विज्ञान एवं प्रौद्योगिकी विभाग
DEPARTMENT OF
SCIENCE & TECHNOLOGY

सत्यमेव जयते

राविप्रौसंप NCSTC

National Children's Science Congress(NCSC)

Focal Theme
Science and Innovation for Sustainability

Activity Guide Book 2026 & 2027

A Flagship Programme of

National Council for Science & Technology Communication (NCSTC) Division
Department of Science & Technology (DST)
Government of India

Activity Guidebook created under the guidance of National Academic Committee (NAC) of National Children's Science Congress **(NCSC)**

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भारत सरकार

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MESSAGE

The vision of our Hon'ble Prime Minister Shri Narendra Modi Ji to make India self-reliant and developed nation by 2047, fosters significantly upon Science Technology and Innovation. Investing in next generation scientists is critical for achieving "Viksit Bharat", as it fosters innovation, strengthens research and development capabilities, and builds a skilled talent pipeline for emerging sectors.

The Government of India is providing several platforms for young scientists and innovators to experiment innovate and translate. For several years, the National Children's Science Congress (NCSC) has inspired young students to view the world around them with curiosity and explore societal issues through the lens of science with confidence.

What began as a small initiative to bring science closer to children has now evolved into a nationwide movement that touches students from schools as well as out of schools, communities, and families across the country. It gives me immense satisfaction to witness how this programme continues to nurture fresh innovative ideas and a spirit of exploration among our younger generation.

The theme for NCSC 2026–2027, "Science and Innovation for Sustainability" is timely and significant. Around the world, societies are seeking ways to use resources wisely and adopt practices that are both responsible and future-oriented. By exploring subjects such as water, energy, waste management, agriculture, health, and traditional knowledge systems, children learn to connect scientific understanding with everyday choices. These experiences help them realise that sustainability is not merely a policy concept, but a way of life—one to which each of us can meaningfully contribute.

The National Academic Committee (NAC) and team NCSTC Division, DST has carefully curated this Activity Guidebook to support participating students and teachers throughout their project journey and offer structured guidance, practical insights, and relevant examples to help young participants carry out scientific investigations with clarity and confidence to think beyond textbooks and engage with real-world challenges. I congratulate them for their dedicated efforts in creating this resource material.

I hope this guidebook inspires children to observe their environment closely, think independently, and use science to improve the world around them. The brilliant hands-on approach it promotes could sow the seeds for some sparkling ideas that could transform the future of science as well as that of our country.

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Secretary
Government of India
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Department of Science and Technology

1st December, 2025

FOREWORD

Inspirational activities play a vital role in helping children discover science through experiential learning and hands-on exploration connected to their daily lives. For over three decades, the National Children's Science Congress (NCSC), a flagship programme of the National Council of Science & Technology Communication (NCSTC), Department of Science and Technology (DST), has served as a vibrant platform encouraging young learners across India to observe, question, and understand the world around them. It nurtures careful observation, thoughtful inquiry, and research based scientific thinking.

The NCSC provides a platform for children from diverse backgrounds including remote villages, small towns, islands, and learners with special needs to actively participate and present their research work. By promoting scientific engagement in vernacular languages, the programme ensures that knowledge and creativity remain accessible to all, fostering equitable learning opportunities nationwide. Through this initiative, generations of Child Scientists have developed curiosity, critical thinking, and independent reasoning that extend beyond classroom learning.

The dedication of mentors, subject experts, and the National Academic Committee (NAC) has been instrumental in shaping the NCSC into a platform that identifies talent, encourages collaboration, and inspires responsible citizenship. The theme "Science and Innovation for Sustainability" has been thoughtfully chosen in alignment with the vision of Hon'ble Prime Minister, Shri Narendra Modi ji, to sensitize young scientists to various aspects of sustainability and the need to protect and conserve our future.

It is my pleasure to present this edition of the Activity Guide Book, designed to support participants in exploring research topics beyond the textbook. I hope it serves as a valuable resource for participants, guide teachers, and coordinators, helping them nurture creativity, scientific temper, and a lifelong passion for research among India's young scientists. I appreciate Dr. Rashmi Sharma, Head NCSTC, and Dr. Anil Kothari, Chairman, NAC, for their contribution. May this book inspire all participants to continue exploring, learning, and contributing positively to society.

(Abhay Karandikar)

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Preface

The National Children's Science Congress (NCSC) continues to be one of the most effective platforms for nurturing scientific thinking among young learners. Since its inception in 1993, it has provided children across the country with an opportunity to explore scientific concepts, identify local issues, and develop innovative solutions through systematic inquiry.

The world is undergoing rapid environmental transformations, making "Mission LiFE" as envisioned by Hon'ble Prime Minister, Shri Narendra Modi ji timely and appropriate. The identified theme of NCSC "**Science and Innovation for Sustainability**," is suitable in current perspective as it aims to engage child scientists towards addressing local and global challenges leading to sustainability.

The carefully envisioned sub-themes include Water, Energy, Waste Management, Agriculture, Health, and most important Application of Indian Knowledge Systems for Sustainability. These domains align aptly with the Sustainable Development Goals (SDGs) and encourage students to think critically about building a sustainable and equalised future. This Activity Guide Book will assist child scientists and their mentors in understanding the theme, identifying pertinent project ideas, and executing them effectively. It also serves as a practical resource for guide teachers, helping them nurture curiosity, guide research, and foster problem-solving skills among participants.

My heartfelt thanks to Prof. Abhay Karandikar, Secretary, DST for guiding us in identifying a powerful theme to converge with National Mission. I am also thankful to Dr. Shiv Kumar Sharma Ji, Shri Praveen Ramdas Ji for their inputs related to NCSC. I extend my appreciation members of the NAC under the Chairmanship of Dr. Anil Kothari and to all mentors, coordinators, and for their commitment to nurture scientific curiosity among children. Special thanks to Dr. Prabhat Rai for taking up this herculean task of preparing this Book.

The enthusiasm and creativity of young participants is commendable to keep this programme vibrant year after year. I hope this guidebook supports every child in exploring their ideas, experimenting confidently, and seeing science as a way to make life better for all.

Yours sincerely,
Dr. Rashmi Sharma

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ESTD. 1981

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About This Activity Guide Book

This Activity Guide Book (AGB), developed for NCSC 2026–2027, is the result of dedicated and collective efforts by the members of National Academic Committee (NAC), a body responsible for overseeing the academic framework of NCSC. The development of AGB commenced with in-person meeting of NAC on 11th -12th August, 2025 in New Delhi, where thematic suggestions from various stakeholders were reviewed and discussed, followed by series of deliberations through online meetings. Five sub-committees were constituted for content development on sub-themes, followed by vetting and proof reading by NAC. The experiments provided are suggestive, and Child Scientists should apply them creatively and imagine innovative ways to take the ideas further.

The theme of NCSC-2026 and 2027 has been thoughtfully selected after due deliberations as **Science and Innovation for Sustainability**. The thematic domains explored under the current theme encompass areas aligned with the Sustainable Development Goals (SDGs), as well as Waste Management, Energy, Water, Food, Agriculture & Health, Application of Indian Knowledge Systems for Sustainability. These intellectually stimulating themes inspire Child Scientists to develop innovative, research-driven projects that reflect creativity and scientific rigor.

The NCSC welcomes participation from children of class 6th to 12th, including those in formal education, out-of-school learners, and Divyangjans (children with special needs), fostering inclusivity and broad-based engagement. As NCSC enters its fourth decade, the scope and depth of its scientific content and outreach are being expanded to meet contemporary challenges and opportunities.

As the Chairman of NAC, I extend my sincere thanks to the members of the committee for bringing out this wonderful Activity Guide Book. My sincere thanks to **Prof. Abhay Karandikar**, Secretary, DST for giving idea for theme and his constant valuable guidance. I also thankful to **Dr. Rashmi Sharma** & **Dr. Prabhat Kumar Rai** for giving cooperation and all support, My special thanks to **Dr. Shiv Kumar Sharma Ji**, **Shri Praveen Ramdas Ji** and **Shri Vivekanand Pai Ji** from Vijnana Bharti for their valuable inputs and guidance for making this Activity Guide Book. I hope this guidebook meets the expectations of all stakeholders and serves as a valuable resource for Child Scientists and their mentors in effectively implementing the Children's Science Congress at the District, State, and National levels.

(Dr. Anil Kothari)

Expression of Gratitude

The National Children's Science Congress (NCSC) is a flagship programme of NCSTC Division, Department of Science & Technology (DST), Government of India. It provides a platform for children to explore and present research-based solutions to local problems using scientific methods under a specific theme.

I sincerely thank **Prof. Abhay Karandikar, Secretary**, Department of Science & Technology (DST), Govt. of India (GoI), for his valuable guidance and encouragement. His visionary support has been instrumental in elevating NCSC into a programme of national importance. I extend my heartfelt gratitude to **Dr Rashmi Sharma**, Scientist-F & Head, NCSTC, DST, for her insightful suggestions and unwavering guidance in the design and development of this publication.

This AGB is the outcome of the in-person meeting held on 11–12th August 2025 at IIT Delhi, along with several discussions among members of the National Academic Committee (NAC), the NCSTC team, and other experts. I am extremely thankful to **Dr. Anil Kothari**, Chairman, NAC, for his valuable inputs and leadership in bringing all NAC members together as a team. I also thank all NAC members for content creation and proofreading of the book within a short time.

I extend my special thanks to **Prof. Jayanti Dutta** for editing and reformatting the entire book. I offer my sincere thanks to **Shri Vivekanand Pai**, National Secretary General, Vijnana Bharati, New Delhi, and **Shri Sandeep Bhattacharjee**, Assam Science Technology and Environment Council, for their valuable inputs.

I extend my heartfelt thanks to **Shri Ravi Kumar**, DST, for his creative contribution in designing the cover page and illustrations of the book, and to **Smt. Anupama Kaushal** for her support in proofreading the book. I also express my sincere appreciation to **Dr. Narottam Sahoo**, Gujarat Council on Science & Technology (GUJCOST), for his support in facilitating the printing of its hard copies.

I am extremely thankful to **Shri Rajinder Singh** (Scientist E), **Dr. Pushp Sen Satyarthi** (Scientist C), **Dr. Vishnu Kiran Rompicharla** (Scientist C), and **Dr. Sudheesh N** (Scientist B) of the NCSTC Division, DST, for their continuous support and encouragement.

Dr Prabhat Kumar Rai

Scientist-C, NCSTC

Department of Science & Technology (DST)

Government of India

Chapter 1

National Children's Science Congress (NCSC)
A Journey of Science and Culture

The National Children's Science Congress (NCSC), also popularly known as Children's Science Congress at district and state levels, is a dynamic platform designed to empower children to undertake small-scale research projects at the micro level. The initiative started at local level by voluntary organization Gwalior Science Centre, Madhya Pradesh. Recognizing its potential, the National Council of Science and Technology Communication (NCSTC), Department of Science and Technology (DST), Government of India, adopted this unique concept and expanded the programme to the national stage.

The launch of NCSC in 1993 coincided with a period of vigorous science communication movements across India, such as Bharat Jan Vigyan Jatha (1987) and Bharat Jan Gyan Vigyan Jatha (1992). These efforts underscored the need for sustained science awareness campaigns for students and educators, leading to the establishment of NCSC as a nationwide programme. Its primary objective has been to cultivate scientific temperament, stimulate curiosity, and deepen understanding of scientific methods among future generations taking them along towards societal advancement.

The National Academic Committee (NAC), a core group of experienced academicians constituted by NCSTC, DST to oversee the academic integrity, identify Focal Theme and Sub-Themes and carefully designs engaging Activity Guide Book (AGB) exclusively on the Focal and Sub-themes to help participants with their projects.

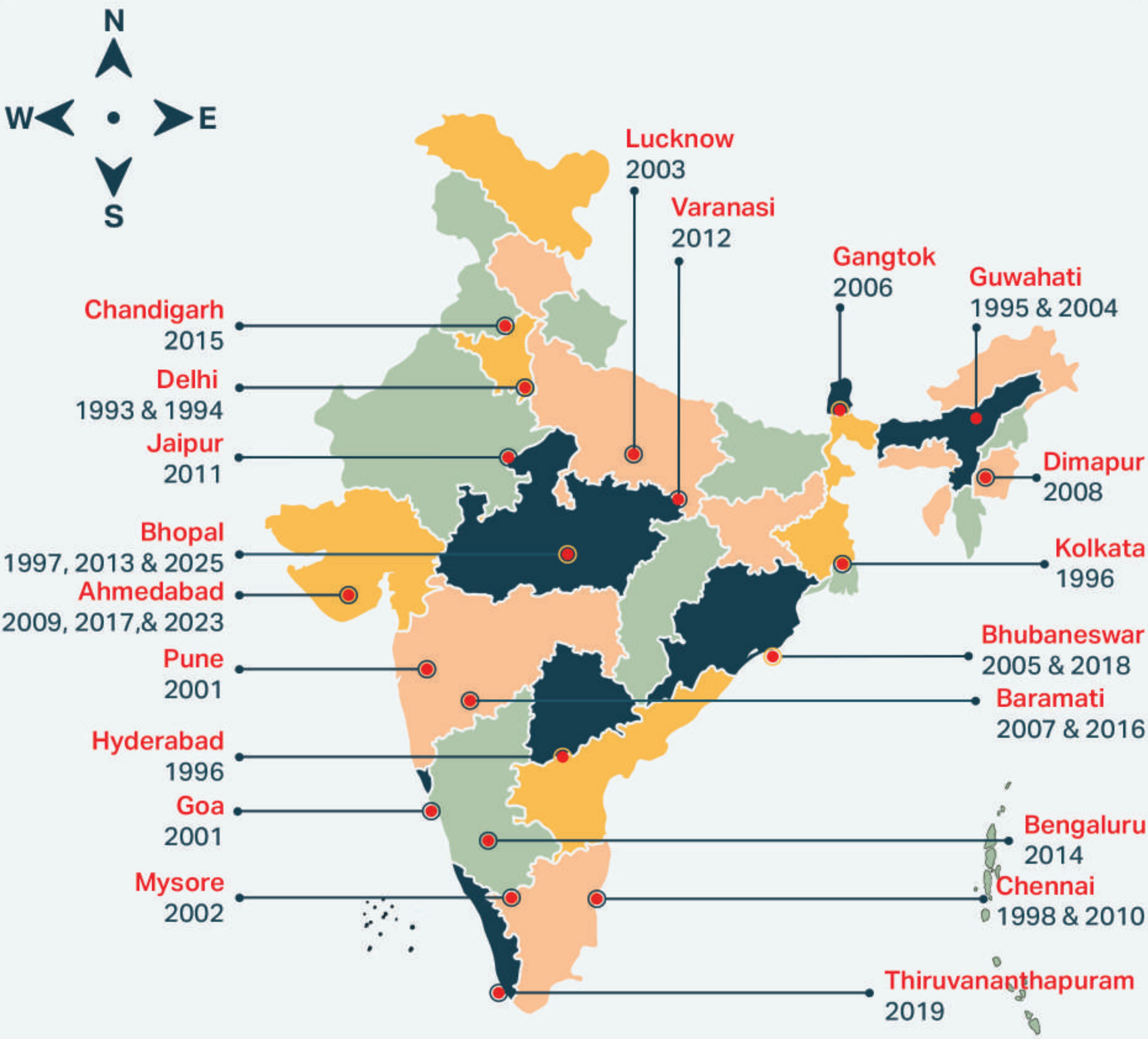
The Children's Science Congress is being organized at District and State level through District and State Coordinators and the selected children participate at State Level Competition. The best research projects from States and UTs as per designated numbers are selected to participate at National Level Competition.

The NCSC is organized at different locations across the country to provide an ecosystem for child scientists not only to present their research work, but also interact with experts from across the country and learn from peers to gain confidence and diverse perspectives. It also gives platform to see the diverse culture (geographical location, weather, food, language and local heritage sites) in states and UTs. The NCSC observes participation of approx. 658 students selected from across States/UTs and gives them an occasion to celebrate their cultural roots during evenings along with science. Till date, NCSC has been organized in 17 states, in the times to come, it will be organized in other States to ensure equity and inclusion.

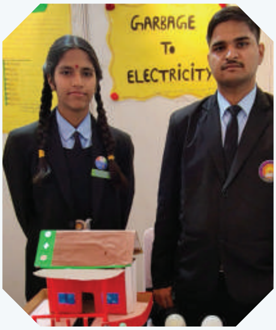
National Children's Science Congress (NCSC)

A programme for children to inspire, innovate and implement

Journey of NCSC through years and places



A glimpse of NCSC



Chapter 2

Introduction to the
Focal Theme and Sub-Themes

Planet Earth has been nurturing life in different forms for ages through its a bundant natural resources. However, during the past few centuries, due to the evolution of civilization with industrialization and over consumption of available resources had disturbed the delicate balance of the ecosystem leading to deforestation, loss of habitat, pollution, biodiversity loss, climate change, environmental challenges, disasters, etc. The warning signs in recent years, such as extreme weather conditions like heatwaves, heavy rainfall, shrinking glaciers and ice sheets, rising sea levels, indicate the need for an immediate action.

In this context, the vision of Mission LiFE — Lifestyle for Environment – given by Hon'ble Prime Minister Narendra Modi at COP26 in 2021 has emerged out as a movement to reconnect people with nature and promote a mindful way of living. Mission LiFE appeals to every citizen to become a "Pro Planet Person" – through changes in their daily choices that are advantageous for both people and the planet. The concept is simple yet powerful, suggesting that each one of us make small modifications in the lifestyle to create a large global impact collectively. The mission believes that protecting Mother Earth is not just the responsibility of the government or scientists; it is the responsibility of each one of us and begins with individual actions -the way we eat, travel, shop, study, and even celebrate.

Science and Innovation for Sustainability is at the core of Mission LiFE, as it means meeting our needs without harming the ability of future generations to meet theirs. It is about balance - using resources wisely, ensuring availability for all living beings, and maintaining harmony between nature and human progress. From conserving water and energy to reducing waste and promoting biodiversity, sustainability teaches us that everything in nature is connected.

As child scientists are the change - makers for the future, this extremely important theme offers a wonderful opportunity to create new prospects towards research and innovation. This youthful, imaginative, and ingenious generation can shape the outlook by adopting eco-friendly habits, applying creativity, and using science and technology to solve real-world problems. Whether it's reusing, recycling, and reprocessing materials, setting up composting pits in your locality, measuring your school's energy use, or spreading awareness that every step counts and every drop counts, your contribution could be immense in this direction. Thus, the child scientists who will participate in the National Children Science Congress (NCSC) will act as the ambassadors of Mission LiFE to connecting the vision with their families and communities.

Mission LiFE not only celebrates India's traditional wisdom and cultural practices that have long promoted sustainability but also promotes the principle of "Vasudhaiva Kutumbakam" – one world, one family lived by our ancestors. Practices like rainwater harvesting, organic farming, herbal medicine, and respect for nature's cycles reflect a deep ecological understanding that existed with our indigenous communities. By blending this Indian Knowledge System (IKS) with modern science, we can find innovative, culturally rooted solutions for today's challenges.

Schools provide a structured environment for academic learning, develop social and emotional skills, and shape students into responsible citizens for society, therefore they play a vital role in this movement. Teacher-mentors of NCSC can inspire students to observe their surroundings, ask questions, design and carry out simple research projects that reflect the spirit of Mission LiFE. Field visits, surveys, experiments, and local problem-solving pursuits can enhance the learning ability of students through hands-on research activities and motivate them to pursue science in the future. This also aligns with the National Education Policy (NEP)-2020's concept of experiential learning. The goal is to move from awareness to action -from knowing what is right to actually practising it.

Sustainability is therefore not a subject we study once; it is a way of life we live every day. Together, we can make Mother Earth greener, cleaner, and safer - ensuring that our shared home thrives for future generations to come. Hence, with NCSC, we take the role of children-scientists to look deeply and scientifically into the various domains of life and sustainability. The theme therefore, is carefully spread into five verticals in alignment with the current perspective as given below:

R5 for Waste Management: Reduce, Reuse, Retrieve, Redesign & Recycle

Urbanization, industrialization, and irrational consumption have led to a multifold increase in waste generation. The proposed R5 approach offers sustainable, smart solutions. We must **Reduce** what we use effectively, **Reuse** items efficiently whenever and wherever possible, **Retrieve** useful materials from waste, **Redesign** products for longer use, and **Recycle** materials to create new ones. Each step helps to save available resources, protect the climate, and the environment. Through the R5 approach, we learn that waste is not the end-it's the beginning of a sustainable cycle.

E4 for Energy: Explore, Experiment, Enhance & Evolve

Energy empowers our lives-from electricity to transport-but most energy sources harm the planet, Therefore the E4 model encourages students to **Explore** different energy forms, **Experiment** with clean sources like solar, wind, tidal, geothermal etc. **Enhance** energy efficiency, and **Evolve** towards greener technologies with innovative thinking, the young generation can help shape a future powered by clean, smart, and sustainable energy.

Water: Harvesting, Harnessing, Recycling & Conservation

The life on Earth is not possible without water, but due to the growing global population and climate change, water shortage has become a serious issue. The theme highlights the need to **Harvest** rainwater, **Harness** water resources wisely, **Recycle** used water, and **Conserve** every single drop. Understanding the natural water cycle helps us respect and protect it. By managing water responsibly, we ensure health, food security, and balance for both people and the planet.

Food, Agriculture & Health

Food is fundamental to health as it provides energy and nutrients required for development and over all well-being. In India, it is often said, 'Jaisa Ann, Vaisa Mann', reflecting that food is responsible for good health. Sustainable agriculture involves growing food without damaging soil, water, or biodiversity and choosing local, seasonal, and chemical-free foods support both farmers and health. Therefore, it is important to understand the association between agriculture, ecology, and health, to make healthy choices for the people and planet.

Application of Indian Knowledge Systems for Sustainability

India is one of the oldest civilizations in the world. The ancient wisdom of Bharat offers timeless lessons on sustainable living. Traditional practices like Yoga, Ayurveda, water harvesting systems, organic farming, irrigation practices, and architecture based on nature's rhythm show harmony with the environment. These Indian Knowledge Systems (IKS) teach balance, respect for resources, and interconnectedness of life. Students can explore local traditions-like using neem for health, terracotta for cooling, or panchang for agriculture-to see how science, art and culture blend beautifully. Reviving these eco-friendly methods helps us rediscover sustainable living deeply rooted in our heritage.

Chapter 3

Model Projects
Under Sub-Themes

R5 for Waste Management:
Reduce, Reuse, Retrieve, Redesign & Recycle

Waste management is one of the biggest challenges, our planet is facing today. You must have seen overflowing landfills, or plastic-choked rivers. The way we handle waste affects every aspect of our lives-our environment, health, and ultimately our climate. According to the Central Pollution Control Board (CPCB) our country generates nearly 65 million tonnes of waste every year, while only about 30% of it is properly processed. Most of it ends up in dumps or drains, polluting air, water, and soil.

The R5 principles: Reduce, Reuse, Retrieve, Redesign, and Recycle, can bring change because together these form a scientific and practical approach to waste management and sustainable living.

Reduce means producing and consuming less. It is reflected in our choices- saying no to plastics, avoiding single-use items, and buying only what we need. Every small decision counts.

Reuse encourages us to use things again instead of disposing them. By refilling, repairing, repurposing jars, or donating old articles, we can practice this. What we see as waste can be a resource too.

Retrieve means recovering valuable materials or energy from waste. Organic waste in kitchens can be converted into compost or even biogas, thus retrieving nutrients and clean fuel.

Redesign helps in bringing up innovation by creating products that generate less waste or which can be easily repaired, reused, or recycled. Young scientists can think creatively to design eco-friendly packaging and products.

Recycle is the process of transforming used materials into new products-like turning paper waste into handmade sheets, plastic into building materials, or e-waste into reusable components.

This sub-theme offers many interesting areas for child-researchers to investigate waste management strategies through their projects.

- Making organic fertilizer from biodegradable waste and studying its effect on plant growth.
- Developing eco-friendly materials from natural sources like banana fibre, rice husk, or corn starch.

- Finding out how electronic waste is disposed of in homes or schools and suggesting safe disposal methods.
- Designing strategies for schools/ shops/ hospitals where waste is minimized and managed scientifically.
- Studying how products can move in a continous loop of use and reuse instead of ending up in a landfill.

Assessment of the Value of E-Waste and Its Potential for Recycling in India

Background

Nowadays, we are using several electronic gadgets like TVs, watches, headphones, music systems, computers, and mobile phones etc., at home or equipment and devices in institutes. These gadgets, too, have a life cycle - they stop working, break down, or become out-dated, and are then disposed of as electronic waste (e-waste). Imagine the number of such e-waste items thrown away by each household. India is one of the largest producers of e-waste in the world.

Most e-waste is not properly recycled and ends up in landfills, where toxic substances such as lead, mercury, and cadmium leak into the soil and water. E-waste also contains valuable metals like copper, gold, platinum, lithium, and indium, which can be reused if properly extracted. Recycling these can reduce import dependence, save energy, and protect the environment.

This project aims to study the economic and environmental importance of recovering metals from e-waste and to assess India's self-sufficiency in these resources.

Hypothesis

If e-waste metals are properly identified, recovered, and recycled, then India can significantly reduce its dependency on imported metals and contribute to both environmental conservation and economic growth.

Objectives

- To identify the types of metals present in common e-waste items such as TVs and mobile phones.
- To assess India's self-sufficiency in these metals and find out major global suppliers.
- To estimate the percentage of metal demand met from domestic resources.
- To understand how recycling even a small portion of e-waste can impact the national economy.
- To create awareness about the importance of retrieving and recycling e-waste for sustainable living.

Methodology

Data Collection:

- Collect information on key metals present in e-waste from secondary sources (books, internet, government reports).
- Prepare data tables for devices like TV and mobile phones showing uses, self-sufficiency, suppliers, and percentage of demand met.

Example data for TVs:

Metal	Uses in other devices	Self-sufficiency	Major Supplier	% Demand met domestically
Copper	Wires, heating coils	No	Japan, Tanzania	45%
Iron	Machinery, tools	Partially	Australia	80%
Quartz	Optical fiber, watches	Yes	-	100%
Gold	Circuit boards, connectors	No	South Africa	5%
Platinum	Catalytic converters	No	Russia	10%
Aluminium	Casings, wires	Yes	-	100%
Mica	Insulators, capacitors	Yes	-	100%

Example data for Mobile Phones:

Metal	Uses in other devices	Self-sufficiency	Major Supplier	% Demand met domestically
Lithium	Batteries	No	China	0%
Manganese	Steel, batteries	Yes	-	100%
Indium	LCDs, semiconductors	No	South Korea	25%
Gold	Chips, connectors	No	South Africa	5%
Cobalt	Batteries, alloys	No	Congo	15%

Analysis:

- Identify which metals are mostly imported and estimate how much India could save if even 20% of these were recycled.
- Create charts or infographics to show metal recovery potential.

Awareness Activity:

- Conduct a school e-waste collection drive and categorise collected items.
- Discuss safe recycling and collection methods with students and families.

Expected Outcomes

- Identification of valuable metals present in common e-waste.
- Estimation of India's dependency on imported metals and potential savings through recycling.
- Increased awareness among students about e-waste segregation and recycling.
- Development of simple models showing how waste can be turned into a resource.

If even 20% of metals like copper, gold, lithium, and cobalt are recovered; India could save thousands of crores of rupees annually and reduce environmental pollution.

Significance

Waste can be a hidden treasure, and exploring all the resources that can be extracted from it is significant for the environment and sustainability, a lesson that can be learnt from this project. By appreciating the value of e-waste, young scientists can contribute to sustainable resource management and the national goal of a circular economy.

Recycling precious metals not only conserves nature's resources but also supports the vision of Lifestyle for Environment and Sustainability (LiFE). By undertaking this project, student-scientists learn that retrieving and recycling are key parts of the R5 approach, helping the country move toward a cleaner, greener, and more self-reliant future.

Biodegradable Waste Composting

Objective

To study and demonstrate how biodegradable household waste can be recycled into compost for sustainable use and conservation of soil and the ecosystem.

Introduction

Every household generates a large amount of biodegradable waste every day - vegetable peels, fruit rinds, leftover food, dry leaves, and garden waste. Usually, this waste is thrown into dustbins and sent to landfills, where it decomposes slowly and releases harmful gases like methane. However, this waste can become a valuable resource if converted into compost - a nutrient-rich natural fertilizer that improves soil health and helps plants grow.

Composting is a natural biological process in which microorganisms such as bacteria and fungi break down organic matter into humus-like material. For this, you don't need big equipment, it can be done in simple ways using pits, bins, or even plastic bottles. Composting reduceswaste going to landfills, enriches soil, saves money on chemical fertilizers, and supports environmental sustainability.

Methodology

1. Collect information about types of biodegradable waste generated in homes and schools.
2. Identify suitable methods for home composting - pit composting, bin composting, or bottle composting.
3. Collect and record data on temperature, moisture, and time taken for complete composting.
4. Study the role of earthworms, microbes, and aeration in the composting process.
5. Compare the compost quality with chemical fertilizers by using both on potted plants and observing plant growth.
6. Document the cost, energy efficiency, and environmental benefits of composting as compared to waste disposal.

Expected Outcome

1. Successful production of compost from kitchen and garden waste.
2. Better understanding of waste segregation and recycling at source.

3. Demonstration of how biodegradable waste can be transformed into valuable organic manure.
4. Awareness among students and families about composting as a simple method of waste management.
5. Appreciation for the waste-to-wealth approach

This project helps students to see waste as a resource rather than a problem. By practicing composting, they learn the importance of Reduce, Reuse, Retrieve, Redesign, and Recycle (R5) in everyday life. Composting supports sustainable living, prevents pollution, and promotes a Lifestyle for Environment and Sustainability.

Through this activity, young scientists become agents of change, showing how science and responsibility can work together to turn everyday waste into wealth- making homes, schools, and communities cleaner and greener.

E4 for Energy Explore, Experiment, Enhance & Evolve

Energy is what runs our modern world. From lighting our homes and powering our gadgets to running schools, hospitals, and industries - every activity depends on energy. Much of the energy still comes from fossil fuels like coal, oil, and gas, which are limited, are not renewable, and cause pollution and climate change. To ensure a clean and green future, we have to explore, experiment, enhance, and evolve new ways of producing and using energy wisely. Research in all the domains of energy, ie. E4 can be undertaken by child-scientists to unlock the exciting potential of energy for a sustainable future.

Explore

Exploring energy begins with curiosity for understanding different forms of energy, such as solar, wind, hydro, geothermal, and biomass. Student-scientists can explore how solar panels capture sunlight, how e-vehicles work, or how water stored in dams can generate electricity. India has already become one of the world's leaders in solar energy, with giant solar parks like the Bhadla Solar Park in Rajasthan. But there's still so much more to discover - especially at the local and household level. Keeping our eyes open to the carbon footprints of conventional fuels, can help us explore the vast field of green energy, where the technology needs much more intensive research.

Experiment

Experimenting helps us understand how energy works and how to use it efficiently. Simple classroom or home experiments like building a solar cooker, a mini windmill, or a bicycle-powered generator can show how energy is transformed from one form to another. Student-scientists can design simple experiments, such as measuring how LED bulbs save more power than traditional bulbs or how proper insulation keeps rooms cooler without air-conditioners. Experimenting means turning learning into action and using your hands to implement what you studied in your books. Thus, even small experiments can lead to a deeper understanding and give rise to innovation.

Enhance

Enhancing energy means improving the way we generate and use it. Many of the green energy solutions cannot be used on a larger scale because they still need more research for improvement. Student-scientists can design innovative ways to capture more sunlight, store energy in better batteries, or use local resources such as agricultural waste for producing biogas. For enhancing, we can also look into traditional practices such as architectural methods of using courtyards, earthen pots, and ventilated homes to stay cool without consuming electricity. These tried and tested practices can provide novel ways of enhancing energy efficiency.

Evolve

The final step is to evolve, which involves moving towards a smarter, sustainable lifestyle where every individual takes responsibility for energy conservation. Evolving means adopting a mind-set of sustainability. It is about blending science, innovation, and environmental care to create a lifestyle that respects nature. As young scientists, you can become Energy Ambassadors, leading your schools and communities toward a greener future. It means we have to evolve from a consumerist to a sustainable approach.

The E4 for Energy theme inspires children to understand that energy is not just about electricity, it is about responsibility. By exploring, experimenting, enhancing, and evolving, every young mind can contribute to India's journey toward "Lifestyle for Environment and Sustainability (LiFE)." Through creativity, teamwork, and scientific thinking, today's child scientists can ensure that tomorrow's world is bright - powered not just by energy, but by innovation and care for our planet.

Spring loaded Projectile Motion

Projectile motion is discussed at length in the theory classes, but very few experimental setups are discussed. In this paper, we discuss the fabrication of a setup, the data collected, and some of the experimental tips. The experimental setup is fabricated using materials easily available in the local market.

Introduction

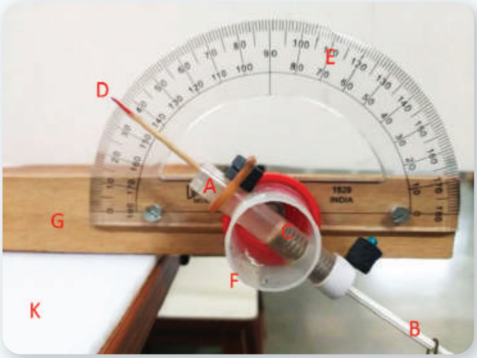
The theoretical basis of projectile motion is very well established, along with the mathematical equations that support it. The theories start from the point that the projectile is launched with the initial velocity is V_0 (> 0). However, in a real experiment, a projectile at rest needs to be accelerated to V_0 before it is launched as a projectile. This work describes the functioning of a simple home-made spring-based launcher, which explains the acceleration process along with the projectile motion.

The Apparatus:

The equipment required for carrying out this experiment includes plastic vials, which can be purchased from any medical store, a protractor to measure the angles, a tooth-pick to point out the angles on the protractor, a spring, and a syringe piston that can be locked and helps in the release of the steel ball-bearing. A measuring tape, a plastic tray filled with fine sand, a few more tooth picks to be used as markers on the sand where the ball lands are also required.

The launcher was assembled in-house and can be described as follows. A vial labelled 'A', which is around 1.1 cm in outer diameter and 0.9 cm in inner diameter, available commercially, is used as the 'muzzle' from where the projectile is launched. A shaft of syringe 'B' is used as the piston to launch the projectile, which is a steel ball bearing weighing 1.7 g.

Spring 'C' with a known spring constant is trapped between the shaft end and the threaded top of the vial 'A'. Vial 'A' is fitted in a bigger vial 'F' attached to the protector 'E' and a wooden strip 'G'. The wooden strip is around 1 cm thick, so that it can be glued to a flat plastic sheet 'K'. The whole arrangement can be seen in Figure 1b launcher part of which is shown in figure 1a.



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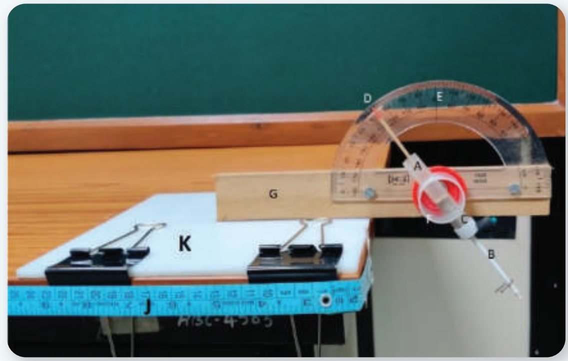


1b

Figure 1. The picture of launcher and that of the projecting system attached to a table top.

The whole setup connected to 'K' is attached to the table top with file clips. A steel ball (of diameter 7.5 mm) is inserted in the muzzle 'A', and then the shaft 'B' is withdrawn outwards compressing spring 'C'. The shaft 'B' has a small hole across the shaft so that a pin can be

inserted to lock the shaft in its extended position. Upon removal of the pin, the spring is allowed to expand and launch the ball out of the muzzle.

The arrangement can be seen in Figures 2 and 3, which show the setup from different perspective.

Figure 2 & 3. Set up from different angles.

Caution

It is observed that a pin was also inserted to restrict the motion of the piston (and spring) beyond the equilibrium point. This restriction ensured arresting the oscillations of the spring beyond the equilibrium point, and minimized fluctuations in the launch velocity, at any given angle. [Note: If the spring is released in different formats/styles, then the "release" velocity will vary each time.]

It was also noticed that the projectile had a tendency to be dislodged from its position just before launch. To prevent this ,a very small magnet was attached to the top portion of the muzzle to hold the ball against any stray motion during release.

At the other end of the table, as seen in Figures 2 and 3, is a tray filled with a sand bath. The ball lands in the sand without bouncing, and a marker can be used to record the location where the ball touches the 'ground level' after its flight. The top view of the of the launcher arrangement is shown in Figure 4.

A long rod with a bar magnet attached to it is also very handy. Although, It is not part of the experiment, but in case if the ball overshoots the sand-filled tray, it can be very useful in picking up the ball quickly from corners it may roll into.

Figure 4. Top view of the launching arrangement.

Theory

When an object (projectile) is launched under gravitational force with velocity "v", called muzzle velocity, at various angles of projection, its trajectory is nearly parabolic. Depending on the impulse from the spring and the angle of projection, the trajectory will have different heights, ranges, and times of flight. Here, we ignore the air resistance. The small range over which the projectile is in contact with the spring, it accelerates from zero to "release" velocity (or muzzle velocity) "v'' due to the expansion of the spring. After which it continues the ballistic trajectory in a projectile motion. Although the release velocity primarily depends on the impulse imparted by the spring, the gravitational contribution makes it a function of the angle of release as well.

Related formulae:

Time of flight $T = \frac{2v\sin\theta}{g}$;

Range of the projectile $R = \frac{v^2}{g}\sin 2\theta$

Here, v is the muzzle velocity and θ is the angle of projection.

Hence, by measuring the range at any given angle, the velocity v can be calculated.

When a spring is compressed (stretched), a restoring force is generated within the spring, which is proportional to the compression or elongation (x) of the spring. The proportionality constant (k) is called the spring constant. When the spring is released, this force decreases linearly as the spring approaches its equilibrium length. Thus, an average force of $\frac{1}{2}kx$ acts on any external body against which the spring is released.

Alternatively, one can look at this as the potential energy $\left(=\frac{1}{2}kx^2\right)$ stored in the spring due to its compression is converted into the kinetic energy of the projectile at the time of release. The energy balance equation could be written in the average form as

$$\frac{1}{2}kx^2 = \frac{1}{2}mv^2 + mgx \sin sin\, \theta$$

Here, the first term on the right-hand side is the kinetic energy of the projectile, and the second term represents the increase in the potential energy due to the slight change in height of the ball during launch – which is zero for horizontal projection.

$$v^2 = \frac{kx^2}{m} - 2\, xg \sin sin\, \theta$$

In the experiment we carried out, we have used a steel ball (used in bicycles) of mass m=1.7×10-3kg. The spring we used was about 0.1 m in length, which was compressed by 0.02m from its equilibrium position for launching the ball. The spring constant, determined by quasi-statically loading the spring using a known mass and measuring its compression was ~250 N/m, which is very close to the value given by the vendor. Under these conditions, it can be easily verified that the dependence of value v^2 on the second term (=0.2 m^2s^{-2}) is negligible and is less than 1% of the first term (= 58.8 m^2s^{-2}).

Procedure

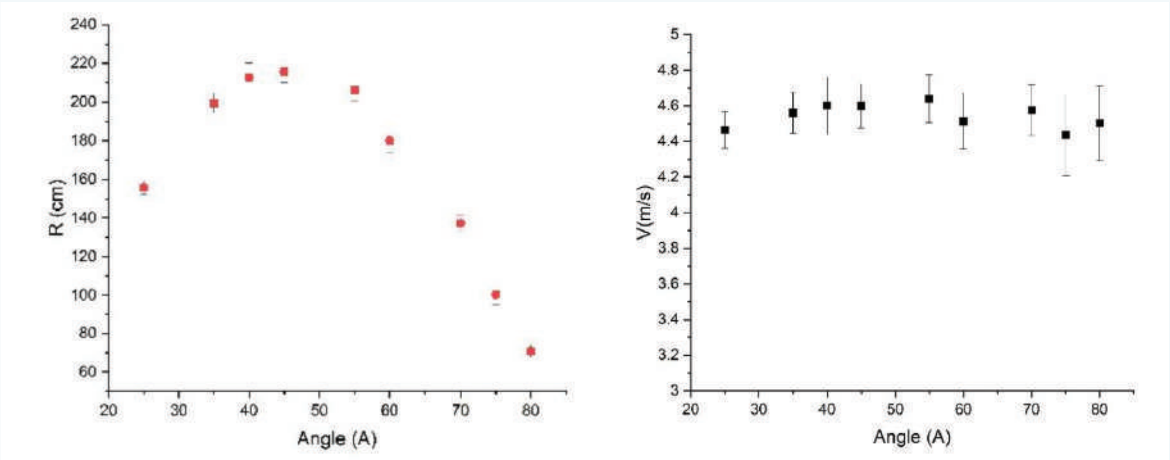
The magnitude of the spring compression of the spring (x) is chosen such that the maximum range is about 2 m. In our case, we chose 2.0 cm and used a pin hole on the shaft of the piston to make sure that the compression of the spring is kept constant every time the ball is launched. The launcher was firmly fixed to the table, and a sand-filled plastic tray was kept at the expected place the ball will land after projection. The distances were measured using a spring-loaded metal tape with 1 mm precision and a maximum length of 5 m. A long rod with a magnet attached to the end is used for retrieving the ball, as it sometimes travel erratically.

The launch was repeated ten times at each angle, and the results are given below.

Result

The value v2 for different angles A, are given in Table 1.

Angle	sin	Range (cm)	v^2 m^2s^{-2}	V ms^{-1}
25	0.42	155.8 ± 3.6	19.9 ± 0.5	4.46 ± .05
35	0.57	199.4 ± 5.0	20.8 ± 0.5	4.56 ± .06
40	0.64	212.7 ± 7.5	21.2 ± 0.7	4.60 ± .08
45	0.71	215.8 ± 5.8	21.1 ± 0.6	4.60 ± .06
55	0.82	206.3 ± 5.9	21.5 ± 0.6	4.64 ± .07
60	0.87	180.0 ± 6.3	20.4 ± 0.7	4.51 ± .08
70	0.94	137.3 ± 4.3	20.9 ± 0.7	4.58 ± .07
75	0.97	100.4 ± 5.2	19.7 ± 1.0	4.44 ± .16
80	0.98	70.7 ± 3.3	20.3 ± 0.9	4.50 ± .10



The weighted average of the velocity of launch of the ball v_0 = 4.54 ± 0.02 m/s.
Using the mass of projectile m = 0.0017 Kg, the value of the spring constant k, obtained was 156 ± 2 N/m.
Whereas when a mass was hung on the spring to expand it, the k value obtained was 251 ± 26 N/m.

The two values do not match because the potential energy does not convert fully into kinetic energy due to various losses during the process of expansion of the spring. The efficiency of launch could be calculated as $=156 \pm 2/251 \pm 26 = 0.62 \pm 0.06$.

Conclusion

This work presents how a simple arrangement can be designed and fabricated by a teacher and/or a student to carry out a fairly rigorous experiment on projectile motion to understand the concepts involved in the projectile motion.

Model Project 2

Conversion of Chemical Energy to Heat Energy

Background

According to the First Law of Thermodynamics, energy can neither be created nor destroyed-it only changes from one form to another. In this experiment, the chemical energy stored in wax is converted into heat energy through combustion. However, part of this energy is absorbed by the copper vessel and lost to the surroundings, illustrating inefficiencies in energy conversion.

Hypothesis

If wax is burned under controlled conditions, the chemical energy released will increase the temperature of water and the copper vessel proportionally to their specific heats.

Objectives

1. To demonstrate the conversion of chemical energy into heat energy.
2. To calculate the heat absorbed by the water and the copper vessel.
3. To understand losses during energy transformation.

Experiment

Burn 10 g of wax under a copper vessel containing 100 g of water. Measure the rise in water temperature using a thermometer. Calculate heat energy absorbed.

1 mole of wax burning = 14800 kJ of energy released
C25H52 molecule mass is 352g
1 mole is 352g

1 kg of wax = 2.841 mole
1 kg of wax gives 42 MJ of energy
1 g of wax gives 42 KJ of energy
10 g of wax burning will give 420 KJ of energy
Now to heat water from 25 degrees centigrade
10 gm of water with
Specific heat = 4.184 J is required to raise the temperature of 1 g of water by 1 degree
100 g of water needs 418.4 J for each degree
If it was only water, all of it would evaporate.
But there is a copper vessel which is also getting heated up.
Which needs 0.385 for 1 g of copper by 1 deg c

Expected Outcomes

The heat gained by water and copper will be less than 420 kJ, confirming energy losses to the environment.

Significance

The experiment highlights the principle of energy conservation and practical inefficiencies during energy conversion processes.

Water Harvesting, Harnessing, Recycling, and Conservation

Water is life, every drop counts! Water is one of Earth's most precious resources, essential for all forms of life. Yet, across the world, freshwater resources are shrinking while our needs are growing. According to the United Nations, nearly 2 billion people live in regions facing severe water scarcity, and by 2030, almost half of the global population may experience water stress. However, rapid urbanization, population growth, and unsustainable habits have led to water scarcity in many parts of the world. In India, where rivers and rains have always been revered, we now face challenges like groundwater depletion, pollution, and unequal distribution of water. The sub-theme "Water Harvesting, Harnessing, Recycling and Conservation" focuses on understanding how we can use water wisely and sustainably.

To create a sustainable lifestyle, we must learn to harvest, harness, recycle, and conserve water wisely.

Water harvesting means collecting rainwater and storing it for future use - through rooftop tanks, ponds, recharge pits, or small check dams.

Harnessing water refers to using it efficiently by adopting technologies such as drip irrigation, grey water recycling, and solar-powered pumps that reduce wastage. Recycling involves treating used or "grey" water from homes, schools, and industries so that it can be reused for cleaning, gardening, or flushing. Finally, **conservation** emphasizes responsible behavior, adopting habits that save water daily - turning off taps, fixing leaks, using water-smart appliances, and spreading awareness about saving water.

This sub-theme encourages young scientists to explore innovative, community-based, and nature-friendly ways of managing water. By integrating traditional wisdom with modern science, we can ensure that every drop is valued and reused. Practicing water stewardship in daily life is a vital step toward a sustainable future and aligns perfectly with the vision of a "Lifestyle for Environment and Sustainability."

Children can play a key role as young scientists and innovators in solving water problems. Some possible research areas include:

- Designing low-cost rainwater harvesting models for schools or homes.
- Studying the impact of grey water reuse on plant growth.
- Testing local materials for water filtration or purification.

- Mapping water sources and usage patterns in their localities using simple surveys.
- Exploring traditional water bodies in a locality and their contribution to society.
- Studying traditional practices of water conservation.
- Design of green and environment-friendly building with water and energy harvesting devices.
- Studying a rain-water harvesting system.
- Studying ways and means to reduce domestic, agricultural, and industrial water usage.
- Studying ways and means to store, channelize, and use surface water for the recharge of groundwater.

By combining science, creativity, and local wisdom, children can become true Water Warriors- helping to build a sustainable future where every drop is valued. A responsible lifestyle today ensures a healthier, greener, and water-secure tomorrow.

Water Audit - Jal Shakti Abhiyan Linkage

Hypothesis

If students measure the water they use every day, they will become more aware of how much is wasted and more willing to conserve it. Linking this with the Jal Shakti Abhiyan shows how individual effort contributes to a national mission.

Background

Water scarcity is not always about drought - it is often about waste. In many homes, taps are left running, tanks overflow, and leaks go unnoticed. The Jal Shakti Abhiyan, launched by the Government of India, urges us to save every drop. By conducting a water audit at home or in school, we can realize how our daily habits affect the future of our rivers and groundwater.

Objectives

To calculate how much water is used in households and hostels.
To identify where and how water is being wasted.
To suggest and practice simple changes that can save liters every day.

Methodology

1. Observe and record water use in your home or hostel: bathing, brushing, cooking, washing, cleaning.
2. Note down the number of buckets used or minutes of tap flow and estimate liters used (1 bucket = 15 liters, 1 minute of tap flow =6 liters).
3. Check for wastage -running taps, overflowing tanks, leaky pipes.
4. Discuss with family or classmates how you can reduce water use: shorter showers, turning off taps, reusing washing water, fixing leaks.
5. Prepare a simple water-saving plan and track your progress for a week.

Expected outcomes

- You will find out how much water is used daily.
- You will find simple but effective ways to cut down wastage.

Significance

This activity makes water conservation personal. It transforms numbers into awareness and awareness into action. By linking personal habits to national campaigns like Jal Shakti Abhiyan, students understand that saving water is both a duty and a shared responsibility.

Constructed Wetland - Lotus Pond Filtration

Hypothesis

If we allow wastewater to flow through a miniature wetland made of local plants sach as lotus, vetiver, and water hyacinth, the water will be naturally filtered - just as temple tanks and lotus ponds have purified water in Indian villages for centuries.

Background

Across India, temple tanks and sacred ponds have long been spaces where water remained fresh through the self-cleaning power of plants and soil. Today, wastewater often goes untreated into drains and rivers. By recreating a small wetland system, we can see how nature itself is a purifier and how traditional Indian practices understood this process.

Objectives

1. To create a small constructed wetland with aquatic plants.
2. To observe how wastewater changes in appearance and odor after treatment.
3. To connect ancient practices of pond purification with modern ecological science.

Methodology

1. Take a tub or shallow tank and fill the base with gravel and soil.
2. Plant aquatic species like lotus, vetiver grass, or water hyacinth in the tank.
3. Pour in some wastewater (from washing vegetables or clothes).
4. Leave it for 2–3 days and then collect a sample of the treated water.
5. Observe differences in clarity, odor, and freshness compared to the original sample.

Expected outcomes

- The treated water will look cleaner and smell fresher.
- You will see how nature's systems can solve modern waste problems.

Significance

This activity teaches the functioning of healthy ecosystems. It helps students realize that wetlands, ponds, and plants together are capable of keeping water pure naturally. By blending tradition and ecology, the activity nurtures both scientific curiosity and cultural pride.

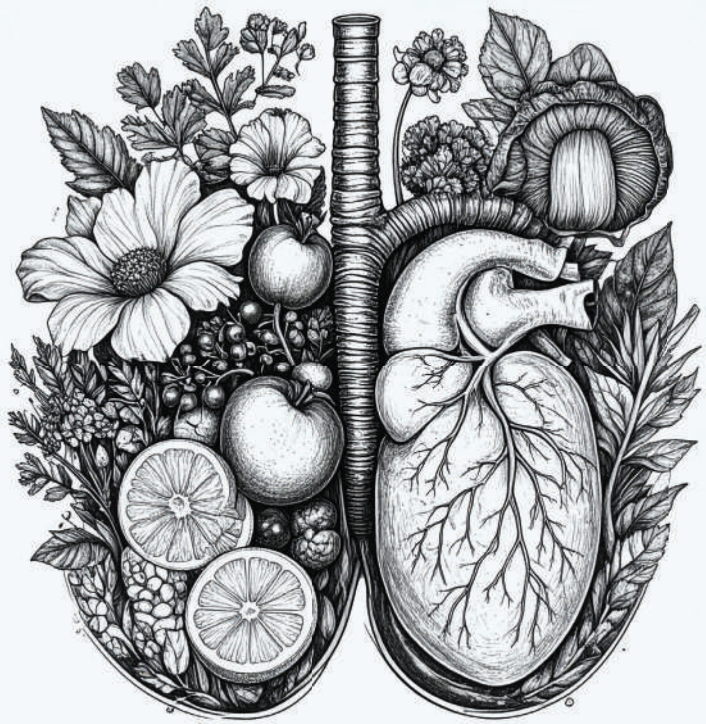
Food, Agriculture and Health

Food, agriculture, and health are three pillars of human survival, deeply connected with the environment and our lifestyle. The way we produce, consume, and share food directly influences not only our personal health but also the well-being of communities, ecosystems, the planet, and future generations.

In today's world, where climate change, soil degradation, and poor nutrition threaten our future, understanding this connection has become essential.

According to the Food and Agriculture Organization (FAO) of the United Nations, nearly one-third of all food produced globally is wasted, even as over 700 million people go hungry. In India, the agricultural sector supports more than 40% of the population, yet farmers face challenges such as declining soil fertility, excessive chemical use, and erratic rainfall. Poor eating habits, consuming junk food, and reduced physical activity have also led to rising cases of obesity and lifestyle-related diseases in both children and adults.

To build a sustainable lifestyle, we must think how food is produced and consumed. Sustainable agriculture promotes organic farming, composting, crop rotation, water-efficient irrigation, and reduced chemical dependence. Local and seasonal foods reduce transportation costs and carbon footprint, while balanced diets rich in fruits, grains, and vegetables ensure better health.



As the world faces new challenges in the area of food, agriculture, and health, child-scientists can focus their attention on this very important theme for life and sustainability. By engaging in research studies in these areas, students will strengthen their understanding of sustainable farming practices, responsible food choices, and the role of nutrition in building a healthier lifestyle. It encourages reflection on how agriculture impacts the environment, and how mindful actions at the individual and collective level can contribute to long-term ecological balance, which is an invitation to live consciously and responsibly. It is a step towards youth involvement in shaping the future.

The sub-theme -Food, Agriculture and Health inspires young scientists to explore how we can achieve 'Nutrition for All' while protecting the environment. Through research activities, students can learn and practice values of stewardship, resilience, and innovation, contributing to a culture where sustainability is a way of life.

Some possible research areas are as follows:

- Growing vegetables using compost made from kitchen waste and comparing them with chemically grown plants.
- Studying how much food is wasted in homes or school canteens and suggesting ways to reuse or redistribute it.
- Documenting local, indigenous foods and understanding their nutritional and medicinal value.
- Experimenting with soil-less farming systems in limited urban spaces.
- Studying how millets contribute to good health and climate resilience.
- Observing how chemical pesticides affect insect diversity

Model Project 1

Analysis of the Health and Environmental Impact of Seasonal versus Off-Season Food Consumption

Hypothesis

Consuming off-season fruits and vegetables has no different impact on health (nutrition) and the environment (carbon footprint) compared to consuming local, seasonal produce.

Background

The food we eat has a direct impact on our health and a hidden impact on the environment. Off-season fruits and vegetables are often grown in energy-intensive green houses or transported over long distances, leading to a higher carbon footprint. They may also require more chemicals to preserve them. Consuming local, seasonal food is often more nutritious, supports local farmers, and is more sustainable. This project studies these connection.

Objectives

- To create a seasonal calendar for fruits and vegetables for the local region.
- To trace the origin and calculate the approximate "Food Miles" for a selection of off-season produce available in the local market.
- To compare the cost and (if possible) conduct a simple nutrient test (e.g., Vitamin C) between seasonal and off-season versions of the same produce (e.g., Tomato in summer vs. winter).

Methodology

1. Market Survey and Data Collection:
2. Research online or interview local farmers to create a simple chart or seasonal calendar showing which fruits and vegetables are grown in the region in different seasons.
3. Visit a local vegetable market and a large supermarket. For 5 common items (e.g., tomato, apple, cucumber, capsicum, spinach), note:

- Price
- Place of origin (from the label or by asking the vendor)
- Whether it is in season locally or not.

4. Undertake Food Miles Calculation: For an off-season item (e.g., an apple from Kashmir in summer), use Google Maps to calculate the approximate distance it travelled to reach your city. This distance is an indicator of its carbon footprint.
5. A Simple Nutrient Comparison can also be done. Such as the Vitamin C Test: Using a simple iodine titration test, which can be done in a school lab experiment, compare the Vitamin C content of a seasonal orange (in winter) with an off-season orange (in summer) that has been in cold storage.

Expected Outcome

1. A visual seasonal food calendar for the community.
2. A map showing the long travel routes of off-season food.
3. Data showing the higher cost and likely lower nutrition of off-season produce.
4. A clear link between a sustainable practice (eating local/seasonal) and its benefits for health (better nutrition), economics (supports local farmers), and the environment (lower carbon footprint).

Significance

This project empowers students to make informed food choices. It clearly shows how a personal health decision is connected to global sustainability issues like climate change (food miles) and local economic resilience. It directly addresses the social and economic benefits of sustainable practices.

Study of Waste Citrus Peels for the Management of Mosquito Larvae

Background

Mosquito-borne diseases like dengue and malaria are a significant public health burden. Commercial repellents and larvicides can be expensive, contain chemicals, and contribute to plastic waste. Citrus peels (from oranges, lemons, etc.) are common kitchen waste containing essential oils (like limonene) that are known to be insecticidal. This project studies the efficacy of repurposing this waste as a natural larvicide, offering a sustainable approach to vector control.

Hypothesis

An extract derived from waste orange peels (Citrus sinensis) is not effective in killing mosquito larvae compared to an extract from lemon peels (Citrus limon) or a commercial chemical larvicide.

Objectives

- To prepare extracts from dried waste orange and lemon peels using a simple distillation method.
- To identify and collect mosquito larvae (genus Aedes or Culex) from local stagnant water bodies.
- To test the efficacy of the citrus extracts in killing the larvae compared to a control and a commercial product.
- To propose a model for sustainable waste-to-wellness management at the community level.

Methodology

1. **Field Study and Preparation**- Larvae Collection- Using a dipper or a small mug, carefully collect mosquito larvae and pupae from stagnant water sources (like unused pots, ditches). Place them in a wide bowl with some of the same water for observation.

2. **Peel Extract Preparation**- Collect peels from consumed oranges and lemons. Sun-dry them for 3-4 days until they become brittle. Crush them into a coarse powder.

3. **Simple Distillation**- Place the crushed peel in a round-bottom flask. Add water and heat gently using a spirit lamp. Connect the flask to a condenser (a long glass or metal tube running through a bowl of cold water). The condensed vapour will contain the essential oil

and will be collected in a beaker. This is the extract to be tested. This can be done in the school lab.

4. Bioassay Experiment- Take 4 clear glass beakers. Add 100 ml of water and introduce 10 healthy larvae into each beaker using a dropper.

Treatment:

1. Beaker 1: Add 1 ml of orange peel extract.
2. Beaker 2: Add 1 ml of lemon peel extract.
3. Beaker 3: Add 1 ml of a commercial chemical larvicide (positive control).
4. Beaker 4: Add 1 ml of distilled water (negative control).

Observation- Observe the beakers every 30 minutes for 4-6 hours. Record the time at which larvae stop moving (are dead) in each beaker. Calculate the percentage mortality for each treatment after a fixed time period (e.g., 4 hours).

Expected Outcome

The study will provide mortality rates for larvae exposed to different citrus extracts. It is expected that the orange peel extract will show significant larvicidal activity, potentially comparable to the commercial product. A protocol for creating an effective larvicide from kitchen waste will be established.

Significance

This project demonstrates an example of "wealth from waste," turning an environmental problem (kitchen waste) into a solution for a public health problem (mosquito control). It reduces reliance on chemicals and plastic-packaged products, promotes a circular economy, and utilizes ecosystem principles for sustainable well-being. It is a low-cost, accessible innovation for local communities.

Application of Indian Knowledge Systems for Sustainability

Indian Knowledge System (IKS) consists of the accumulated wisdom, practices, innovations, and philosophies of India evolved over the ages in close connection with nature and society. The spectrum of IKS is very diverse and it includes domains such as astronomy, metallurgy, maritime sciences, agriculture, water conservation, forest and biodiversity management, health and wellness, architecture, crafts, and community governance. These knowledge systems were deeply rooted in ecological ethics, resilience, and a harmonious relationship between humans and nature, which in fact was practised as a lifestyle for sustainability.

In today's world of environmental degradation, resource depletion, and climate change, countries are looking for sustainable solutions that can protect the environment so that it can continue to provide what we need to live while also ensuring resources for the future generations too. Revisiting IKS can inspire sustainable practices and bridge traditional wisdom with modern science. By studying IKS, we can understand how our ancestors created systems that conserved resources, respected biodiversity and promoted collective well-being. We can also explore how these practices can be reinterpreted to address current challenges in sustainable development.

The exploration of indigenous knowledge presents exciting opportunities- accessing a treasure trove of local, time-tested practices, documenting overlooked traditional methods, and identifying simple yet impactful actions leading to large-scale environmental benefits. To facilitate this, understanding some fundamental concepts is essential. A list of a few domains under IKS, which child-scientists can research, is given here. :

1. **Local tradition and practices in agriculture:** Mixed cropping, crop rotation, seed preservation, natural fertilizers, and zero tillage.
2. **Traditional water systems:** Step wells, tanks, johads, bamboo drip irrigation, and sacred groves around water bodies.
3. **Health and Wellbeing:** through Ayurveda, yoga, use of medicinal plants, and dietary practices.
4. **Indian architectural wisdom:** Use of mud, lime, bamboo, natural ventilation, climate-sensitive building design.
5. **Crafts Technologies for sustainability:** Handloom weaving, pottery, metalwork, food preservation (fermentation, pickling).

6. **Cultural-ecological ethics:** Sacred groves, festivals linked to seasons, community rituals promoting ecological balance.

You can study how these practices are still relevant, how they have changed, and what role they play in sustainable livelihoods today.

General Methodology

You may undertake studies using the following simple scientific methods:

Survey- Document oral traditions, community practices, and local knowledge through interviews with elders, farmers, artisans, and healers.

Field Study

Observe agricultural fields, water harvesting structures, herbal gardens, or traditional architecture to analyze their sustainability features.

Observation

Record seasonal variations in practices (e.g., crop cycles, rainfall harvesting) and note how local communities adapt to changing conditions.

Experimentation

Compare productivity, cost, and ecological footprint of traditional vs. modern practices (e.g., organic manure vs. chemical fertilizers).

Maintain a detailed Logbook

While doing your research, it is very important to keep a record of activities and findings related to your research. A logbook is a handy diary of a scientist which he/she keeps with themselves to note down and document the steps of research. By looking at your logbook, any person will be able to see the development of your research project and check the authenticity of your research. Hence, writing a thorough and meticulous logbook will help you in the long run.

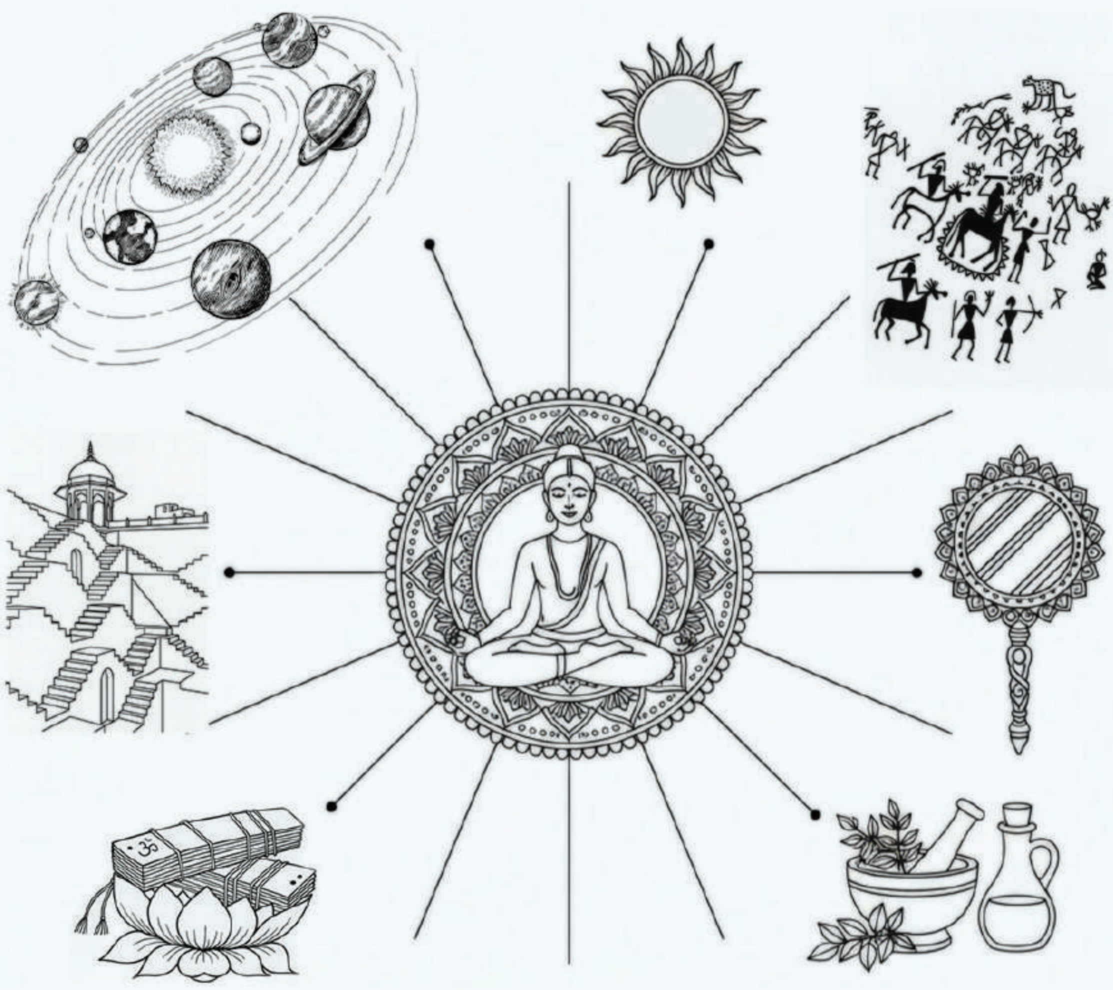
Expected Outcomes

Child-scientists exploring IKS and Sustainability are expected to:

1. Understand the interrelationship between traditional knowledge and modern sustainability goals.
2. Appreciate community wisdom and its relevance for ecological balance.
3. Document traditional knowledge from local contexts as valuable community resources.

4. Develop models and small experiments demonstrating how IKS can address present challenges such as water scarcity, soil degradation, and health issues.
5. Suggest strategies to revive and adapt IKS for a sustainable future.

By engaging with Indian Knowledge Systems, child-scientists will rediscover the roots of sustainability in their heritage and also contribute to evolving innovative solutions that integrate tradition with modern science for the well-being of people and the planet.



Sustainability in Indian Textiles in the Context of the Indian Knowledge System

Background

India has a rich heritage of textiles based on natural fibres, handlooms, and traditional dyeing techniques. Traditional practices using cotton, jute, silk, and wool, natural dyes from plants, roots, and minerals; weaving methods represent eco-friendly approaches. Handlooms consume less energy compared to power looms. Natural fibres are biodegradable and promote sustainability.

On the other hand, modern synthetic textiles create microplastic pollution, depend on petrochemicals, and consume a large amount of water in processing. In contrast, Indian traditional practices are environment-friendly, labour-intensive, support livelihoods, and sustainable.

Child-scientists can ask

I. What natural fibres are used locally?

II. Which traditional weaving and dying practices exist?

III. How are natural dyes prepared?

IV. What are the differences in cost, durability, and environmental impact of natural vs synthetic textiles?

V. How can traditional textile practices be revived for modern needs?

VI. What is the traditional wisdom in these practices?

Objective

To explore traditional textile practices that support sustainable clothing and livelihood.

Methodology

- List local fibres used- cotton, jute, silk, wool, banana fibre, bamboo fibre.
- Identify weaving and dyeing practices- khadi, handloom, block printing, tie-dye, indigo dyeing.
- Study the process- steps in the cultivation of fibre, spinning, weaving, dyeing, finishing.
- Compare traditional and modern textiles in cost, energy use, waste generation, durability,

and biodegradability.

- Document socio-economic aspects- livelihood, gender roles, cooperative societies.
- Identify challenges- loss of demand, competition from synthetic textiles, and lack of awareness.
- Suggest sustainable plans- promotions of Khadi, eco-labeling, fashion with natural fibers, and awareness campaigns.

Significance

Child scientists will understand how Indian textile traditions promote eco-friendly lifestyles, support rural artisans, and reduce environmental impact. They will also realize how reviving and modernizing traditional textiles can reduce reliance on polluting synthetic fibres and encourage sustainable consumption.

Model Project 2

Understanding the Indian Calendar System

Hypothesis

If we study the principles behind the Indian calendar system and compare them with the Gregorian calendar, we can understand how ancient Indian scientists used astronomy and mathematics to develop a more nature-linked and precise method of timekeeping.

Background

Timekeeping is one of humanity's earliest sciences. Long before modern clocks and calendars, ancient Indians observed the movement of the Sun, Moon, and stars to measure days, months, and years. This led to the creation of Panchanga - the traditional Indian calendar, which combines solar and lunar cycles to mark festivals, agricultural activities, and religious events.

Unlike the Gregorian calendar, which is purely solar, the Indian calendar is lunisolar - it adjusts months and years using astronomical calculations to align with seasonal changes. Ancient scholars such as Aryabhata, Varahamihira, and Bhaskaracharya contributed to these systems using keen observation and mathematics.

Understanding the Indian calendar reveals how science, culture, and environment are interlinked. This project encourages children to explore astronomical observation, mathematical reasoning, and traditional knowledge -blending the wisdom of the past with the scientific curiosity of the present.

Objectives

- To study the structure and components of the Indian calendar system (Tithi, Nakshatra, Yoga, Karana, Vara).
- To compare the Indian (Panchanga) and Gregorian calendars in terms of month length, leap years, and seasons.
- To understand how astronomical events like solstices, equinoxes, and lunar phases influence the Indian calendar.
- To explore local festivals or agricultural practices linked with the Indian calendar.
- To promote awareness of India's scientific heritage in time measurement.

Methodology

Literature Study: Collect information from books, Panchangas, and online sources on Indian and Gregorian calendars.

Observation: Record sunrise, sunset, and moon phases for one month and compare with Panchanga predictions.

Data Comparison: Create charts showing differences in months, leap year adjustments, and important dates between the two systems.

Interview: Talk to local priests, astronomers, or farmers about how they use the Indian calendar for festivals or crop timing.

Model Creation: Make a simple visual or 3D model showing the movement of the Earth, Moon, and Sun that defines Tithis and months.

Expected Outcomes

1. Children-scientists will understand how the Indian calendar connects astronomy, agriculture, and daily life.
2. They will be able to explain why the same festival (like Diwali or Holi) falls on different Gregorian dates each year.
3. The project will demonstrate that ancient timekeeping was based on scientific observation, not superstition.
4. Children-scientists will appreciate the precision and sustainability behind India's traditional systems.

Significance

This project bridges science, culture, and environment — showing that India's traditional knowledge systems were rooted in observation and logic. It helps children realize that Indian astronomers were early scientists who linked human life with natural cycles.

By exploring the Indian calendar system, students not only rediscover cultural heritage but also learn how astronomy shapes time, seasons, and festivals. This understanding nurtures scientific temper, curiosity, and respect for traditional wisdom - aligning perfectly with the Children's Science Congress theme of "Lifestyle for Environment and Sustainability."

Chapter 4

Guiding Principles for Teachers, Mentors, and Child Scientists

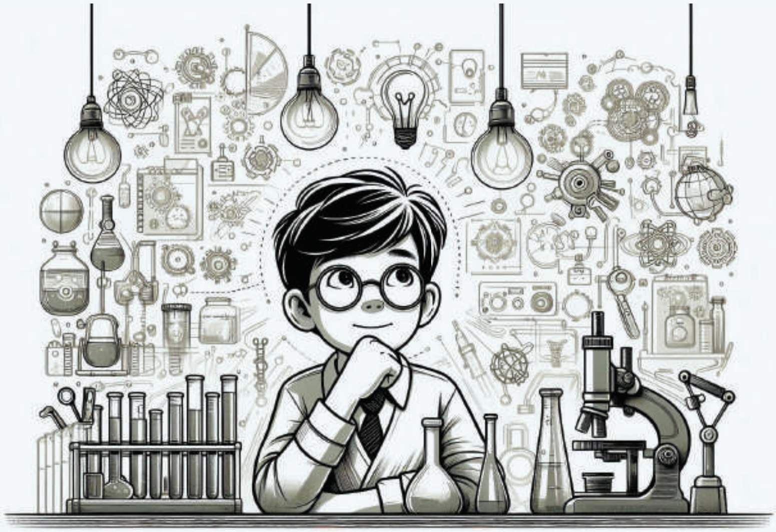
Teachers should ensure that students learn the scientific research methods, practice academic rigor, and also realize the ethics of scientific research. A mentor is to guide the student rather than carry out the measurements/observations or experiment by himself/herself which is unethical and defeats the purpose.

Also, check that the project is not copied from any pre-existing project/write-up or that data is taken from some other source. Students should not manipulate the data to suit their "expectations".

The mentor/teacher should ensure that safety issues are listed before the project is carried out, and the safety rules are adhered to by the child-scientist. For example, a student working with raw benzene, without a guide/mentor objecting to the student handling carcinogen material with bare hands, is unacceptable. Or a guide not objecting to the student handling naked wires connected to a 230-volt supply. Use of hazardous chemicals should be avoided unless absolutely essential, and in such cases, that portion of the project should be handled by experts, and appropriate notes should be maintained.

In case of projects that require ethical clearances from the Government or relevant departments, mentors should ensure that the same are obtained.

Mentors/guides should be aware of the materials/equipment that students should not use. Hazardous chemicals, chemicals dangerous for children to handle, high voltage, high current, heavy weights etc., should be avoided at all costs.



How to Do a Research Project for the NCSC

Doing a research project is one of the most exciting ways to explore science beyond textbooks. The National Children's Science Congress (NCSC) encourages students to think scientifically about real-life problems and find creative solutions. The project should be for the students (learning), it should be at the student level (educational level of the student), and by the student (carried out by the student). Of course, it is done under the guidance of a mentor/teacher.

Here's a simple step-by-step guide to help you plan and complete your project successfully as a student-scientist.

Step 1: Choose a Topic

Start with your curiosity! Look around your home, school, or community. What problems or questions catch your attention?

Choose a topic related to the year's NCSC sub-themes, and make sure it's something you can explore with available time and resources.

Step 2: Define Your Research Question and Aim/Objective of Your Research

Once you have a topic, narrow it down to a clear, specific question. Clearly identify the aims/objectives of the project, which can be written in a specific way to bring more clarity. Your research question should be practical, measurable, and focused.

Example:

Topic: Waste management
Research Question: "Can biodegradable waste be used to make organic fertilizer for home gardens?"

Aim/Objective: To explore whether biodegradable household waste can be effectively converted into organic fertilizer suitable for use in home gardens.

More detailed Objectives:

1. To identify the types of biodegradable waste commonly generated in households.
2. To develop a simple and sustainable composting method for converting biodegradable waste into organic fertilizer.
3. To analyze the nutrient content and quality of the fertilizer produced from biodegradable waste.

4. To evaluate the growth and health of plants in home gardens using this organic fertilizer compared to those using chemical fertilizers or no fertilizer.
5. To promote awareness about sustainable waste management practices and the benefits of home composting.

Step 3: Study What Others Have Done

Before starting your work, read or search about your topic. Ask teachers, experts, scientists or people working in that area, use the school library, or explore reliable websites. This will help you understand what is already known and how you can add something new. Always note the details of your sources, such as the name of the book/ journal/newspaper/website, authors, dates, etc.

It is required that students explore similar projects conducted in the past. This helps students to avoid repetition of the existing project. However, a modification or variation to such a project is welcome. Even new information and/or data on older projects is welcome. Students should explore the scientific background for conducting a project. The existing literature will help students set up the scientific background of the problem that the student wants to study.

Example: If you want to do a research project on natural and bio-friendly insecticides, you should read and search content on the concept of insecticides, their need, and purpose.

Example: If you want to do a research project on automating an existing equipment, you should find out earlier work done and writings on the purpose of the equipment, its end use, the automation requirement, its advantages, etc.

Step 4: Form a Hypothesis

On the basis of the theory or previous literature/research writing in the area, you will be able to make an intelligent guess and predict the conclusion of your research project. A hypothesis is your guess or idea about what might happen or assuming what result you expect from your research. Hypothesis can be framed in experimental research (in which we determine cause-and-effect relationships), analytical research (in which we examine relationships or associations between variables), and quantitative research (in which we measure, quantify, and statistically analyze data).

Example: “If we compost kitchen waste, it will produce nutrient-rich fertilizer.”

Your research will test whether your hypothesis is correct or not.

Hypothesis is not framed in all types of research. Forming a hypothesis is not possible in exploratory research (in which we explore a new or poorly understood area of study), descriptive research (in which we describe characteristics, patterns, or processes) or qualitative research (in which we try to understand opinions, perceptions, or motivations).

Step 5: Plan Your Experiment or Study

Many things needed to be done to complete the planning of the experiment/ study.

Start a logbook — Keep a science diary, also called a logbook, to note all the ideas, observations, measurements, dates, and even the problems you are facing. Be honest and record what actually happens, not what you expect. It need not be a decorated or fancy diary, but it is a simple notebook where research details are documented continuously. It is not created after the project is over, but before the research project begins.

Finalize the methodology — This will depend on the kind of research topic that you have selected.

Decide and finalize the following:

- The layout or flowchart of the plan for carrying out the actual project.
- What methodology will you use in your research project (How do you plan to do your research, what steps you will be following, what methods you will adopt)?
- What materials or equipments will you need?
- How many times will you repeat the test?
- How will you collect data and what data analysis method will you use?
- How will you record your results?
- The location of the project (so that external parameters do not disturb the experiment/ project during its duration and is not a disturbance to others around you).
- The timeline of the project

Make sure your plan is safe, practical, and ethical (no harm to animals or the environment).

Step 6: Conduct the Project/Experiment and Collect Data

After this preliminary preparation, you can now carry out the actual experiment/project with regular entries in the logbook. This logging of activities is very essential to revisit the data while writing about the project findings. Later on, if someone wants to see the steps of your research project, the log entries can clearly indicate that.

Carry out your experiment or field study carefully and collect data. While collecting data, you have to take care of the following:

- You have to carry out the experiment/project in a way that the number of parameters that can affect the outcome are controlled and standardised. For example, any project that deals with or is affected by external room temperature, a similar condition must be ensured for all the measurements/observations.
- Data should be noted down sincerely. No data should be discarded “because I had a hunch that a particular data point is wrong”. It is difficult to conclude which data point is “wrong”.

- Data should be repeated as many times as possible to ensure that the experiment is repeatable. This aspect should be governed by the type of measurements and hence can

vary from project to project. When not repeatable, data collection or observation should be carefully planned. Students must note down the reasons when repetition is not possible. When possible, the external factors can be varied to ensure the reliability of data. For example, if an observation is independent of the voltage applied, the data should be collected at different voltages to ensure this point.

Step 7: Analyze the Results

Once you have collected enough data, study it carefully. Make tables, graphs, or charts to find patterns. The data analysis should be carried out. Data should be noted with correct significant digits and appropriate symbols/units. Ask yourself:

Does the data support my hypothesis?

What did I learn from the results?

What patterns are emerging from the data?

Step 8: Draw Conclusions

Summarize your findings. State whether your hypothesis was right or wrong, and explain why. It does not matter if your earlier guess or hypothesis is wrong. What matters is your research finding. Suggest improvements or future studies. Ensure that you have met the objectives of your research project that you have aimed to achieve. Describe how the conclusion reflects the aim of the experiment/project. The conclusion should clearly state how the aim was achieved (or not achieved, which is also a valid conclusion) through the proposed methodology.

Science is about learning, not just being right!

Step 9: Prepare Your Report and Presentation

Write your report in clear sections

1. **Title**
2. **Aim / Objective**
3. **Hypothesis**
4. **Materials and Methods**
5. **Observations and Data**

6. Results and Conclusion
7. References and Acknowledgements

Prepare a simple, attractive presentation. Practice explaining your work in 3-5 minutes. (See the detailed section on How to document your research project)

Step 10: Present with Confidence

At the final presentation/Congress, speak clearly and confidently. Share your journey- what inspired you, what challenges you faced, and what you discovered. Judges love originality, clarity, teamwork, and genuine enthusiasm. (See the detailed section on How to present your research project).

Final Tip: Enjoy the Process

Doing a research project is not just about winning- it's about thinking like a young scientist, observing the world, and learning to find solutions that make a difference!

How to Document Your Research Project?

Writing and documenting a research project involves presenting your work clearly, systematically, and professionally. The process should reflect your understanding, analytical ability, and contribution to the chosen topic.

The most important part of your project documentation is real-time, hand-written observations and data points with dates in your project book. Please note that printed versions of raw data or rewriting the raw data from the project book into another book, such as a fair notebook, are not acceptable for evaluation.

In addition to the hand-written project notebook, prepare a project report about your findings. A guideline for such a representative report is given below:

1. Title Page

Include:

- Title of the project
- Your name and roll number
- Supervisor's/Mentor Teacher's name and designation
- Affiliation (Institution name) and academic year

2. Abstract

Provide a brief overview (150–250 words) summarizing:

- The purpose of your study
- The methods used
- Key findings or outcomes
- Major conclusions or recommendations

An abstract should give the reader a quick understanding of the research objectives and outcomes.

3. Acknowledgements

Acknowledge individuals, organizations, or institutions that assisted you, such as your supervisor/mentor, teacher/guide, funding source (if any), or collaborators.

4. Table of Contents

List all main sections and subsections with page numbers for easy navigation.

5. Introduction

This section should:
Present the research problem or question
Explain the relevance and background of your topic
State your hypotheses or specific objectives
Define the project's scope and limitations

6. Literature Review

Summarize and evaluate existing research. Discuss what has been previously done, highlight knowledge gaps, and explain how your research builds upon or differs from existing work.
Include:

- Key publications reviewed, as applicable
- Summary and critique of findings
- Identification of research gaps
- Relevance to your present study

7. Methodology

Describe how the research was conducted in detail so others can reproduce your study.

Include details such as:

- Study design (qualitative, quantitative, or mixed)
- Population/sample studied
- Tools or instruments used (e.g., questionnaires, assays, datasets)
- Data collection and analysis methods
- Ethical considerations

8. Results

Present findings clearly using:

- Tables, graphs, and figures
- Statistical analysis summaries, as appropriate
- Key patterns, trends, or observations
- Avoid interpretation here—focus on what was observed

9. Discussion

Interpret and analyze your results in light of previous literature:

- Explain the significance of the findings
- Discuss potential limitations
- Suggest future research directions

10. Conclusion

Summarize the key findings, their implications, and the overall contribution of the study. Keep it concise and aligned with your research objectives.

11. References

List all the sources you cited in a consistent academic format. Include only works you directly referred to.

12. Appendices

Attach supplementary material that supports your main text:

- Raw data, questionnaires, interview transcripts
- Detailed protocols, calculations, or software codes
- Ethics approval letters or consent forms

Style and Presentation Tips

Maintain formal academic tone and clear formatting.

- Use the past tense for completed work.
- Number all tables and figures.
- Proofread grammar and consistency before submission.

This systematic approach helps ensure that your research documentation is transparent, credible, and academically sound.

How to Present Your Research Project?

Purpose

The research presentation allows you to communicate your study's purpose, design, findings, and conclusions to the audience and evaluators. It demonstrates your understanding of the topic, ability to synthesize information, and communication skills.

Structure of the Presentation

1. Title Slide (1 slide)

Include the project title, your name(s), roll number(s), class, affiliation, supervisor's/mentor teacher's name, and date of presentation.

Keep it simple and visually balanced.

2. Introduction (1-2 slides)

Briefly introduce the research problem, its background, and relevance.

State your research aim, objectives, and/or hypotheses clearly.

Explain why the topic is significant and what gap or issue your research addresses.

3. Literature Context (1 slide)

Provide a short overview of existing work.

Highlight key studies or theories that informed your research approach.

Explain how your study contributes to or differs from previous research.

4. Materials and Methods (1 slide)

Describe your study design and the procedures followed.

Mention instruments, materials, or data sources used.

Summarize statistical or analytical methods (avoid excessive technical details).

5. Results (1-2 slides)

Present findings clearly using graphs, tables, or images.

Explain figures verbally; do not overload slides with text.

Ensure all visuals have labeled axes, units, and concise captions.

Discussion (1 slide)

Interpret what your results mean.

Link your findings to the research question or hypothesis.

Mention unexpected observations or limitations objectively.

Conclusion (1 slide)

Summarize the main findings, their implications, and possible future work.

Avoid introducing new information here.

References and Acknowledgements (1 slide)

Acknowledge your guide, collaborators, and funding sources.

Include a brief reference list following a citation style.

How to Present Your Research Poster

Your research can also be presented visually through a research poster. On a chart paper you can organize all the information in a clear and continuous flow. Different sections of the presentation such as Introduction, Literature context, materials and methods, results, discussion, conclusion, references and acknowledgements. The different sections should be clearly separated. Try to tell your research journey through minimal text and well-labelled figures, flowcharts, tables, pie-diagrams, graphs etc. Don't forget to write the title of your research project at the top in a larger font. There is no need to 'decorate' your poster but make it visually balanced with redable fonts. Make sure that there are no mistakes in your poster, readable fonts, and proper colour scheme.

During the prsentation, stand beside your poster, speak confidently to the evaluator and explain them the steps of your research project. Use simple language, point to the part that you are speaking about. Do not read from the poster. You have done the project yourself and you have command over the domain, so you will be able to explain it on your own. Maintain eye contact, listen to the questions patiently and answer in your own language clearly. A well presented poster is an effective way of communicating your research in a professional but easy way.

Delivery Guidelines

Organization: Follow a logical flow that tells the "research story." Use a structured approach and emphasize the key points.

Time Management: Keep total time within limits (e.g., 10–12 minutes plus Q&A). Rehearse to maintain pace.

Clarity: Speak slowly, enunciate clearly, and avoid reading directly from slides.

Visual Design: Use a clean background, large, readable fonts, and consistent formatting.

Engagement: Face the audience, make eye contact, and use gestures naturally.

Question Handling: Anticipate queries. Respond briefly and confidently; admit if unsure, but indicate how you would follow up.

Checklist before Presentation

- Slides reviewed for accuracy and grammar.
- Figures labelled and properly cited.
- Backup of slides saved (USB/cloud).
- Practice with peers or supervisor(s)/mentor teacher(s).
- Ensure technical compatibility with projector systems.

Further Reading Material

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Science and Innovation for Sustainability

राविप्रौसंप NCSTC

Catalysed and supported by

National Council for Science & Technology Communication (NCSTC)
Technology Bhawan, New Mehrauli Road
New Delhi – 110016

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