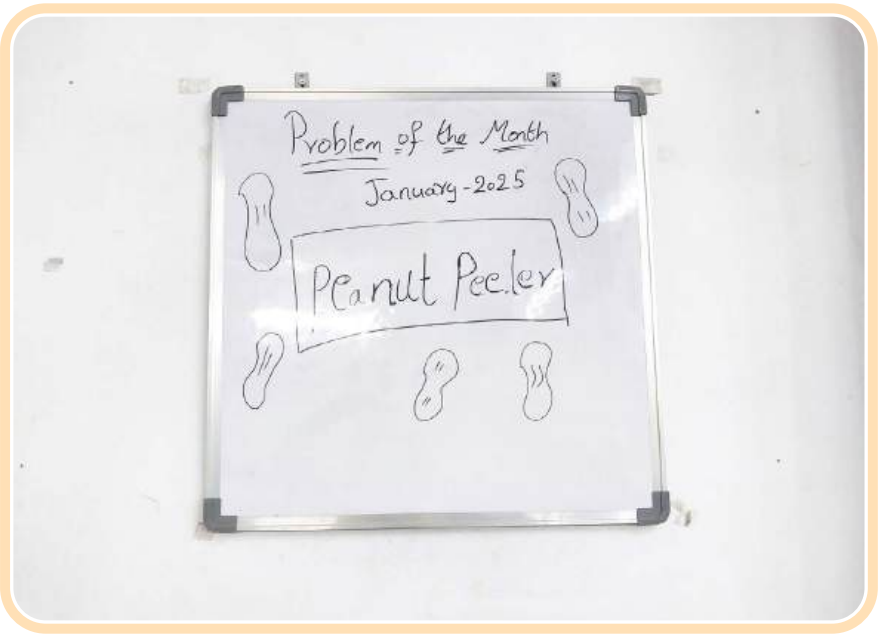
How it All Began

Background and Context

The Atal Tinkering Lab at ZPHS Karmanghat, established in 2023, opened new opportunities for students to explore science and innovation. Many students including Shiva and Ajay were first introduced to robotics and simple circuits through an external mentor-led programme. Due to their quick grasp of concepts and problem-solving skills, the organisers appointed Shiva as Captain and Ajay as Vice-Captain of the programme.

Seeing their skills and enthusiasm, the ATL teacher at the school encouraged both of them to visit the lab regularly, as it gave them access to more advanced tools and methodologies. The two of them realised that they could design complete solutions from start to finish in the ATL moving beyond pre-set circuit tasks. Some of the projects they worked on included a smart waste management system, an alerting device to prevent train accidents and a sensor-based obstacle

detector for visually impaired people. Each project strengthened their technical skills and showed them how innovation could address real-world problems.



One of the ATL's most engaging initiatives was its "Problem of the Month" challenge, where students were given a real-life problem to solve. One day, a visitor to the school shared a household challenge with the students in the lab: at home, both she and her mother found peeling peanuts, especially when hot to be slow, uncomfortable and tedious.

She wrote this as the month's challenge: "Design a Peanut Peeler." For Shiva and Ajay, this was the perfect opportunity to apply their creativity to something both familiar and unique. They had often seen this scene in their own homes, so the problem felt personal. At the same time, it was a new kind of challenge for them, requiring a solution that blended practicality with mechanical innovation. Determined to find a solution, they threw themselves into the task.

Empathise

Understanding the Struggles

The students began by reflecting on their own experiences at home and soon realised that the problem was a common occurrence. To understand the issue more deeply, Shiva and Ajay spoke with their teachers and other staff in the school. These conversations revealed that peeling peanuts was not only time-consuming, especially in larger

Did You Know?

India is the second largest producer of peanuts in the world, contributing nearly 20% of global production.

"Sometimes we don't realise how much effort goes into the smallest part of preparing a meal. Watching it closely made us want to make it easier for the people we care about."

quantities, but also uncomfortable because of the heat. Over time, the repetitive motion could make fingers sore and the task tiring.

Hearing these accounts convinced the students that a better solution was needed - one that could make peeling peanuts quicker, safer and easier, without taking away the enjoyment of eating them fresh.

Define

Framing the Problem

Once they had gathered enough insights, the students worked with their teacher to draft a clear problem statement.

Design Tip

When you define a problem, think about the setting where it happens. The kitchen environment shaped every choice in this design, right from size and safety to ease of cleaning.

Problem Statement

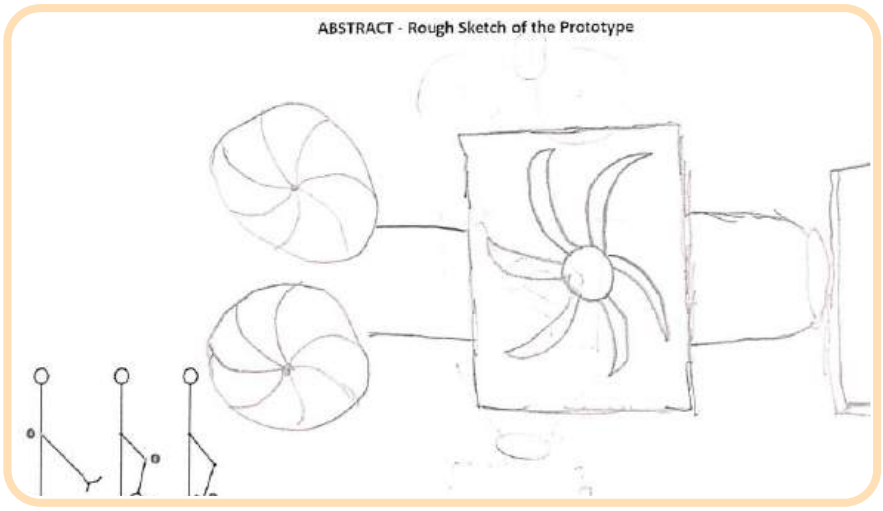
> **"Peeling peanuts by hand is slow and uncomfortable, especially when they are hot. There is a need for a simple, efficient and safe device that can peel peanuts quickly, without burning fingertips, and with minimal effort."**

Putting their observations into a single, well-defined statement gave the team both clarity and purpose. With a shared understanding in place, they were ready to move to the next stage of ideation.

Ideate

Brainstorming Solutions

With the problem clearly defined, Shiva and Ajay began exploring possible ways to peel peanuts faster, without burning fingers or wasting time. They first sketched a range of concepts from mechanical hand-operated peelers to small devices powered by simple motors. During these sessions, their teacher reminded them to think about what would be easy to use in a home kitchen, safe for anyone to operate and able to work for both hot and cooled peanuts.



As they explored different approaches, they identified friction as the most promising method. If they could create a controlled space where peanuts rubbed against a textured surface, the skins would come off quickly. The challenge would be to design this in a way that was compact, affordable and easy to maintain. With this in mind, they moved forward to build their first working model.

Did You Know?

Do you know how we walk without slipping, write with a pencil or stop a bicycle with brakes? The answer is friction – the same force that the students used to design the peanut peeler!

Prototype

Turning Ideas into Reality

Shiva and Ajay's first attempt used two rubber tubes with wheels between them, each powered by a motor spinning in the opposite direction. When peanuts would pass between the moving surfaces, friction would loosen the peanut skins. But problems showed up quickly. The tubes weren't cut to the right size and a gap between the tubes allowed peanuts to slip through. Adjusting the motor combinations didn't help and the smooth rubber surfaces created too little friction to be effective.

Design
Tip

Prototypes are not meant to be perfect. They are meant to teach you what to fix, improve or completely rethink.

To improve performance, they wrapped the rubber tires with coarse sandpaper. This small change dramatically increased friction and started peeling peanuts more effectively. They also sewed the tubes together to remove the gap, which kept the movement smooth and controlled. The whole design was mounted on a stand.

Excited, they tested this version in their school staffroom. The peeling worked but there was a new problem. Since the peels and peanuts weren't separated, the lightweight skins flew all over the room, especially with the ceiling fan on.

Learning from the mess, Shiva and Ajay added two separate compartments - one for collecting peanut skins and another for the peeled peanuts. The teachers also suggested covering the device to make it more appealing and suitable for a kitchen. For this, the students repurposed the outer casing of a second-hand mixer blender, giving the peeler a familiar, appliance-like look. The final version included two motorised wheels with sandpaper for friction, a fan to blow away loosened skins, a basket for peel collection and a sliding tray for peeled peanuts. Iron plates and 3D-printed parts were used for the internal structure and a switch with adapter-based power supply was built for portable use.

Test

Validating the Solution

With all the changes in place, Shiva and Ajay brought their final peanut peeler back to the staffroom. This time, it worked flawlessly: skins went straight into the net basket, peanuts into the collection box and nothing flew around the room.

"For us, prototyping and testing happened side by side. Every change we made had to be tested right away — it was like both steps were happening at the same time."

What curricular topics did the students learn through the project?

Science:
Separation of Substances, Electricity and Circuits, Friction, Force and Pressure, Work and Energy, Where Does Food Come From?, Components of Food, Motion and Measurements of Distance

Teachers called it "ready for the kitchen" and praised its neat, professional look. Encouraged by the success, the students are now exploring extra features like speed control, battery power and even a smaller, less heavier portable version.

Impact

Making a Difference in the Community

The peanut peeler designed by the students turned a slow, uncomfortable task into a quick, safe and mess-free process, all in a device that is affordable, easy to use and kitchen-friendly.

Meet the Team

Students' Names from ZPHS, Karmanghat, Telangana

Teacher
(extreme right):

- S. Praveena

Students
(from left to right):

- R. Ajay Kumar
- V. Shiva

What did the students find most exciting?

The fact that one small idea to separate the peels from the peanuts, made the whole thing a success was very exciting! It was almost unbelievable that such a change could work overnight. That single improvement solved the biggest problem we were facing and made the device feel complete. It showed us how even tiny changes can have a big impact on the final result.

What did the students find most difficult?

The first prototype's rubber tubes were the hardest part. It was frustrating when the gaps wouldn't close and nothing worked as planned. We spent hours making adjustments, only to find new problems appearing each time. It really tested our patience and made us realise that persistence is just as important as technical skills.

What did the students learn through this process?

Never give up when something fails. We will find a solution if we keep trying. If we had given up, this product wouldn't exist today. Now we're more confident, more active in our studies, and more patient than before. We also feel better prepared to take on challenges in the future, because we know that failures are just steps toward a better solution.

Note: This project was undertaken in the year 2025.

Design Thinking Format

समग्र शिक्षा
Samagra Shiksha

VIGYAN ASHRAM

Design Thinking Template

Student Names Vardham. Shiva
Rudavath. Ajay. Kumar

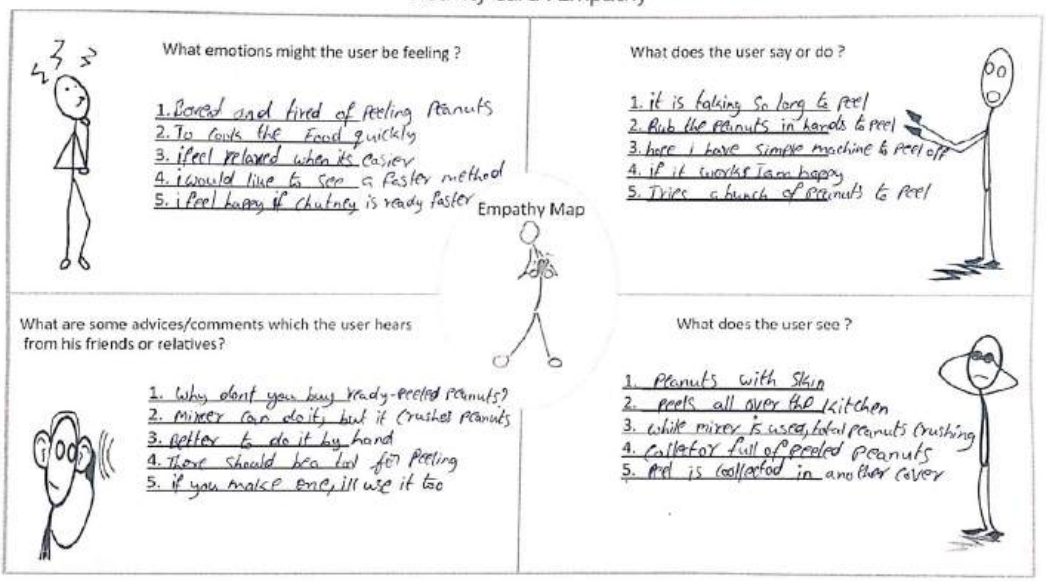
Guide Teacher : S. Praveena

School: Z.P.H.S Karmanghat
District: Ranga Reddy
State: Telangana

समग्र शिक्षा
Samagra Shiksha

VIGYAN ASHRAM

Activity Card : Empathy



समग्र शिक्षा
Samagra Shiksha

VIGYAN ASHRAM

Activity Card: Design Challenge

Research / Observe
List the specific facts and observations that you noticed in the scenario.

1. Peeling by hand is slow
2) Chutney making takes longer because of peeling
3) Mixers crush peanuts along with peel
4) Ready-peeled peanuts cost more
5) Fingers hurt after long peeling
6) People want a clean method
7) our machine peels without crushing peanuts

Define Challenges
Write down all the problems which are relevant and can be addressed.

- Peanuts breaking
- High cost of Peeled peanuts
- No simple tool for peeling
- Peels all over the kitchen
- Fingers pain
- Time waste

समग्र शिक्षा
Samagra Shiksha

VIGYAN ASHRAM

Activity Card: Point of View

I am an student making a project to prepare Peanut Chutney easily

I am trying to make a machine that Peels Peanuts fast without breaking them

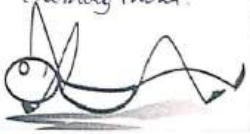
But I am struggling because Peeling by hands take too much time

Because of old methods and no proper tool for this

Which makes me feel frustrated and eager to invent Something useful

Write down the problem you have selected with reason

Peanuts peeling by hand is slow, especially when we need them for Chutney our project aims to Solve this so people can save time and have peeled Peanuts without Crushing them.



Point of View Statement
Write a sentence that summarizes the problem you want to solve

Design a Peanut Peeler that is quick, clean and keep Peanuts without breaking, So cooking Peanut Chutney becomes faster and easier

समग्र शिक्षा
Samagra Shiksha

VIGYAN ASHRAM

Activity Card: Ideate

Generate ideas to solve the problem

Arriving at the right design

Ideas Generated	Uniqueness	Ease of use	Ease of design	Durability	Feasibility
Sandpaper wheels + fan	✓	✓	✓	✓	✓
Rubber rollers	✗	✓	✓	✓	✓
Hot air + abrasive	✓	✗	✗	✗	✗
water assisted peeling operated Sandpaper drum	✗	✓	✓	✓	✓
	✗	✗	✗	✗	✗

VIGYAN ASHRAM

Activity Card: Abstract prototype

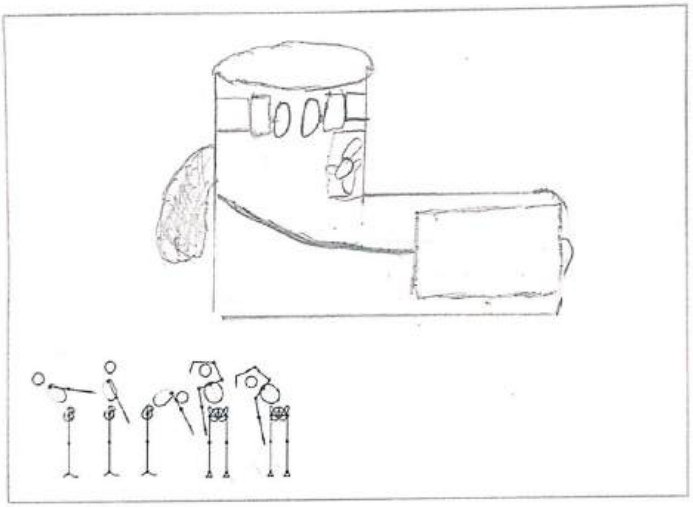
ABSTRACT - Rough Sketch of the Prototype

समग्र शिक्षा
Samagra Shiksha

VIGYAN ASHRAM

Activity Card : Concrete prototype

CONCRETE - Detailed Sketch of the Prototype



Materials Required

1. 2 Motors
2. 2 Wheels
3. 1 Fan
4. 1 3d Printed Tray
5. Piece of net
6. Mixer frame
7.
8.
9.
10.
11.
12.
13.
14.
15.

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Activity Card : Test – Questions

USER TESTING QUESTIONS

Sl.No	User Testing Questions	Remarks
1.	What do you like and dislike about this prototype?	likes: Fast peeling, no crushing, skins collected neatly Dislikes: Noise, Sandpaper wears out.
2.	What could be done to make "you want" to use this prototype more?	• make it quiter • make it smaller and lighter • Easy Sandpaper change
3.	What do you think of how the prototype looks (the aesthetics)?	• Works well but looks like workshop tool • can be made more like a kitchen gadget
4.	Is this prototype efficient, safe, and comfortable to use? If not, how could it be improved to make it user friendly ?	• efficient : yes • Saf : mostly, but cover moving parts • comfortable : yes, but add handle
5.	What are the problems with this prototype?	• Noise • Sandpaper wears out . Some dust leaks
6.	What can be done to solve these problems?	• quieter motor • easy Sandpaper change design

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Samagra Shiksha

VIGYAN ASHRAM

unicef for every child

Activity Card : Test – Observations

USER TESTING OBSERVATIONS

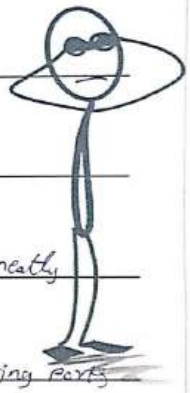
Observations

1. What does the user do with this prototype?

The user pours peanuts into the machine

2. What are the user's perceptions of the prototype?

it peels peanuts quickly



3. How successful or unsuccessful does the user think the prototype is?

Saves time compared to hand peeling

4. How does it meet or fail the user's needs?

~~exhibit noise~~ Saves time, keeps peanuts whole, collects skin neatly

5. How safe is the prototype?

Mostly safe with proper cover, needs better covering of moving parts

Sample Design Thinking Format

Design thinking Format

School:

Mandal:

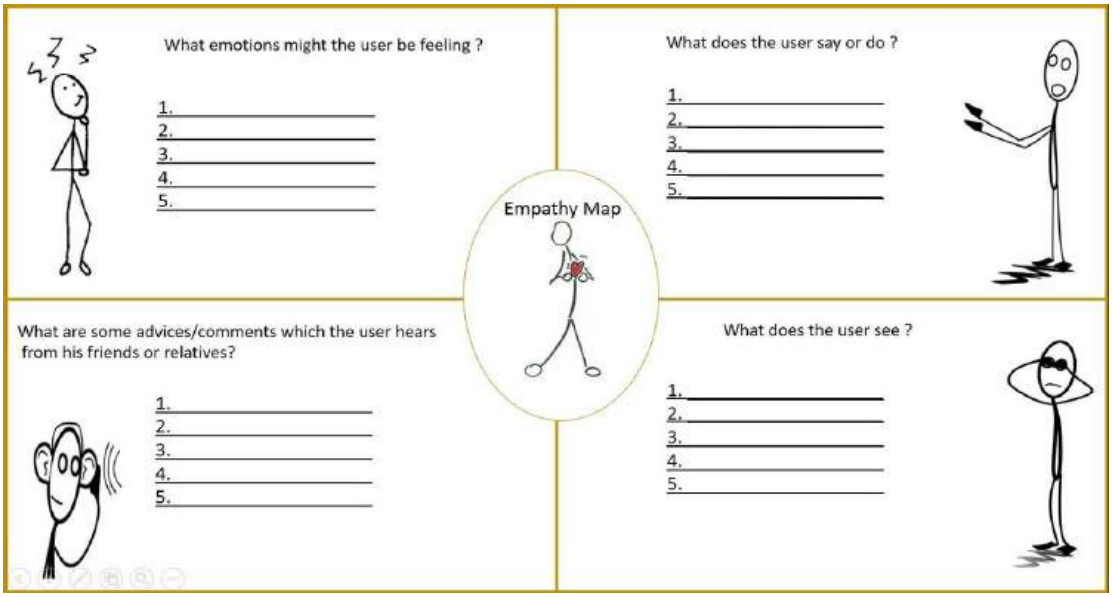
Distict:

State :

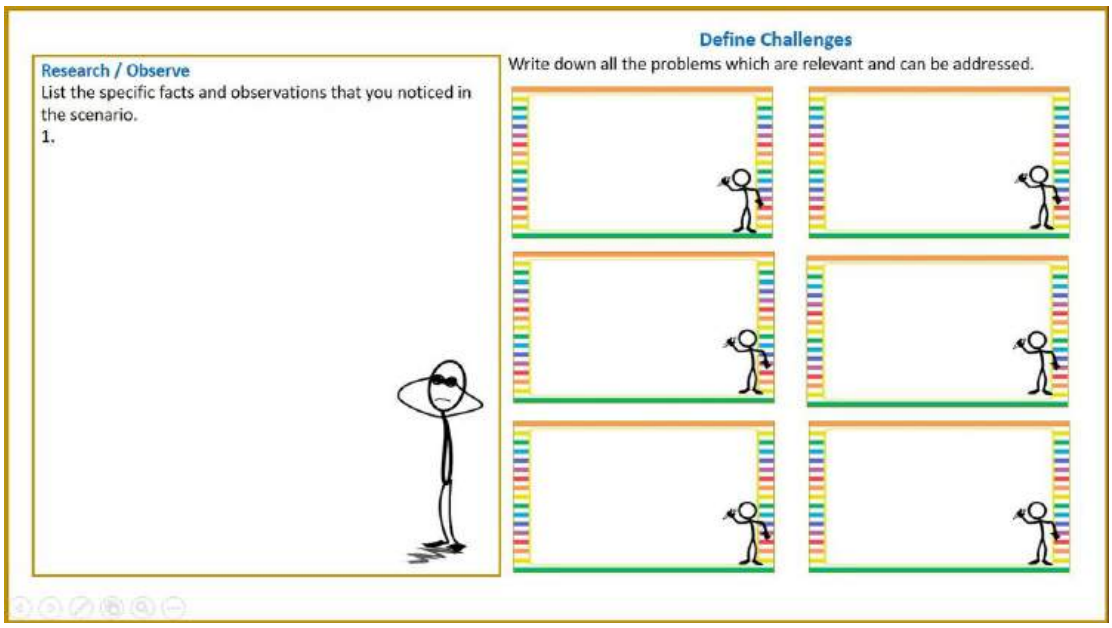
Group Name :_____

The Design Thinking process has 5 steps.
1.Empathize 2. Define 3.Ideate 4.Prototype and 5.Test.

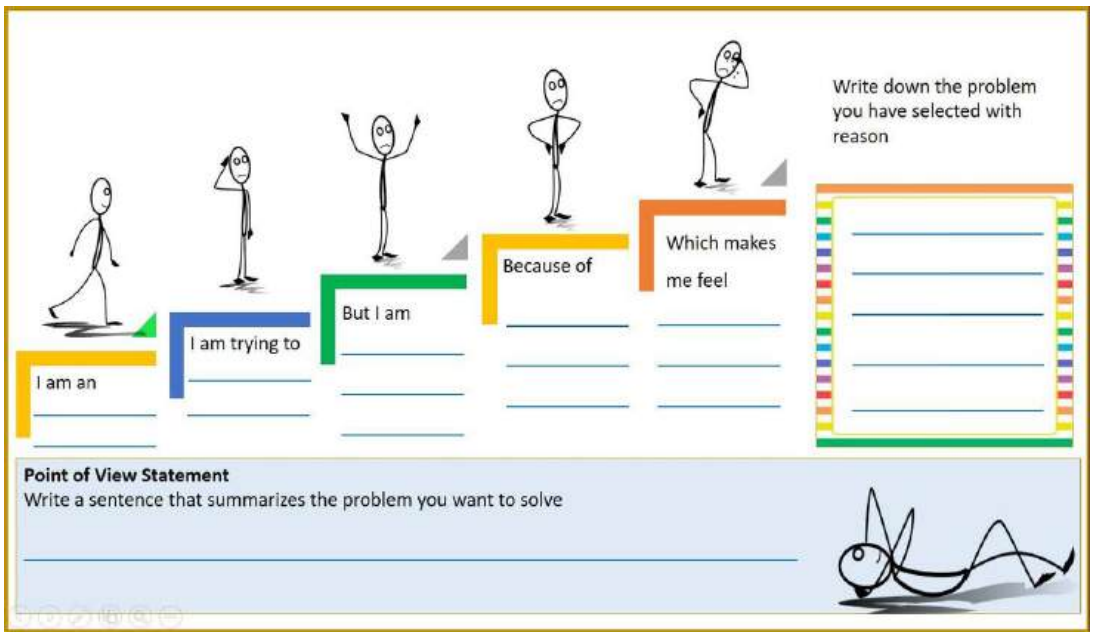
Activity Card : Empathy



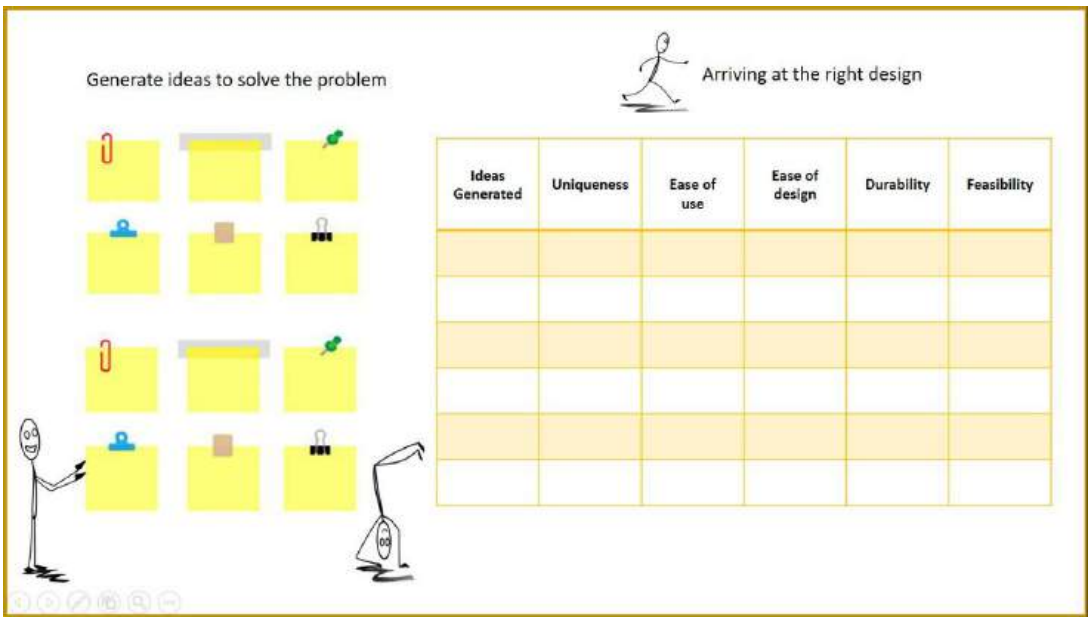
Activity Card: Design Challenge



Activity Card: Point of View



Activity Card: Ideate



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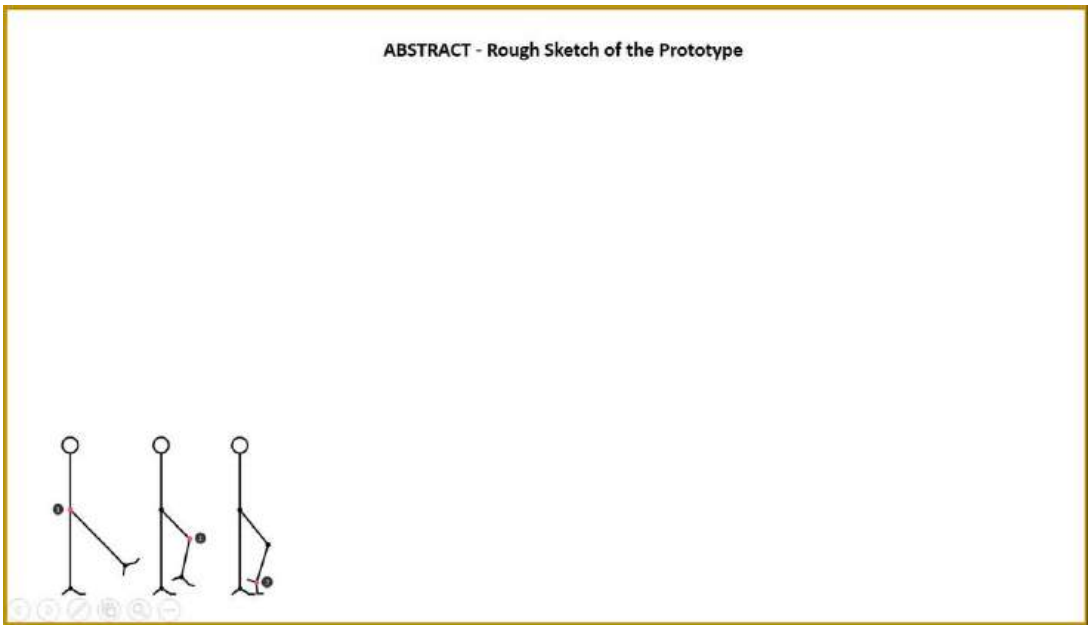
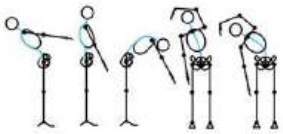


Activity Card : Concrete prototype

CONCRETE - Detailed Sketch of the Prototype



Materials Required

1. .....
2. .....
3. .....
4. .....
5. .....
6. .....
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10. .....
11. .....
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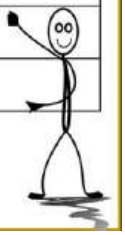

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USER TESTING OBSERVATIONS

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3. How successful or unsuccessful does the user think the prototype is?

4. How does it meet or fail the user's needs?

5. How safe is the prototype?