April 2025

Young Scientist India

A Science & Innovation Magazine for School Students

INDIAN SCIENTISTS

SATYENDRA NATH BOSE

THIRUMALACHARI RAMASAMI

RAGHUNATH ANANT MASHELKAR

KALPATHI RAMAKRISHNA RAMANATHAN

ROOT CAUSE ANALYSIS

VENN DIAGRAMS

3D PRINTING MAGIC

PROTECTING YOUR IDEAS

Volume 01 | Issue 04

www.YoungScientistIndia.org

Young Scientist India

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Editorial

Chairman's Message

Hello, Young Innovators.

Did you visit YoungScientistIndia.org website yet? Look at the knowledgebase pages. I love them. I am sure you would like them too. There is a regular update in Young Scientist Channels, both on Telegram (LINK) and WhatsApp (LINK). Join them not to miss any Science Competition. You would also find rich collections of relevant and useful videos in 20 Young Scientist YouTube Playlists on GYS YouTube Channel. You should visit them too sometime (LINK).

As always, this April issue also comes with interesting and insightful articles. A Nation's development is mostly contributed by its Scientists. This month's Cover Story is a proud presentation on **Indian Scientists**. So inspirational that it refers to great people from the medieval era to modern times. Along with that, brief biographies of Satyendra Nath Bose, Thirumalachari Ramasami, Raghunath Anant Mashelkar, and Kalpathi Ramakrishna Ramanathan are also featured.

We are giving two training modules every month. **Root Cause Analysis** is a great tool to understand problems deeper towards finding an effective solution. It is useful, not just in Innovation Projects in Schools, but also for elders in Business scenarios. **Venn Diagrams** assist in analyzing data sets, particularly when there are multiple combinations to look into to make a decision. Teachers as well as Students benefit equally from these tools.

India invented many things, although the biased Western literature does not expose them. You will find Fiber Optics, Jaipur Foot, and Candied Sugar as such valuable contributions in this issue. Raman Effect by Sir CV Raman made India proud on the World stage. Defence Research & Development Organization (DRDO) is a great source for the Country's self-reliance in Defence. You get a little insight on their work along with three other Indian Science & Innovation Organizations.

My dear students and teachers, keep an eye on exciting events and contests in the new academic year. I wish you good luck.

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S&I Article

What Makes a Great Innovation?

Innovation is that magical moment when a brilliant idea transforms a challenge into an awesome opportunity. Innovators dream up new solutions, turning imaginative concepts into real-world breakthroughs. In India, these brilliant thinkers are constantly turning bold ideas into tangible solutions, from simple hacks to advanced tech.

Get ready to explore what makes an innovation truly great and how India is leading the charge!

Characteristics of a Great Innovation

A great innovation is more than just a new idea; it creates a meaningful impact, solves real-world problems, and improves lives.
Key qualities include:

Solves a Real Problem: Addresses genuine needs, like smartphones consolidating multiple devices.

User-Centered and Inclusive: Easy to use and accessible for people of all ages and backgrounds, just like Airbnb's intuitive design.

Affordable and Accessible: Practical and available to diverse groups, not just the privileged.

Scalable: Can grow and reach new markets, similar to the Internet's global expansion.

Timing and Cultural Fit: Succeeds when launched at the right moment, as seen with Zoom during the pandemic.

Simplicity and Elegance: Offers straightforward solutions, like Post-it Notes.

Sustainable: Considers long-term economic and environmental impact.

Disruptive or Transformational: Shifts industries or creates new ones, such as Tesla's electric vehicles.

Ethical Foundation: Respects privacy, dignity, and societal well-being.

Important Lessons from Great Innovators

Great innovators have shared powerful lessons through their words and actions. Here are some of their most important insights:

1. Embrace Change and Challenge the Status Quo
Innovation requires questioning old ways and daring to be different. As Charles Kettering said, *"If you have always done it that way, it is probably wrong."*

2. Value Imagination and Creativity
"Innovation is seeing what everybody has seen and thinking what nobody has thought." – Dr. Albert Szent-Györgyi.

3. Take Risks and Accept Failure
Failure is part of innovation. Thomas Edison famously said, *"I have not failed. I've just found 10,000 ways that won't work."*

4. Persistence and Patience Are Essential
"It always seems impossible until it is done." – Nelson Mandela.

5. Focus on Creating Value, Not Just Ideas
"Innovation is change that unlocks new value." – Jamie Notter. Ideas matter only when acted upon.

6. Prioritize Customer Experience
Steve Jobs stressed, *"Start with the customer experience and work back toward the technology."*

7. Collaboration Fuels Innovation
Innovation thrives when ideas connect and people collaborate. *"Creating environments where ideas can connect"* is key. – Steven Johnson.

8. Stay Curious and Keep Learning
"Learning and innovation go hand in hand." – William Pollard.

Great Indian Innovators

Here are some of the great Indian innovators who transformed India and the world through breakthrough ideas, technology, and solutions across diverse fields.

- **Satyendra Nath Bose:** Collaborated with Albert Einstein, leading to the Bose-Einstein statistics. A foundational figure in quantum mechanics.
- **M. Visvesvaraya:** Engineer and statesman, known for his contributions to irrigation, flood management, and modern water supply systems.
- **Dr. Homi J. Bhabha:** Father of India's nuclear energy program; established TIFR and BARC.
- **Dr. A.P.J. Abdul Kalam:** From a small town to leading India's missile and space missions and later, becoming the People's President.
- **Narayana Murthy (Infosys):** Laid the foundation of India's IT revolution and global outsourcing industry.

Some Inspiring Stories of Innovation

Arunachalam Muruganantham: Solving a Taboo Problem with Simplicity
Innovation: Low-cost sanitary pad machine
Story: After seeing his wife use dirty clothes during her period, he invented a machine that produces sanitary pads for a fraction of the cost, without formal education or lab access.
Lesson: Empathy drives innovation. Start by solving a real problem in your community.

Sonam Wangchuk: Turning Ice into Innovation

Innovation: Ice Stupa (artificial glaciers for water conservation)

Story: In Ladakh, where spring water shortages ruin crops, Sonam engineered cone-shaped glaciers to melt slowly and release water when needed.

Lesson: Work with nature, not against it. Observe and adapt solutions to your local environment.

Nandan Nilekani: Scaling Identity with Technology

Innovation: Aadhaar – the world's largest biometric ID system

Story: Left Infosys to lead a government project that now helps over a billion Indians access banking, welfare, and healthcare.

Lesson: Scale design. Build systems that are secure, simple, and inclusive.

Key Lessons to Inspire Your Own Projects

- **Start Small, Dream Big:** Begin with what you have. Even tiny ideas can grow into something huge.
- **Solve Real Problems:** Look around—find problems people face daily and work on fixing them.
- **Think with Empathy:** Understand people's needs deeply. The best ideas help others in meaningful ways.
- **Use What You Have:** Limited resources? No problem. Be creative and make the most of what's available.
- **Build, Test, Improve:** Don't wait for a perfect start, get feedback, and keep improving.
- **Share Your Story:** Talk about your journey. You never know who you might inspire.
- **Anyone Can Be an Innovator:** No matter your age or background, if you care, you can create.

The Takeaway

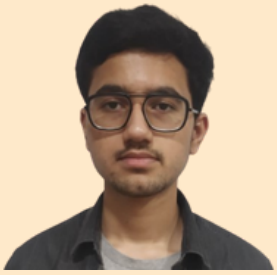
Innovation is like a spark that can light up the world—big or small, your ideas matter! By learning from inspiring innovators, you too can turn everyday problems into awesome solutions. So, roll up your sleeves, get curious, and remember: anyone can be an innovator. Who knows? Your next big idea might just change everything!

Soldering Smoke Absorber

Sumay's idea focuses on developing a "Soldering Smoke Absorber" to address the health risks faced by technicians who work with soldering irons. The smoke produced during soldering contains harmful substances that pose serious threats to their well-being, including occupational asthma, allergic hypersensitivity, and respiratory irritation.

To create an effective and affordable solution, Sumay proposes building a device that absorbs soldering smoke using agricultural and e-waste materials. Instead of expensive charcoal pads, he plans to use charcoal made from corn cobs as a cost-effective alternative.

Additionally, discarded PC fans from old CPUs will be repurposed for the exhaust system, making the device both economical and environmentally friendly.



Sumay Ranjan Singh
10th Class

By developing this Soldering Smoke Absorber, the project aims to

- Create a healthier work environment for technicians.
- Promote the efficient use of agricultural and electronic waste.
- Raise awareness about domestic pollution and the importance of using sustainable materials to combat it.

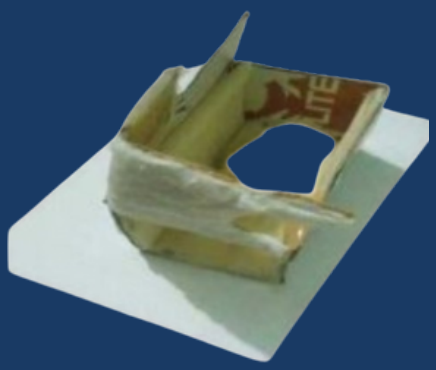
This innovative approach offers a practical, eco-friendly, and affordable solution to a common occupational hazard.

(Source: INSPIRE MANAK NLEPC 2023 Booklet)

Cannula Safety Gloves

Cannula gloves are designed for healthcare professionals who use cannulas during invasive procedures. These gloves help prevent infection transmission between patients and healthcare workers. They significantly lower the risk of needle-stick injuries, which can cause transmission of serious infections like HIV and Hepatitis. Additionally, they help minimise contamination and reduce infection rates in patients.

Purvi Raj
8th Class



The gloves are designed to provide a better grip on cannulas or needles, making procedures smoother and more efficient. Lightweight and flexible, these gloves offer extra comfort and ease of movement during long procedures, helping to reduce fatigue among healthcare workers.

(Source: INSPIRE MANAK NLEPC 2024 Booklet)

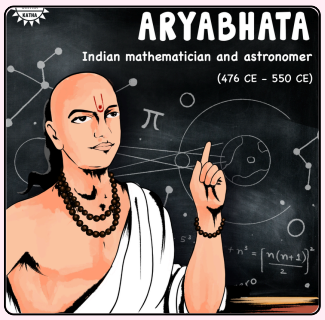
Cover Story

Indian Scientists

Indian Scientists

Ever wondered how the number zero came to be? Or how ancient surgeons performed incredible feats? From the mathematical genius of Aryabhata to today's space exploration, India has been a powerhouse of brilliant minds. This article explores the incredible journey of Indian scientists, a legacy of curiosity, ingenuity, and breakthroughs that continues to inspire globally.

Aryabhata (476–550 CE)



Aryabhata, a legendary Indian mathematician and astronomer, laid the foundation for India's scientific heritage through his work.

Key Contributions

- Introduced the decimal system and zero as a placeholder.
- Accurately calculated π (Pi) as 3.1416.
- Developed sine, cosine and versine functions in trigonometry.
- Solved linear and quadratic equations, introduced Kuttaka method for indeterminate equations.
- Provided geometric formulas for areas and volumes of triangles and spheres.
- Proposed that the Earth rotates on its axis and is spherical in shape.
- Gave scientific explanations for solar and lunar eclipses using shadows.
- Accurately computed sidereal periods and planetary motions.

Aryabhata's legacy shaped future Indian scholars Bhaskara I and II, deeply influencing astronomy, calendar calculations and education across centuries.

Charaka (100 BCE – 200 CE)

Charaka, a pioneering Indian physician, is considered one of the **"Fathers of Medicine"** or the **"Father of Ayurveda"** in India and is considered a cornerstone in the practice of the ancient Ayurvedic medicine system.

Key Contributions

- Charaka Samhita: A foundational Ayurvedic text divided into eight sections, covering medical principles, diagnosis, treatment methods, pharmacology and preventive care.
- Holistic Health: Advocated for ethical living, balanced lifestyle and mental well-being as integral to healing.
- Preventive Medicine: Stressed the importance of diet, exercise and hygiene.
- Concept of Agni: Introduced the idea of digestive fire (Agni), as central to health and disease prevention.
- Therapies: Described herbal medicines, Rasayana (rejuvenation therapy) and Panchakarma (detoxification techniques).

Charaka's teachings focus on treating the body, mind and spirit together. His work continues to influence natural and integrative medicine worldwide.

Sushruta (c. 6th century BCE)

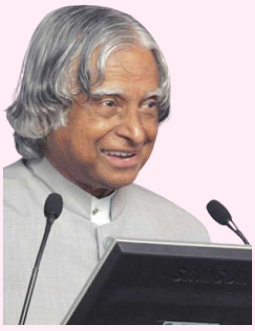
Sushruta, known as the **"Father of Surgery"** for his groundbreaking contributions to surgical science.

Key Contributions

- Sushruta Samhita: A detailed Sanskrit text on surgery, anatomy, diagnosis, prevention and herbal treatments.
- Surgical Innovations: Described over 300 surgical procedures and instruments, many of which resemble modern tools.
- Pioneering Procedures: Performed cataract surgery, caesarean sections and reconstructive surgeries like rhinoplasty (nose repair).
- Anatomy and Hygiene: Advocated human dissection for learning anatomy and promoted sterile techniques using herbal antiseptics.
- Holistic Healing: Treated illness through diet, herbs and balanced living, aligning with Ayurvedic principles.

Sushruta's work influenced ancient Greek and Roman medicine and laid the foundation for modern surgical practices.

Dr. A.P.J. Abdul Kalam (1931–2015)



Dr. Avul Pakir Jainulabdeen Abdul Kalam, known as the **"Missile Man of India"**, was a visionary scientist, educator and 11th President from 2002–2007. He played a significant role in India's defense and space programs.

Key Contributions

- Led the development of Agni and Prithvi missiles, boosting India's defence capability.
- Played a key role in the Pokhran-II nuclear tests (1998) as Chief Scientific Advisor, solidifying India's nuclear status.
- At ISRO, directed the successful launch of SLV-III, placing India's first satellite, Rohini, in orbit (1980).
- Headed DRDO, contributing to the Tejas Light Combat Aircraft and other military innovations.

Awards and Honours

- Bharat Ratna (1997), India's highest civilian award
- Padma Vibhushan (1990) and Padma Bhushan (1981)
- Honorary doctorates from over 40 universities
- International accolades, including the King Charles II Medal (UK, 2007).

Dr. Kalam's books and speeches continue to inspire generations to dream big and serve the nation with integrity.

Gagandeep Kang (Born in 1962)

Dr. Gagandeep Kang, an Indian microbiologist and virologist, is known for her groundbreaking work on enteric infections and her significant contributions to vaccine development and public health initiatives.

Key Contributions

- Rotavirus Research and Vaccine Development: She conducted extensive studies on rotavirus infections in Indian children and played a crucial role in developing and clinically testing Rotavac, an indigenous vaccine developed by Bharat Biotech.
- Enteric Diseases and Public Health: Researched enteric infections, sanitation, and water safety, focusing on child health and development. Established community-based birth cohort studies to understand disease natural history and long-term effects.

Dr. Kang's interdisciplinary approach, combining epidemiology and molecular biology, has significantly improved India's understanding of enteric diseases and vaccine development, thereby enhancing child health outcomes and shaping global health policies.

C.V. Raman (Chandrasekhara Venkata Raman) (1888–1970):

Dr. C.V. Raman, one of India's most celebrated physicists, was awarded the Nobel Prize in Physics (1930) for discovering the Raman effect, a groundbreaking contribution to optics and molecular physics. He was also awarded Bharat Ratna in 1954.

Raman founded the Raman Research Institute in Bangalore (1948), fostering innovation in optics and quantum mechanics. His discovery revolutionized spectroscopic analysis, making it a vital tool in science and industry across the globe.

Key Contributions

- Raman effect: Showed that light changes wavelength when scattered by molecules, key to understanding molecular structure.
- Laid the foundation for Raman spectroscopy, widely used in chemistry, materials science and biotechnology.
- Advanced the study of acoustics, especially sound wave behaviour in musical instruments.
- Explained natural phenomena like the blue colour of the sky through light scattering principles.

Venkatraman"Venki" Ramakrishnan (Born 1952):

Venkatraman Ramakrishnan, an Indian-born American-British structural biologist, was awarded the 2009 Nobel Prize in Chemistry for his groundbreaking work on the structure of ribosome.

Key Contributions

- Used X-ray crystallography to map the 30S ribosomal subunit, revealing how proteins are synthesized in cells.
- His findings advanced understanding of genetic translation and how antibiotics target bacterial ribosomes.
- Contributed to the development of new antibiotics by showing how drug molecules bind and inhibit ribosomal function.

Awards and Honours

- Nobel Prize in Chemistry (2009)
- Padma Vibhushan (2010)
- Knight Bachelor (UK, 2012)
- Order of Merit (UK, 2022)

Ramakrishnan's work revolutionized structural biology, with major implications for medicine, drug design and biochemistry, inspiring a generation of scientists in molecular research.

Conclusion

Indian scientists have made remarkable contributions to science and technology, both in ancient times and in the modern world. Their work has advanced fields like medicine, mathematics, astronomy, physics and biology, showing a deep commitment to understanding the world and solving real-life problems.

Their legacy lies not only in their discoveries, but in the spirit of curiosity, perseverance and innovation they represent, paving the way for future generations to explore, create and lead in the global scientific arena.

World Earth Day – April 22

One Planet. One Chance.

World Earth Day is celebrated to unite people across the globe in a powerful movement to protect and preserve our only home, Planet Earth.

Why Celebrate Earth Day?

Earth Day is a special occasion to remind us how important our planet is and how we must take care of it.

- Nature needs our help: Trees, animals, rivers, and the air we breathe are being harmed by pollution and waste.
- Clean air, water, and land are not unlimited: We only have one Earth, and its clean resources can run out if we waste or pollute them.
- Every living thing is connected: Plants, animals and humans, we all depend on each other to survive. If we harm one part of nature, it affects everything.
- We must act now to protect our future: Earth Day encourages us to think of smart and innovative ideas to save energy, reduce waste, and keep our planet safe for future generations.

How can we Celebrate Earth Day?

- Celebrate with a Theme: Planet vs. Plastic
- Plant a Tree or Start a Mini Garden
- Organise a 'Trash to Treasure' Craft Contest
- Organise a Clean-Up Drive
- Go Digital-Free for an Hour
- Launch a Green Pledge Wall

Did You Know?

A plastic bottle takes over 450 years to decompose. 91% of plastic isn't recycled. Today, oceans have more than 170 trillion plastic particles.

Indian Scientist
Satyendra Nath Bose

Padma Vibhushan in 1954

Born in 1894 in Kolkata

Have you ever wondered how light behaves, or what happens to matter when it gets extremely cold, colder than ice, even? One Indian scientist, Satyendra Nath Bose, helped answer these tough questions. His work in physics led to the discovery of a whole new type of particle and helped change how we understand the universe.

Career and Achievements

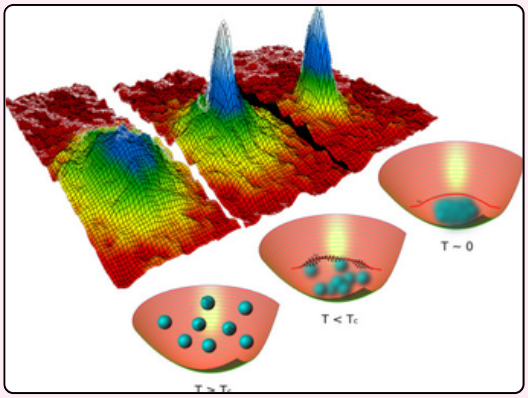
Bose was a curious student who loved numbers and logic. In 1924, while teaching at the University of Dhaka, he tried to explain how tiny particles of light (called photons) behave. Instead of using old methods, he came up with a brand-new idea: Bose-Einstein statistics.

He sent his work to Albert Einstein, who immediately saw how brilliant it was. Together, they predicted a strange state of matter called the **Bose-Einstein Condensate**, seen only when atoms are cooled to near absolute zero.

Bose's idea also led to the discovery of bosons—particles that don't mind sharing space. Unlike electrons (which avoid each other), bosons like to stay together. Light is made of bosons. So is the Higgs boson, a particle that helps give mass to other particles.

Bose didn't stop at research. He:

- Taught at the Universities of Dhaka and Calcutta
- Helped build India's science institutions like CSIR and ISI
- Promoted science in Indian languages and made it accessible to all
- Encouraged students to do original research and publish in Indian journals



Bose-Einstein Condensate

Achievements and Legacy

Though he never won the Nobel Prize, he was awarded the Padma Vibhushan and became India's National Professor. Today, the S.N. Bose National Centre for Basic Sciences in Kolkata continues his legacy.

Satyendra Nath Bose proved that bold thinking—even from a classroom—can shape the future of science. Maybe your next idea will too!

S&I Article

3D Printing Magic

3D printing is a process of creating three-dimensional objects by adding material layer by layer based on a digital design. It's a type of additive manufacturing, meaning it builds objects by adding material rather than cutting it away like traditional methods.

How is it Done?

3D printing, or additive manufacturing, begins with creating a digital 3D model using computer-aided design (CAD) software. This model is then sliced into thin layers by slicing software, generating instructions for the printer. The 3D printer follows these instructions, depositing material layer by layer—usually plastic, resin, or metal—until the object is fully formed. Common methods include Fused Deposition Modeling (FDM), Stereolithography (SLA), and Selective Laser Sintering (SLS). After printing, the object may require post-processing such as support removal, curing, or surface finishing. This process allows for rapid prototyping and the creation of complex, customized parts.

Materials Used for 3D Printing:

- Plastics (like PLA, ABS)
- Resins
- Metals
- Nylons
- Even concrete, food, or living cells in advanced applications.

The Evolution

3D printing was invented in 1983 by Chuck Hull, an American engineer. He created the first working 3D printer using a process called stereolithography (SLA). This method uses ultraviolet (UV) light to harden layers of liquid resin into solid shapes, one layer at a time.

The first commercial 3D printer manufactured

Key Milestones

- 1983 - Chuck Hull invents stereolithography (SLA).
- 1986 - Hull founds 3D Systems, the first 3D printing company.
- 1987-1990s - Other methods developed:
  - FDM (Fused Deposition Modeling) by Stratasys
  - SLS (Selective Laser Sintering)
- 2000s-2010s - 3D printing becomes more affordable for small businesses and hobbyists.
- Today, it is Used in industries like aerospace, healthcare, automotive, and even food and fashion.

While 3D printing was invented in the 1980s, it's become much more popular recently because it has become cheaper, easier to use, and more versatile. What started as a niche, industrial tool is now a powerful creative and problem-solving technology for everyone, from engineers to artists to students.

Applications of 3D printing:

Healthcare:

- Custom prosthetics and orthotics
- 3D-printed implants (e.g., jawbones, skull plates)
- Anatomical models for surgical planning
- Bioprinting tissues (in research)

Automotive:

- Prototyping car parts
- Manufacturing lightweight components
- Custom production tools and fixtures on lines

Aerospace:

- Printing complex engine parts
- Lightweight structural components
- Rapid prototyping for design testing

Construction:

- 3D-printed concrete houses and buildings
- Low-cost housing solutions in remote areas

Fashion and Design:

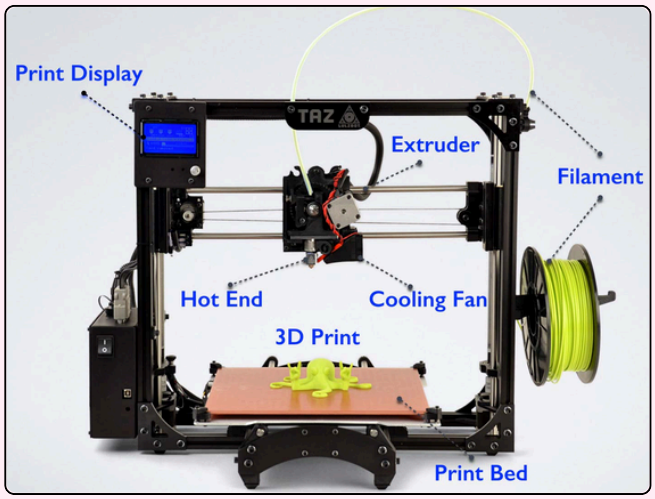
- Customized jewelry
- Avant-garde fashion pieces
- Shoe prototypes and limited editions

Education and Research

- Models for classroom use
- Scientific tools and experimental parts

Food Industry:

- Shaped chocolates, pasta, and decorative foods
- Personalised nutrition experiments



*A desktop **Fused Deposition Modeling (FDM)** printer, widely popular in homes, schools, and innovation labs.*

These examples highlight just a few of the many ways 3D printing is transforming industries, including architecture, robotics, education, and consumer electronics, with new applications constantly emerging.

Importance of 3D Printing Today

Rapid Prototyping: Quickly turns ideas into physical models, speeding up product development.

Customization: Creates made-to-order items like prosthetics and tools, eliminating the need for mass production.

Less Waste: Uses only necessary material, making it more sustainable than traditional manufacturing.

On-Demand Production: Prints parts only when needed, crucial in emergencies or when supply chains are disrupted.

Medical & Educational Impact: Supports healthcare with surgical models and helps students learn by creating real objects.

Supports Innovation: Empowers small businesses and inventors to build and test products affordably.

3D printing in the Education Industry

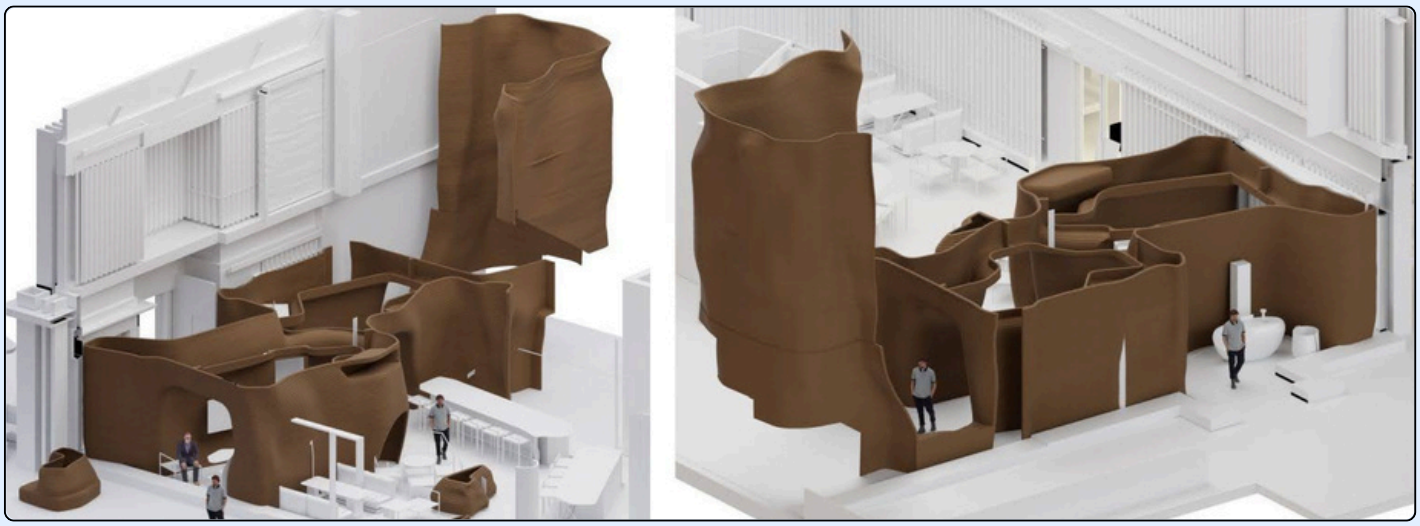
Ever wish you could hold a beating heart to learn biology? Or design a miniature city for urban planning? 3D printing makes this happen in classrooms, transforming learning! It clarifies complex subjects with hands-on 3D models, boosting your problem-solving and unleashing creativity. It's also a game-changer for inclusive learning, offering tactile tools for students with disabilities.

Conclusion

3D printing truly is modern magic, turning imagination into reality, layer by layer. What once seemed like science fiction is now transforming industries, from healthcare and aerospace to art and architecture. It empowers people to design, create, and innovate like never before. Today, the ideas we dream can be brought to life with the press of a button.

Did You know?

The interior installation at Dubai's MYATA Platinum Restaurant holds the **Guinness World Record** as the largest 3D-printed structure by volume (13.75 m^3). Created by Proto21 using 158 FDM printed rs, it spans around 100 m^2, features 23 canyon-inspired polymer elements, and uses over 10 tonnes of filament, showcasing large-scale additive manufacturing's



3D Illustration of The World's Largest 3D-Printed Structure.

Indian Scientist

Thirumalachari Ramasami

Padma Bhushan (2014) and Padma Shri (2001) for Science and Engineering

BORN ON APRIL 15, 1948, IN TAMIL NADU

Have you ever thought about how your leather shoes or bags are made? Or how science can help the process? Dr. Thirumalachari Ramasami did, and he turned these questions into groundbreaking innovations.

Career

Dr. Ramasami studied chemistry and earned his PhD from the University of Leeds, UK. He later became Director of the Central Leather Research Institute (CLRI) and then served as Secretary of the Department of Science and Technology (DST).

Achievements

Dr. Ramasami saw how leather-making polluted water, used harmful chemicals and created waste. So, he created solutions:

- Enzyme-based unhairing
- Waterless chrome tanning

and other safer and eco-friendly techniques. These innovations helped tanneries across India and even influenced global leather standard.

He developed **12 technologies**, earned **37 patents** and published over **220 research papers**.

He even used computer models to predict leather colour, making production more accurate. He combined chemistry and biology to reduce chemical usage, showing how science disciplines can work together to solve real-world problems.

As Secretary of the Department of Science and Technology (DST), he launched national science missions and the INSPIRE Programme, which has impacted millions of students across India. If you've ever thought of building a science project or joining a science exhibition, he's one of the people who helped make that possible.

Awards and Honors

Awarded the Padma Shri, Padma Bhushan and the Shanti Swarup Bhatnagar Prize, Dr. Ramasami is proof that real-world problems need science and young scientists to solve them. Maybe your next idea could help the planet too

Science & Innovation Organization

Salim Ali Centre for Ornithology and Natural History (SACON)

An incredible research institute, founded in 1990 in Anaikatti, Coimbatore, carries the legacy of the legendary "Birdman of India," an ornithologist and naturalist, Dr. Sálim Ali. This is the Sálim Ali Centre for Ornithology and Natural History (SACON)! Operating under the Ministry of Environment, Forest, and Climate Change, SACON stands as India's premier institution for bird and biodiversity conservation.

A Campus Bursting with Life!

SACON's campus is truly special, nestled within the vibrant Western Ghats. Designed by eco-friendly architect Laurie Baker, its naturally lit, open buildings blend seamlessly into the environment. It's a living classroom

- Home to over 400 species of flowering plants and a remarkable 177 bird species.
- Witness 107 butterfly species, with spectacular mass movements in October and November!

With over 17 scientists on board, this institute has even been instrumental in discovering four new species of flora and fauna! Its extensive library is open to all, from students to curious visitors.

SACON's Core Mission: Preserve and Educate!

SACON is committed to safeguarding India's rich biodiversity. They achieve this through

- Comprehensive research in ornithology and natural history.
- Engaging educational programs for wildlife enthusiasts, combining classroom learning with thrilling field visits to protected areas.
- Recognizing vital contributions to these fields.

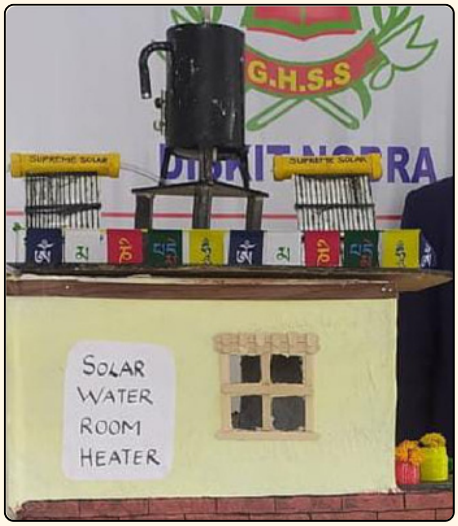
Their state-of-the-art labs support advanced studies in ecotoxicology and wildlife biology. SACON is truly where scientific dedication and a love for nature take flight!

Inspiring the Next Generation of Conservationists!

SACON goes beyond science, nurturing young minds to love nature. Through workshops, internships, and interactive sessions, they empower students as future conservation leaders. Their work fosters a deep connection to India's unique natural heritage, inspiring its protection for generations.

Solar Water Room Heater

Tsering Dolker is from Leh, a cold, snow-covered region. Visitors and residents alike struggle to keep their rooms warm in such harsh conditions. To combat the extreme cold, people in Ladakh often rely on methods like burning firewood, despite the region's limited vegetation, and using room heaters, kerosene heaters, and other non-renewable resources that harm the environment.



Tsering Dolker
9th Class

Concerned by these issues, Tsering developed a solar water room heater, which fulfils a vital need for every household during the cold winters. This eco-friendly solution provides warmth while avoiding the release of harmful chemicals into the environment.

(Source: INSPIRE MANAK NLEPC 2023 Booklet)

A Bed Attached with a Movable/Rotatable Wash Basin

Nethra introduced an innovative, low-cost bed with a rotatable and easily movable washbasin attachment, designed to address the challenges faced by bedridden patients. This bed provides an ideal solution for individuals who need assistance with basic hygiene tasks such as brushing, handwashing, vomiting, gargling, and face washing.

The modified bed features a compact washbasin that can be effortlessly rotated and repositioned. It is equipped with a hosepipe connected to a water source, allowing patients to perform their daily hygiene routines with ease. The used water is collected in removable bags or a bucket for easy disposal, ensuring cleanliness and convenience.

Nethra
6th Class

This design is particularly beneficial for individuals who cannot walk or move easily, offering them greater independence in managing their hygiene. Additionally, the mobility of the bed allows caregivers to relocate it as needed, enhancing overall flexibility in patient care.

(Source: INSPIRE MANAK NLEPC 2023 Booklet)

Indian Inventions

Jaipur Foot

India's Innovation That Helped Millions Walk Again

Have you ever tried hopping on one foot for even a minute? Imagine having to do it your whole life. That's the reality for many people who have lost a leg in an accident, illness or even due to war or natural disasters.

But India found a powerful, life-changing solution and it didn't cost a fortune. It's called the Jaipur Foot, one of the world's most successful scientific innovations. Created right here in India, it's not just a smart invention, it's a story of science helping real people.

What is the Jaipur Foot?

The Jaipur Foot is a prosthetic limb or artificial leg, that helps people walk, run, sit cross-legged, squat and even climb trees. Things that are a part of everyday life, especially in villages and small towns across India.
It was invented in 1968 by a team led by **Dr. Pramod Karan Sethi,** an orthopaedic doctor, and **Ram Chander Sharma**, a skilled craftsman, at the Indian Spinal Injuries Centre in Jaipur.
They didn't have fancy materials or high-tech equipment. What they had was a simple idea: create a low-cost, flexible, and durable foot for people who couldn't afford expensive prosthetics from abroad. And that's how the Jaipur Foot was born!

Why is it so special?

Unlike foreign prosthetic limbs, which often cost lakhs of rupees, the Jaipur Foot costs **just ₹3,000 to ₹5,000**. That's about the cost of a new school bag, shoes, and textbooks for a year!

But even at this low cost, it offers amazing features.

- Made from rubber, wood, and plastic, it's lightweight and works well on uneven village paths.
- It allows barefoot walking, cross-legged sitting, and squatting—very important in Indian homes, farms, and temples.
- It's easy to use and doesn't require complicated machines or power to function.

In fact, someone who loses a leg can walk into a Jaipur Foot centre in the morning and walk out by evening, walking on two legs again!

Who uses the Jaipur Foot?

Over **2 million people** in India and more than **30 countries** have benefited from this invention. Many are

- Farmers who need to bend, squat and walk through fields.
- Children who want to go back to school and play again.
- Factory workers who need to stand all day and move quickly.
- Soldiers and victims of earthquakes or accidents who lost limbs.

It's not just in India. The Jaipur Foot has helped people in Nepal, Sri Lanka, Pakistan, Africa, and even the Middle East, giving them independence and dignity.

Want to know how it works?

- It uses simple engineering design with joints and materials that copy the movement of a real foot.
- It's designed to work on mud, gravel, and stairs, not just on smooth hospital floors.
- The ankle joint gives flexibility to walk, turn and even run!

Think of it like building a robotic leg with recycled parts, but made for real-life challenges.

Meet the Heroes Behind the Mission

The Jaipur Foot is provided by an organisation called BMVSS (Bhagwan Mahaveer Viklang Sahayata Samiti). It was started in 1975 in Jaipur by D.R. Mehta, and is now the world's largest organisation for free artificial limbs.

They run camps in villages, set up mobile vans for remote areas, and even travel to other countries. And it's all free for those who need it.

Riddles 2504

1. Thirty white horses on a red hill, First they champ, Then they stamp, Then they stand still.
2. What are ten things you can always count on?
3. What do dogs have that no other animal has?
4. Anyone can hold me, even without their hands, yet no one can do it for long. What am I?

Solutions are on Inside Back Cover.

What can YOU learn from the Jaipur Foot?

If you're in school and love science, this is more than a story—it's an inspiration.

- Think like a problem-solver. Can you design something useful from simple materials?
- Combine biology and engineering like how joints and bones work.
- Don't just invent for marks; invent for people.

Maybe you could build a walking aid, a water-saving device, or even a smart school bag! The world needs your ideas.

By the end, you might come up with an Indian invention with a global heart.

The Jaipur Foot proves that great science doesn't need great money, just great minds and big hearts. It shows how an idea born in a small Indian workshop can change the lives of millions around the world.

So next time you open your science book, think beyond the pages. Ask: Can my ideas solve a real problem? Because if a doctor and a craftsman in Jaipur could change the world, maybe the next inventor... is YOU.

Do you Know?

On the Moon, you'd feel like a superhero weighing just 10 kg instead of 60!

Your brain can store more info than a supercomputer.

The space is completely silent because sound cannot travel in a vacuum.

Your brain uses about 20% of your body's total energy, even when you're just thinking.

Science and Technology Park, Pune

A single research center sparks innovation, but imagine a place where numerous cutting-edge departments converge, creating an unparalleled collaborative ecosystem that advances things to the next level.

This is precisely what the Science and Technology Park (Scitech Park) in Pune offers! Established in 1986, this independent hub, linked to Savitribai Phule Pune University and backed by India's Department of Science and Technology, is a powerhouse for innovation. It's where academic brilliance meets entrepreneurial spirit, transforming research into impactful ventures.

The Mission

Scitech Park's core goals revolve around nurturing innovation and entrepreneurship:

- Boosting Startups: Providing vital support, mentorship, and funding guidance to tech-based entrepreneurs. From just 4 startups in 2006-07, they've soared to 176 by 2014.
- Tech Transfer: Bridging the gap between university research and market-ready products.
- Green Technologies: Championing eco-friendly, energy-efficient solutions in renewable energy and waste management.
- Skill Development: Offering workshops and training in hot areas like IoT, AI, and clean tech.

Partnerships & Milestones

- Academics: Strong ties with Savitribai Phule Pune University, NCL, and IISER Pune.
- Industry: Supporting startups and SMEs, and working with corporations for tech transfer.
- Government & Global Bodies: Collaborating with DST, MNRE, the European Union, UNDP, and the World Bank.

Key Achievements

- Pioneering Incubation: One of India's first tech incubators for innovative startups.
- 'Growth Lab' & 'StepUp Manxl': Programs offering expert guidance and funding, like the recent Demo Day where 14 manufacturing startups showcased their tech, winning ₹10 lakh!
- Sustainable Tech: Actively promoting eco-friendly projects.

Scitech Park is truly a dynamic ecosystem, driving technological advancement and sustainable growth across India!

S&I Article

Protecting Your Ideas

Intellectual property (IP) laws protect creations of the mind, such as stories, inventions, logos, music, and confidential business information. These laws grant exclusive rights to creators and inventors to use, sell, or license their work, preventing unauthorized copying or theft.

The main goal is to encourage innovation and creativity by giving creators recognition and the chance to benefit financially, while also supporting progress in society.

Types of Intellectual Property

- **Patents:** Protect new inventions or processes.
- **Trademarks:** Protect brand names, logos, and slogans.
- **Copyrights:** Protect creative works like books, music, art, and software.
- **Trade Secrets:** Protect confidential business information.

Need for Protecting Ideas

Protecting ideas motivates people to create by ensuring they receive credit and rewards. It prevents others from stealing or copying their work, which helps inventions, art, and businesses grow. This leads to more choices and progress for everyone in society.

What is a Patent?

Patents are government-granted rights for inventors to protect and profit from their ideas. They allow them to use, sell, or license their invention for 20 years. The purpose is to give inventors a temporary monopoly in exchange for publicly disclosing details about the invention, which helps spread technical knowledge and encourages further innovation.

Qualifications for a Patent

- **Novelty:** New Invention, not a used and known one
- **Non-obviousness:** It must not be a clear idea to someone skilled in the field
- **Usability:** Invention must be useful

Types of Patents

- **Utility Patents:** It gives protection to new inventions, machines, manufacturers, compositions, matter, and useful processes. **Examples:** a new type of engine, software algorithms, or a pharmaceutical drug. **Duration:** 20 years.
- **Design Patents:** Protect the ornamental design of manufactured items. Examples: the unique shape of a smartphone, a sneaker sole pattern, or a bottle design. **Duration:** 10 + 5 (extendable) years.
- **Plant Patents:** Invention or discovery of a new and distinct plant variety that is asexually reproduced. Examples: new types of flowers, fruit trees, or hybrid plants. **Duration:** 15 to 18 years.

Why are Patents Important?

- Protect inventions by granting exclusive rights
- Add business value and attract investors
- Provide competitive edge in the market
- Encourage innovation and knowledge sharing
- Enable legal enforcement against copycats
- Strengthen branding and marketing
- Offer recognition as a credible innovator

Remember!

A patent doesn't protect natural laws, abstract ideas, or mental processes. It can't stop similar creations unless they infringe directly, and it expires, allowing public use. It also doesn't prevent use for research, teaching, or government needs. A patent provides rights, but its success and high costs depend on its strategic use.

IP Qualified Student Projects

Here are a few real and notable student projects that have qualified as Intellectual Property (IP) and gained recognition nationally or internationally.

1. SoaPen – Hand-Washing Crayon

By: Indian students Shubham Issar and Amanat Anand

Description: A colorful, soap-filled crayon for kids to make handwashing fun.

IP Status: Patent filed

Achievements: UNICEF Wearables for Good Challenge winner

Why it qualifies: It's a novel, useful invention, and protectable as a utility patent.

2. Project GraVITy – Smart Helmet (India)

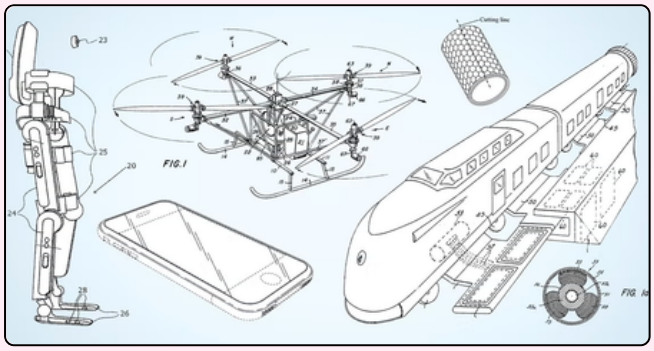
By: Students at VIT University, India

Description: A helmet that won't let the vehicle start unless it's worn, and alerts emergency services during accidents.

IP Status: Patent filed

Why it qualifies: Novel integration of IoT and safety tech — fits patentable criteria.

Some famous Patented Inventions that changed the World:



- Light Bulb
- Wright Brothers' Airplane
- iPhone Design
- Quadcopter Drone
- 3D Printer
- Global Positioning System (GPS)
- Bluetooth
- Self-Driving Car
- Virtual Reality

Final Thoughts

Ideas are powerful. They can solve problems, change lives, and even shape the future. But just like a treasure, they need to be protected wisely. Whether you're a student, a budding scientist, or a creative thinker, learning how to protect your ideas is the first step toward turning them into real-world success.

So dream big, create boldly, but protect your brilliance!

Indian Scientist

Raghunath Anant Mashelkar

Padma Bhushan (2000), Padma Vibhushan (2014)

Born on January 1, 1943

Have you ever tried to make something useful using simple, low-cost materials? That's exactly the kind of thinking Dr. Raghunath Anant Mashelkar has promoted throughout his scientific journey, making science work for everyone. This is what we want you to do in the Avishkar Awards too!

Career and Achievements

Dr. Mashelkar was born in a small town in Goa and faced many difficulties growing up. But he never gave up on learning. He studied chemical engineering and became one of India's most respected scientists. His field of research, polymer science, deals with materials like plastic, rubber and fibers that we use in everyday life.

One of Dr. Mashelkar's major contributions was in studying how thick liquids (like glue or paint) flow and react under different conditions. This helped industries improve how things like paints, shampoos and medicines are made. For example, thanks to such research, toothpaste can now come out smoothly from the tube but also stay firm on your brush!

Dr. Mashelkar also improved chemical reactor designs, such as bubble column reactors, which are important for making everyday products from plastics to medicines.

One of his big breakthroughs was in water purification. His research helped advance reverse osmosis membrane technology, making clean drinking water more accessible and affordable in India.

Contributions beyond Science

He led India's efforts to protect its traditional knowledge, like turmeric's healing power or neem's use as a pesticide. He helped stop foreign companies from patenting what India has known for centuries!

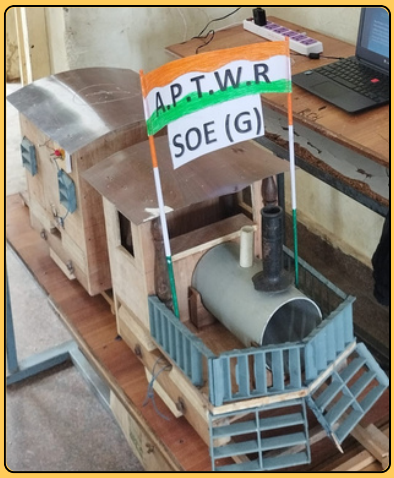
As the head of the Council of Scientific and Industrial Research (CSIR), he encouraged to create real solutions, like affordable medicines and simple tools for rural areas.

Dr. Mashelkar is also known for promoting **"Gandhian Engineering"**-finding ways to make *"More from less, for more people."* His legacy continues to inspire innovators to tackle challenges with cleverness and a deep commitment to societal benefit.

Gradient Doors for Train

The height difference between the train and the platform poses difficulties for physically challenged individuals, pregnant women, and kids. Carrying heavy luggage onto the train becomes difficult. Gradient doors are an economical solution for trains, equipped with ease-of-use controls, allowing passengers to request assistance if required. It is also very helpful during rush hours to streamline the boarding process.

Banavath Yuvajyothi Bai
10th Class

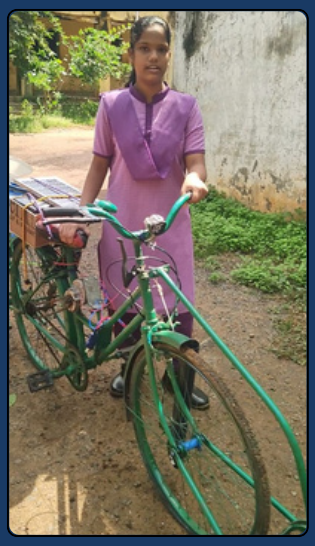


The gradient door can be implemented by using a CD drive mechanism or an automatic hydraulic pump mechanism. Whenever a station is reached, the passengers press the switch placed near them, or they are centrally controlled by the loco pilot. Once the switch is pressed, the door is opened slowly to avoid any accidents.

M Meenakshi
10th Class

(Source: GYS Avishkar Awards 2024Booklet)

Farmer's Friendly Bicycle



Farmer's friendly bicycle is aimed at enhancing the livelihood of farmers by allowing farmers to carry out multiple activities, including ploughing, seeding, weeding, watering, fertilising, spraying pesticides, and drying the grains from a single bicycle. This idea struck Supriya when her parents struggled to farm, as they could not afford high-cost agricultural equipment.

Avvaru Gowri Supriya
8th Class

A farmer's friendly bicycle can be used to carry out various agricultural work. As this runs on solar energy, it reduces the electricity charges to a large extent.

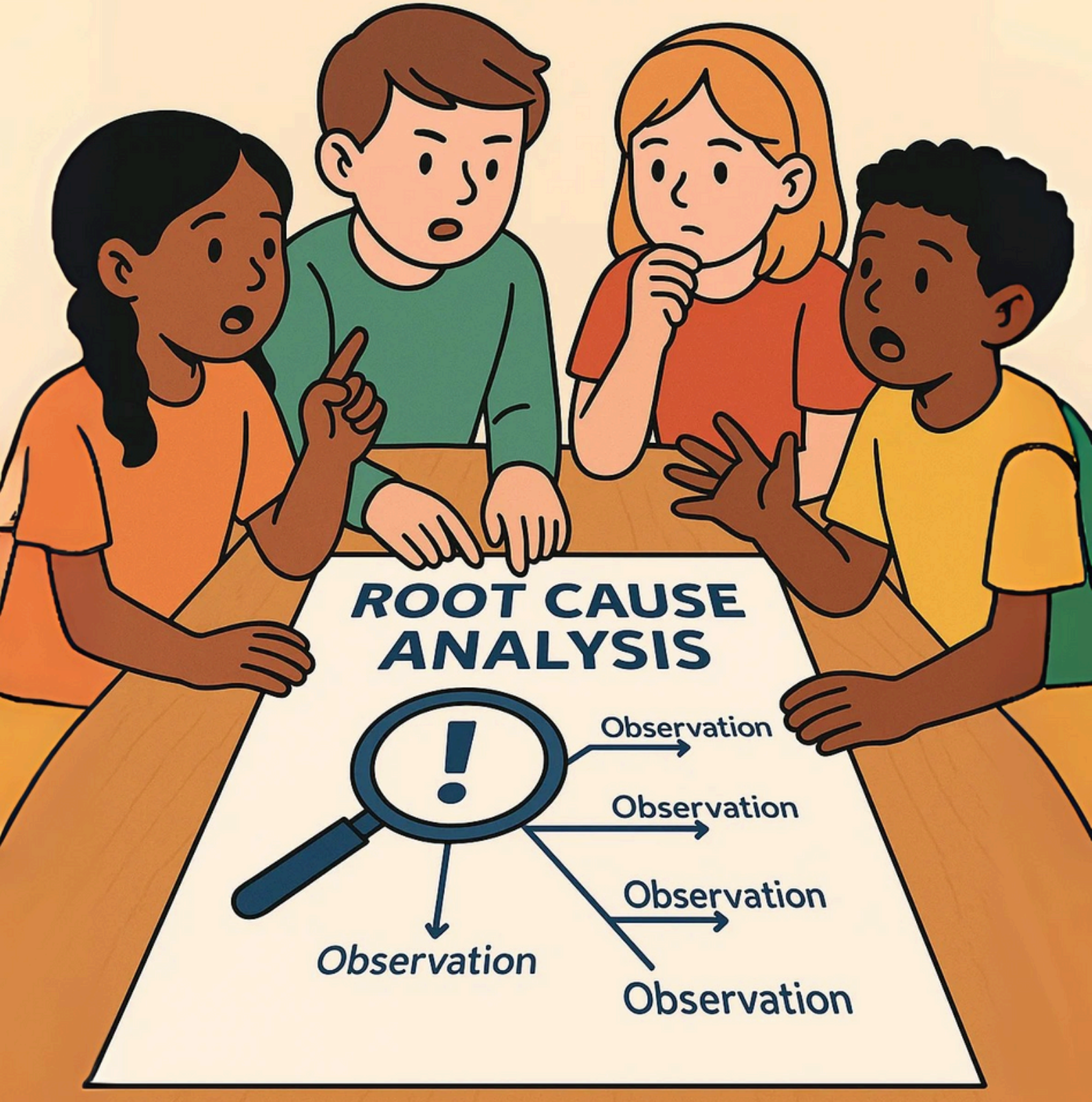
The materials used are motor, bicycle, old bicycle parts, light, batteries, solar panel, water can, rubber pipes, etc. Multiple attachments can be added to this bicycle to carry out most of the agricultural work. This is a portable and low-cost solution, greatly improving farmers' economic well-being.

(Source: GYS Avishkar Awards 2024 Booklet)

Innovation Training Module

Root Cause Analysis

Digging Deeper to Solve Problems



Introduction

National innovation programs like INSPIRE MANAK and GYS Avishkar Awards are not just looking for cool gadgets or clever models. They're searching for ideas that solve real-world problems, are socially relevant and can be scaled across the country.

But before we jump into making things, it's important to ask: Are we solving the right problem?

One powerful tool to do this is **Root Cause Analysis**, a simple step-by-step method that helps you find the actual reason behind a problem.

What Is Root Cause Analysis?

Root Cause Analysis (RCA) is a technique to identify the true cause of a problem, like a detective finding the real culprit.

This method helps you ask smart questions to reach the bottom of the issue, so your solution is not temporary but lasting and effective.

Why Use Root Cause Analysis?

- **Understand the Real Problem:** Avoid fixing symptoms and get to what's really wrong
- **Build Better Solutions:** Once you find the root, your idea becomes more effective
- **Think Scientifically:** Ask questions, analyse data and form strong conclusions
- **Innovate with Purpose:** Create ideas that matter to people
- **Solve Indian Challenges:** Use local thinking to solve local problems

When and Where Can You Use Root Cause Analysis?

You can use RCA in many real-life situations

- In Schools: Why is student attendance low in government schools?
- In Villages: Why does the hand pump in a drought-prone area stop working?
- In Cities: Why are garbage bins always overflowing in a colony?
- In Environment Projects: Why are plantation drives failing despite planting thousands of trees?
- In Road Safety Projects: Why do children in your area avoid using the zebra crossing?

Wherever something is going wrong, RCA can help make it right.

How to Use Root Cause Analysis?

Let's break it down into steps you can use in your projects.

Step 1: Identify the Problem. Describe it clearly.
Example: "Our model to collect rainwater is not working."

Step 2: Ask "Why" Five Times

Use the 5 Whys method to dig deep.

Why is it not working? The water overflows quickly.

Why? The tank fills too fast.

Why? The pipe diameter is too wide.

Why? We didn't measure rainfall intensity.

Why? We copied the design from a different region.

Root Cause: The model wasn't suited for local rainfall conditions.

Step 3: Observe and Record

Check your model. Talk to users. Collect data.

Step 4: Fix the Root Cause

Redesign your solution based on what you found.

Let's Explore Through Indian Case Studies

Case Study 1

Solar Lamps in Rural Maharashtra

Problem: Students in Palghar district were given solar lamps for night study. But many stopped using them within a month.

A student team investigated using RCA

Why did students stop using the lamps? – They stopped working.

Why? The battery died.

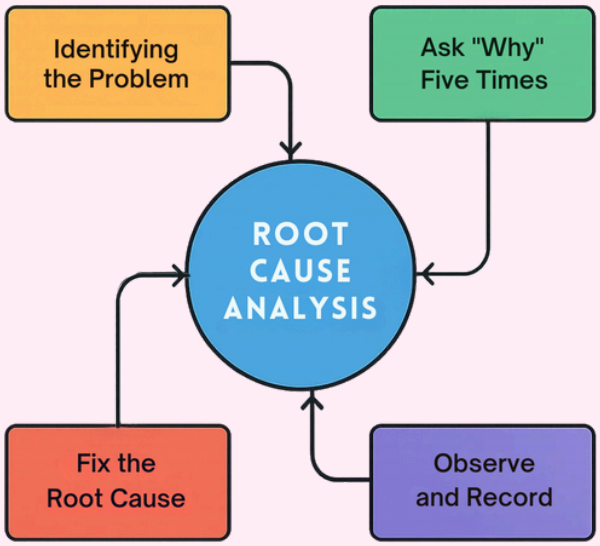
Why? It wasn't charged.

Why? The solar panel didn't face the sun.

Why? The design didn't allow rotation.

Root Cause: Fixed panel position made charging ineffective.

Innovation Outcome: Students added a 360-degree rotatable base for better sun exposure. The improved design won them a state-level award.



Case Study 2

Dirty Water in a Pond (Tamil Nadu)

Problem: A pond near Madurai turned green and smelly even though it was cleaned last year.

Local students used RCA to explore:

Why is the pond dirty again? – Algae is growing rapidly.

Why? There's too much sewage in it.

Why? Drains from nearby homes connect to it.

Why? There's no sewage treatment system.

Why? Families aren't aware of the danger.

Root Cause: Lack of awareness and absence of treatment systems.

Innovation Outcome: Students designed a basic floating wetland using old bottles and native plants to clean the water naturally. It was implemented with the Panchayat's help.

Case Study 3

The School Attendance Drop in Bihar

Problem: A school in Araria saw a major drop in Class 6-8 attendance during the winter months.

Students used RCA to investigate

Why do students skip school? - It's too cold.

Why don't they wear warm clothes? - They don't have them.

Why? Families can't afford them.

Why not? Seasonal jobs reduce income in the winter.

Root Cause: Economic hardship during winter months.

Innovation Outcome: Students proposed a community sweater bank using donated woollens and initiated awareness through wall posters and skits. Attendance improved significantly.

Try the 5 Whys Challenge!

Choose a real problem you've noticed—maybe your school's water cooler is always leaking or your village bus stop is always dirty.

Ask "why" five times and go as deep as you can. Then brainstorm a solution.

Tips to Use Root Cause Analysis

- Draw it out - Use flowcharts or a "cause and effect" fishbone diagram
- Look carefully - Observe before jumping to conclusions
- Work with your community - They may have insights you don't
- Don't stop at one answer - Go deeper than the obvious
- Use your phone - Record changes, patterns or interviews as part of your RCA process

Conclusion

Real Problems Need Real Thinking

Great innovations aren't just shiny or smart, they're rooted in real problems. Root Cause Analysis helps you think like a scientist, act like an engineer and innovate like a changemaker. So next time you see a broken swing, a water shortage or an idea that just won't work, don't just patch it up.

Ask WHY! Then solve it.

That's how innovators are born.

Sudoku Challenge 2504

3	8		9			2		5
					8	7	3	
	6		3			9	8	
					3	5		1
9	1		5		7		2	3
7		3	1					
	3	5			1		9	
	7	4	6					
8		1			2		6	7

Solutions are on Inside Back Cover.

Indian Invention

Candied Sugar

A Sweet Invention from Ancient India That Still Shines Today

India's contributions to the world span many fields—mathematics, medicine, astronomy, architecture—but one of its sweetest and most enduring innovations is often overlooked: candied sugar, known to many as mishri or kalakand.

When and How?

Believed to have been developed during the Gupta dynasty (circa 4th to 6th century CE), candied sugar was a product of India's golden age of science and culture.

During this time, Indian food scientists were exploring how to preserve and transform sugarcane juice. Through repeated boiling and cooling, they discovered how to create large, clear crystals of sugar—a form that was more stable, easier to store, and more versatile than liquid sweeteners.

This was such a remarkable breakthrough in food technology that Buddhist monks carried it from India to China, where it later spread through trade and travel to the rest of the world.

Significant Properties

- Preservation and storage: Unlike jaggery or syrups, candied sugar could be stored for long periods without spoiling.
- Culinary versatility: It enhanced sweets, drinks and even savoury dishes, balancing sharp spices and acidic ingredients.
- Medicinal applications: In Ayurveda, mishri is used to cool the body, soothe the throat, and deliver herbal medicines in a palatable form.
- Cultural significance: It became a staple in temple offerings, post-meal mouth fresheners, and festive foods.

How is it made?

The process of making candied sugar involves boiling sugar syrup to the hard-crack stage, allowing it to cool and crystallise. These crystals can then be used in various forms—whole, powdered, or as coatings.

More than a culinary item, candied sugar is an example of how early Indian innovators transformed a natural resource into something with lasting cultural, scientific, and practical value. Its continued use in Indian homes, temples, and traditional medicine shows how relevant ancient innovations remain today.

Defence Research and Development Organisation (DRDO)

Ever wondered who designs those awesome missiles you see in the news, or the cutting-edge tech that keeps our brave soldiers safe? Meet DRDO, the Defence Research and Development Organisation. India's very own science superheroes! From drones and missiles to AI systems and life-saving gear for jawans, DRDO does it all!

What is DRDO?

Born in 1958, this incredible Indian organization, envisioned by Jawaharlal Nehru, is like a super-smart science club and high-tech workshop rolled into one. Its scientists, part of the elite Defence Research & Development Service (DRDS), are true patriots—combining science and love for the country. DRDO is the country's largest and most diverse science team, working under the Ministry of Defence to make sure our soldiers have the best technology. Living by their powerful motto, "*Strength's Origin is in Science*," they're busy building a self-reliant India.

Who are they?

- A massive network of over 50 labs across India.
- Home to roughly 5,000 elite scientists (DRDS) and 25,000 dedicated staff.
- Specialized in areas like:
  - Missile Systems
  - Aeronautics (think aircraft!)
  - Armaments (like the Arjun Tank)
  - Naval Systems
  - Life Sciences (yes, even soldier nutrition!)

What do they do?

DRDO designs and develops cutting-edge defence systems to make India less dependent on foreign suppliers. They're constantly innovating, recently even testing hypersonic missile technology! Committees are also working to make them even more efficient.

Their "Hall of Fame" Achievements

- Integrated Guided Missile Development Programme (IGMDP): This brought us game-changers like **Prithvi, Agni, Akash, and Nag missiles!**
- **BrahMos Missile**: One of the world's fastest supersonic cruise missiles.
- **Tejas**: India's very own Light Combat Aircraft.
- COVID-19 Response: They even developed ventilators and the 2-DG drug during the pandemic!

DRDO is where science meets patriotism, creating a stronger, safer India!

Raman Effect

How an Indian Scientist Discovered the Invisible

Have you ever seen sunlight streaming through your classroom window and wondered why the dust in the air seems to sparkle? Or why the sky is blue, the ocean looks deep, and soap bubbles shine with all the colours of the rainbow?

These aren't just beautiful sights, they're clues to something much deeper. And one Indian scientist followed those clues so brilliantly that his discovery changed the world.

That scientist was Dr. C.V. Raman, and the amazing idea he discovered is called the **Raman Effect**.

This wasn't just any discovery, it helped us "see" what our eyes cannot. It told us what molecules are doing inside everything around us, from flowers to fingerprints to cancer cells.

And guess what? He discovered it right here in India.

So, what is the Raman Effect, really?

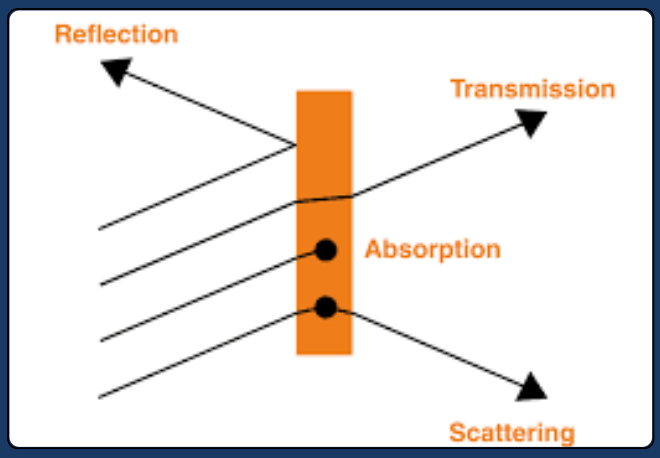
Let's imagine you shine a torchlight through a glass of water.

Most of that light will pass straight through, or bounce off in the same direction and colour. That's called Rayleigh scattering, boring and predictable.

But here's the twist: a tiny bit of that light behaves differently.

It bumps into molecules and changes its energy, like a ball hitting a wall and bouncing back slower or faster. That's the Raman Effect, when light interacts with matter and comes out slightly changed.

And that tiny change? It gives us huge clues about what's inside the material. Every molecule has its own unique "light bounce" pattern, like a fingerprint made of light.



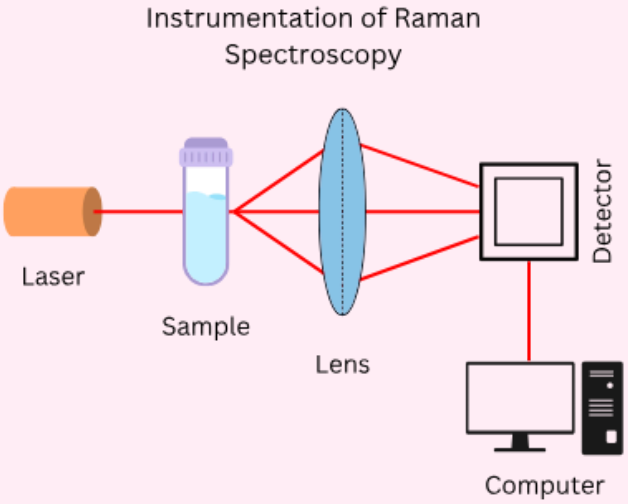
Let's break the science down

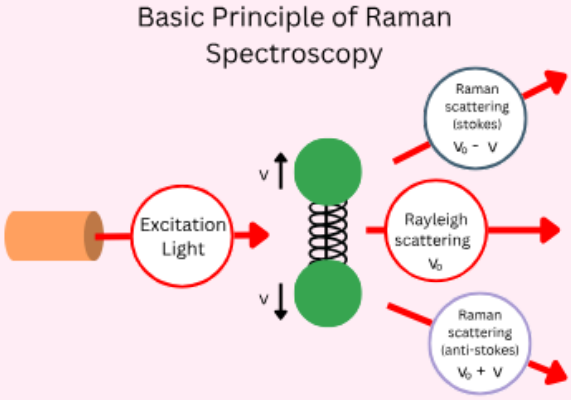
Here's how the Raman Effect works in simpler terms:

- **Inelastic Scattering:** Some light particles (called photons) bump into molecules and either lose energy (Stokes shift) or gain energy (Anti-Stokes shift).
- **Raman Spectrum:** Scientists use machines to capture these energy shifts and turn them into colorful graphs that tell us what molecules are doing inside.

- **Vibrational Modes:** These energy changes match how molecules vibrate or move, and that's how we learn what they're made of.

This is called Raman spectroscopy, and it's like X-ray vision, but using light instead of rays.





But how did Raman discover it?

In 1921, Dr. Raman was sailing back from England and staring at the deep blue sea. He wondered, "Why is the ocean blue?" Everyone else said, "Because it reflects the sky." But Raman wasn't satisfied with that answer.

Back in his lab in Kolkata, he used sunlight, coloured filters, a prism, and some clever setups to study how light behaved in water and other materials. And in 1928, he discovered a new kind of light scattering.

He didn't have fancy machines. He didn't have global funding. What he did have was curiosity, and that changed science forever.

In 1930, Dr. Raman became **the first Asian and the first Indian to win the Nobel Prize** in Physics. And India beamed with pride.

Where is the Raman Effect used today?

You'd be amazed how much of the modern world uses Raman's discovery. Here are some ways:

1. Medicine

- Detecting cancer cells without cutting open the body.
- Studying tissues, DNA, and blood, all using light!

2. Forensic Science

- Solving crimes by analysing tiny samples of hair, ink, paint or powder.

3. Environmental Science

- Finding pollutants in rivers, checking for pesticides in vegetables, or spotting microplastics in the ocean.

4. Art and History

- Helping archaeologists study ancient paintings and artefacts, without damaging them.

5. Factories and Science Labs

- Checking if a medicine is real or fake.
- Controlling the purity of materials used in electronics, like your phone.

6. Space Research

- Yes! Even Mars rovers use Raman tools to study rocks on other planets.

Why is this so cool for young scientists like you?

- You don't have to break anything to study it. Raman spectroscopy is non-destructive.
- It works like a molecular fingerprint scanner.
- It's used in every field: biology, chemistry, medicine, materials, and even textiles!

Imagine this: your school science project on turmeric could include Raman data showing its chemical composition!

Celebrating India's Legacy

Dr. Raman's discovery was so iconic that **February 28**, the day he discovered the Raman Effect, is now celebrated as **National Science Day** across India.

Schools hold exhibitions, debates, experiments, and science fairs. And you, yes, you too can participate and showcase your own scientific ideas.

From your classroom to the cosmos

The Raman Effect proves that even with simple tools, a curious mind can uncover the deepest secrets of the universe.

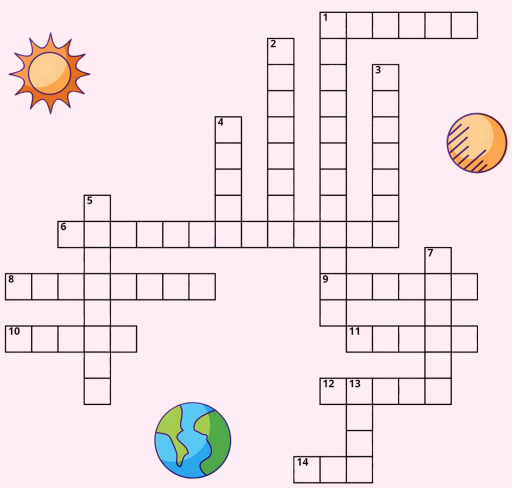
So next time you shine a light through a prism or wonder why the sky is blue, remember Dr. Raman, and know that science is for everyone who dares to ask, "Why?"

Maybe someday, a science fair idea from your school notebook could become the next Nobel-worthy discovery. Raman did it. And so can you.

Word Search 2504

SOLAR ECLIPSE

Solve the following puzzle based on the clues given!



Solutions are on Inside Back Cover.

Across

[1] Alignment of the sun, moon, and earth during a solar eclipse
[6] What is another name for a group of stars?
[8] Time a solar eclipse is visible from a specific location on earth
[9] The moon causes a _____during a total eclipse.
[10] What month in 2024 will the total solar eclipse occur during?
[11] What constellation is famous for its belt of three stars?
[12] Darkest part of the moon's shadow during a total solar eclipse
[14] Don't look directly at this without special glasses

Down

[1] Celestial event where the moon passes between the sun and the earth (2 words)
[2] Outer part of the moon's shadow during a solar eclipse
[3] Phase of the moon necessary for a solar eclipse to occur (2 words)
[4] Type of solar eclipse that occurs when the moon completely covers the sun
[5] A phenomenon that occurs when the sun is completely covered during a solar eclipse
[7] Glowing halo of plasma visible around the sun during a total solar eclipse
[13] A body that goes around the Earth

Reduced CO_2 Emissions from Industries

Industrial CO_2 emissions contribute to global warming, the melting of ice glaciers, and a rise in sea level, threatening life on Earth. Kruthi's project aims to control CO_2 emissions from industries to reduce these impacts.

When flue gases containing CO_2 are let pass through a chamber containing a fine mist of lime water, the unburnt carbon particles in the form of carbon dioxide react with lime water to form calcium carbonate. The calcium carbonate formed gets trapped as it is wet and settles in the chamber itself.

Kruthi
9th Class

Chemical Equation

$Ca(OH)_2 + CO_2 , \rightarrow CaCO_3 , + H_2O$

This results in lesser CO_2 emissions and eventual control of air pollution and global warming. Additionally, the calcium carbonate formed during the reaction can be utilized in the cement and fertilizer industries.

(Source: INSPIRE MANAK NLEPC 2012 Booklet)

Safety Attachment for Sewing Machine

Soumya's idea focuses on developing a safeguard to prevent minor finger injuries while operating a sewing machine. The solution requires only a sewing machine, a screwdriver, and steel wire. To create and install the safety guard, the steel wire is bent and shaped to form a protective barrier. This guard is then mounted near the pressure foot of the sewing machine using a screw and screwdriver.

Soumya Ranjan Singh
8th Class

The working mechanism is simple yet highly effective; it ensures that the operator's fingers remain safely away from the moving needle, significantly reducing the risk of injury.

This practical and low-cost safety enhancement helps sewers operate the machine with greater confidence and peace of mind, knowing their fingers are well protected from potential accidents.

(Source: INSPIRE MANAK NLEPC 2023 Booklet)

NAL - National Aerospace Laboratories

Get ready to explore the fascinating world of the National Aerospace Laboratories (NAL)! Established in 1959 and headquartered in Bengaluru, NAL is India's leading institution dedicated to pushing the boundaries of flight and space exploration. Operating under the Council of Scientific and Industrial Research (CSIR), NAL is at the forefront of aerospace research, making sure India's aviation and space ambitions truly soar!

NAL's Mission: Reaching for the Skies!

NAL's core goal is to make India a leader in aerospace. They focus on:

- **Indigenous Aircraft Development:** Designing Indian-made civil aircraft like the SARAS Mk2 light transport plane and HANSA-NG trainer.
- **Cutting-Edge Research:** Innovating in advanced materials (think lightweight composites for Tejas!) and aerodynamics, including supersonic & hypersonic testing vital for jets and space missions.
- **Industry Support:** Providing crucial R&D, testing (like their world-class wind tunnels), and consultancy to giants like ISRO, HAL, and DRDO, and even private firms

Achievements that Fly High!

NAL's impact is immense

- Aircraft: Developed SARAS Mk2, HANSA-NG, and proposed the 90-seater Regional Transport Aircraft (RTA-90).
- Smart Tech: Their Drishti System ensures safe landings at major Indian airports by measuring visibility! They also design UAVs for surveillance and disaster management.
- Space & Defence: Supported ISRO's Chandrayaan & Gaganyaan missions and DRDO's hypersonic vehicle research through aerodynamic testing.

NAL is truly driving India's aerospace future, making our nation self-reliant and technologically advanced!

Indian Scientist

Kalpathi Ramakrishna Ramanathan

Padma Bhushan (1965) and Padma Vibhushan (1976)

28 February 1893 – 31 December 1984

Introduction

Kalpathi Ramakrishna Ramanathan was an Indian physicist and meteorologist known for his contributions to atmospheric sciences and radio astronomy. He was the first director of the Physical Research Laboratory (PRL), Ahmedabad, and played a key role in India's space and meteorological research.

Career and Achievements

One of his most well-known contributions is the **Ramanathan Effect**. Have you ever noticed how the sky looks blue during the day and turns red during sunset? This is because of how sunlight scatters when it passes through air. Ramanathan studied this phenomenon and discovered how particles like water vapour and dust affect radiation. This helped scientists understand how Earth heats and cools, which is very important in predicting the monsoon and climate change

Ramanathan was also called "Mr. Ozone" because of his pioneering research on the ozone layer. He used balloons to study the ozone layer. He used balloons to study ozone and ultraviolet (UV) radiation in the upper atmosphere, long before satellites existed. His findings showed how ozone protects us from harmful UV rays and how its behaviour affects weather patterns

He worked on solar and terrestrial radiation, created the first rainfall map of Travancore, and improved our understanding of monsoon systems. As Director of the India Meteorological Department, he trained Air Force officers and helped modernise weather forecasting in India.

Contributions in Space Research

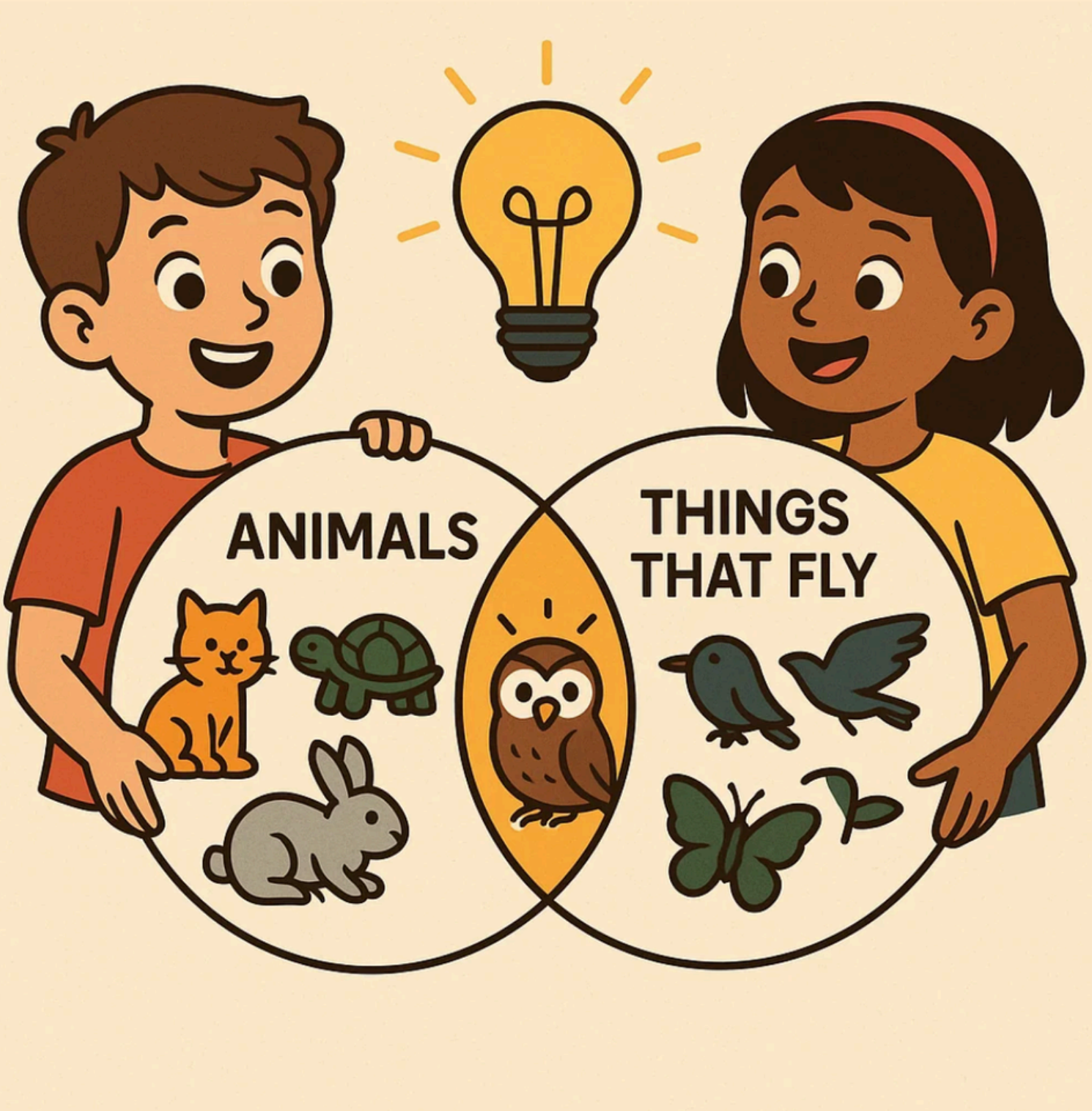
He helped develop the Thumba Equatorial Rocket Launch Station and worked closely with scientists like Homi Bhabha and Vikram Sarabhai. As the founding director of the Physical Research Laboratory (PRL) in Ahmedabad, he laid the foundation for India's journey into space science.

Ramanathan's life shows that science is not just about labs and formulas. It's about curiosity, asking questions about what we see in the world, and using that knowledge to improve lives. Whether it's a school weather project or a question about space, students like you can be the next big innovator, just like him.

Innovation Training Module

Venn Diagrams

Where Insights Intersect to Ignite Innovation



Introduction

Before jumping into your next big idea, take a moment to think differently. What if innovation comes from combining things that don't usually go together? That's where Venn Diagrams come in!

These overlapping circles aren't just for math, they're creative thinking tools. They help you spot hidden connections, spark fresh ideas, and find that sweet spot where imagination meets real-world impact. Whether you're exploring science, tech, environment, or daily-life problems, Venn Diagrams help you mix and match ideas in exciting new ways.

Now, let's learn how to use them to power up your innovation journey.

What Is a Venn Diagram?

At its heart, a Venn Diagram is a visual way to understand how different things relate to each other. Each circle in a Venn Diagram represents a "set" of items or ideas. Where the circles overlap, that's where the magic happens. It shows what those sets have in common.

For example

- One circle = Fruits → Apple, Banana, Grapes
- Another circle = Things that are Red → Fire Trucks, Roses, Strawberries
- The Overlap = Apple and Strawberry → Because they are both fruits and red

Simple? Yes. But this very simplicity makes Venn Diagrams one of the most powerful tools in innovation thinking.

Why do you need to use Venn Diagrams?

Venn Diagrams help you build smart, new ideas in multiple situations. Here's how:

- **Spotting Connections:** Discover overlaps between ideas or problems you didn't realise were related.
- **Generating New Ideas:** The overlap zone can show fresh combinations that lead to unique solutions.
- **Organising Complex Information:** When your ideas get messy, Venn Diagrams simplify them into clear visual chunks.
- **Problem Solving:** They help identify common problems or root causes across different scenarios.
- **Targeting Solutions:** You can tailor your innovation to address multiple needs at once.

When and Where Can You Use Venn Diagrams?

You can use Venn Diagrams at almost any stage of your innovation process.

- While Brainstorming: Mix unusual ideas and spark inventions
- For Community Projects: Compare local needs and design better solutions
- To Improve Products: Combine features for better tools (e.g. smart bags!)
- During Science Projects: Understand how different elements interact
- When Researching Users: See what different people really want and need

How to Use a Venn Diagram

Step 1: Choose two or more sets to compare

Step 2: Draw overlapping circles (2 or more)

Step 3: List unique items outside the overlaps

Step 4: List shared features in the overlaps

Step 5: Look at the overlaps → That's your innovation zone

Let's Explore Through Case Studies

Case Study 1: Smart Safety Stick

Problem: Elderly people face risks while walking alone.

Venn Circles:

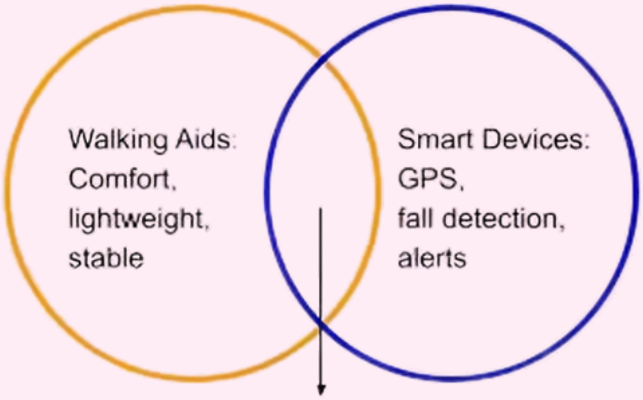
🟠 Walking Aids – Comfort, lightweight, stable
🔵 Smart Devices – GPS, fall detection, alerts

Overlap Idea:

A smart stick that tracks movement, senses falls, and alerts family members.

Innovation Outcome:

Students in Telangana created a smart safety stick with sensors and alert systems. It gained appreciation at a district-level innovation showcase.



A smart stick that tracks movement, senses falls and alerts family members.

Case Study 2: Eco-Friendly Delivery

Problem: City deliveries contribute to pollution.

Venn Circles:

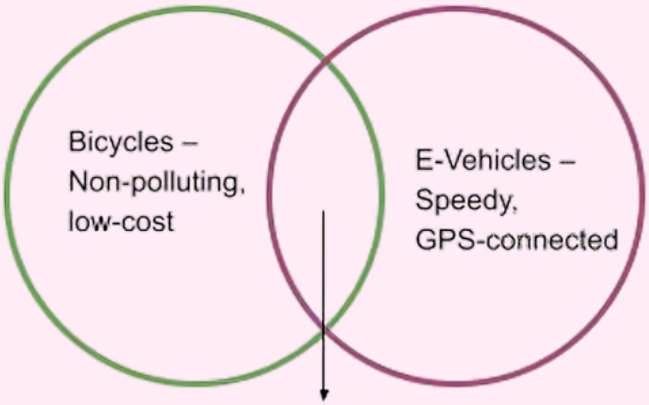
🟢 Bicycles – Non-polluting, low-cost
🔴 E-Vehicles – Speedy, GPS-connected

Overlap Idea:

A solar-powered cycle for local deliveries—eco-friendly and app-enabled.

Innovation Outcome:

A student team in Bengaluru developed a working prototype for a solar delivery cycle.



A solar-powered cycle for local deliveries—eco-friendly and app-enabled

Case Study 3: Smart School Bags

Let's go beyond 2 circles now!

Problem: Students forget schedules, stay unsafe on roads and don't drink water on time.

Venn Circles:

- School Bags – Spacious, easy to carry
- Safety Gear – Reflectors, GPS
- EdTech Tools – Alerts, hydration reminders

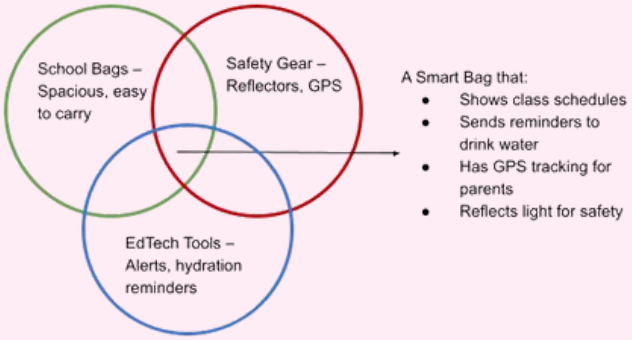
Innovation Zone:

A Smart Bag that:

- Shows class schedules
- Sends reminders to drink water
- Has GPS tracking for parents
- Reflects light for safety

Innovation Outcome

Pune-based students designed this using recycled bags and basic electronic parts. It was selected for mentoring under a state-level student innovation lab.



The Circle Combo Challenge

Try this simple activity

1. Pick any 3 items from your room.
2. Draw 3 overlapping circles.
3. List features for each item in their own circles.
4. Find the overlapping idea.
5. Invent something new!

Example:

- Pen
- Torch
- Keychain

Innovation Idea

A multi-purpose rescue pen – writes, lights up, and clips onto your backpack. Perfect for emergencies or travel!

Conclusion

"Let Your Circles Spark Change"

Whether you're solving a small local issue or working on a national-level innovation, Venn Diagrams help you think deeper and smarter. They help:

- Compare clearly
- Connect creatively
- Combine ideas to solve real problems

So the next time you're exploring an idea, draw some circles first!

World Creativity and Innovation Day - April 21

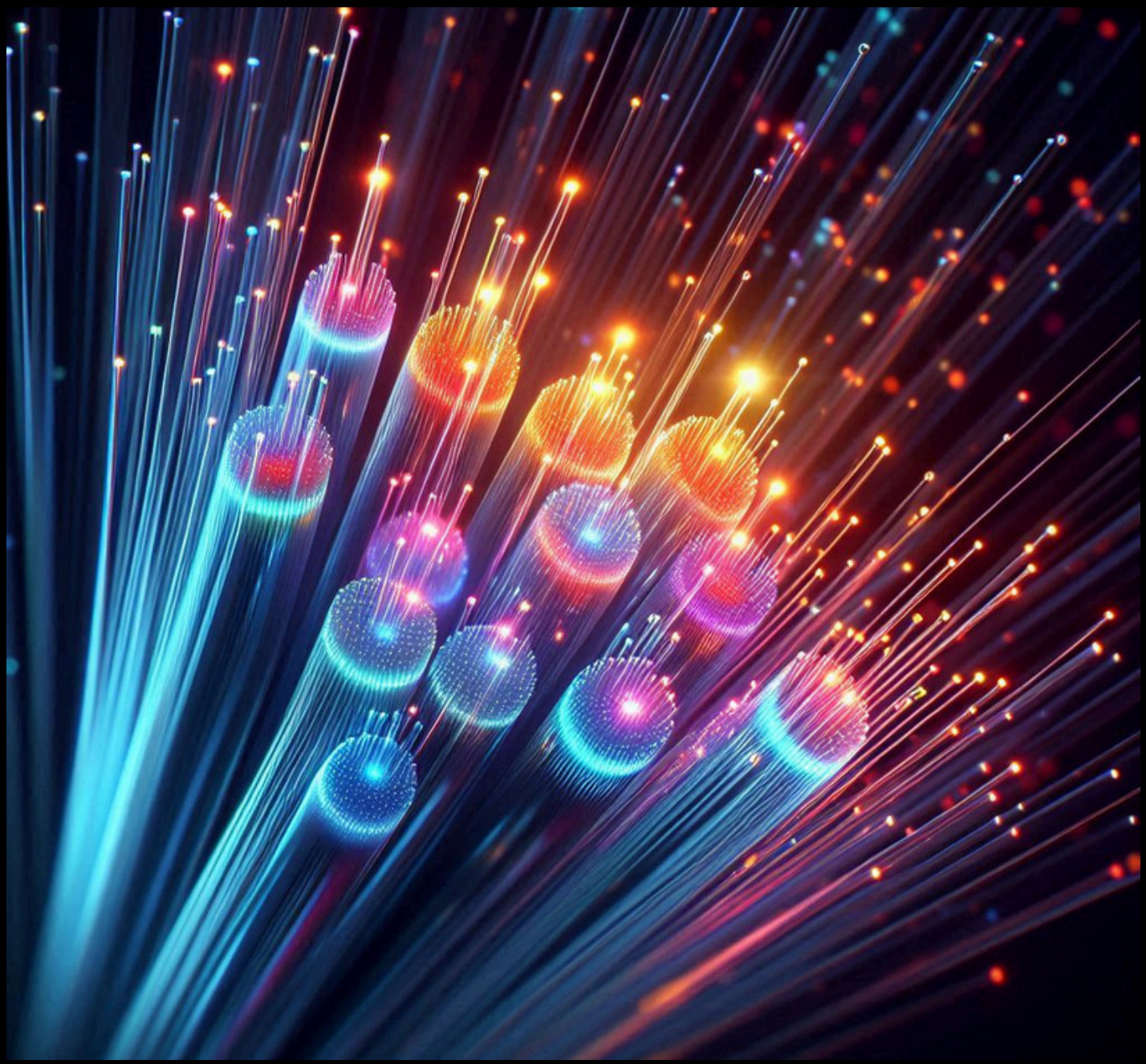
World Creativity and Innovation Day was officially recognized by the **United Nations** in 2017. The date **April 21** was chosen to coincide with the birthday of **Leonardo da Vinci,** one of history's most creative minds, known for his contributions to art, science, engineering, and design.

The day reminds us that **every person has the ability to be creative** and that innovation is not just for scientists or inventors—it can come from anyone, anywhere.

Indian Invention

Fiber optics

Lighting the Way: The Indian Innovation of Fiber Optics



Have you ever wondered how a video call connects you instantly to your cousin in another city? Or how you can stream high-definition movies without any lag? Behind all this magic is a powerful invention called fiber optics—a technology that uses light to send information at lightning speed.

But here's something you should be really proud of: this revolutionary innovation was pioneered by an Indian-born scientist—Dr. Narinder Singh Kapany. Often called the Father of Fiber Optics, Dr. Kapany's experiments in the 1950s laid the foundation for how we use the internet, mobile networks, and even advanced medical machines today.

Let's explore how this Indian innovation is shaping the world—and how it could inspire you to become the next science changemaker!

What is Fiber Optics?

Fiber optics is a way of sending information (like videos, phone calls or pictures) as pulses of light through thin strands of glass or plastic called optical fibers. These fibers are so thin, they're about the size of a human hair!

Each fiber is like a tube that carries light from one end to another. And since light travels very fast, fiber optics helps send information much quicker than normal wires made of copper.

Imagine sending your science project to a national competition instantly—that's fiber optics at work!

How Does It Work?

Fiber optics is based on a cool science trick called total internal reflection. Here's a simple way to understand it.

Have you ever shone a torch into a glass of water and seen the light bounce inside? Fiber optics does something similar. It traps the light inside the fiber, making it bounce all the way through until it reaches the other end.

Each optical fiber has three layers:

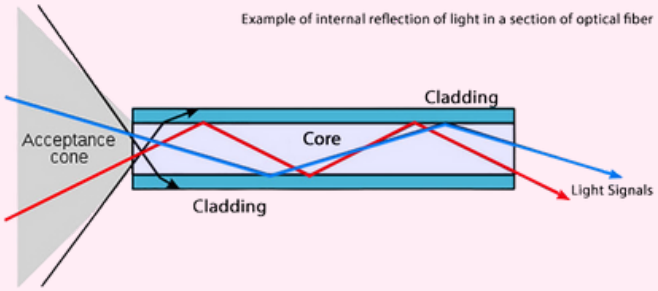
- **Core:** The center where light travels.
- **Cladding:** A layer that keeps the light from escaping.
- **Coating:** A protective layer that keeps the fiber safe from damage.

To send data:

- A laser or LED turns data into tiny light pulses.
- These light pulses travel through the fiber without losing speed or strength.
- Optical amplifiers help boost the signal if it's going a long way—like from Chennai to Delhi!

Each fiber is like a tube that carries light from one end to another. And since light travels very fast, fiber optics helps send information much quicker than normal wires made of copper.

Imagine sending your science project to a national competition instantly—that's fiber optics at work!



Types of Fiber Optic Cables

There are two types students should know:

- **Single-Mode Fiber:** Sends one light beam straight through a tiny core. It's used for long-distance communication like undersea internet cables.
- **Multi-Mode Fiber:** Sends many beams of light at once through a bigger core. It's used in schools, offices, and buildings for short-distance connections.

Where is Fiber Optics Used?

Here are real-life examples students like you can relate to...

1. Telecommunication & Internet

Fiber optics powers the internet in Indian homes, schools and mobile towers. Ever noticed the Jio Fiber or BSNL FTTH connections? That's fiber optics!

2. Medical Field

Doctors use fiber-optic cameras during surgeries to see inside the body without cutting much—like in endoscopy. It helps save lives with minimal pain.

3. Data Centres

Giant companies like ISRO, Google India and even India Stack use fiber optics to move data quickly across their computers and storage systems.

4. Defence and Security

India's armed forces use fiber optics for secure and fast communication, especially in remote border areas where copper wires won't work.

5. Broadcasting

TV channels like Doordarshan and streaming platforms like Hotstar use fiber optics to send live shows and cricket matches in real time.

6. Smart Cities

Indian smart cities like Pune, Ahmedabad and Visakhapatnam are using fiber optics to connect traffic lights, CCTV cameras, and public Wi-Fi.

Why Is It a Great Innovation?

- Superfast Internet: You can download entire books or videos in seconds.
- Reliable Communication: Fewer dropped calls and clearer sound.
- High Bandwidth: Multiple students can use Wi-Fi in class without slowdowns.
- No Interference: Fiber optics is safe from electrical noise, unlike copper.
- More Secure: It's harder for hackers to steal data

Challenges to Overcome

Even though fiber optics is amazing, it has a few problems:

- Installation Cost: Laying fiber cables underground or in buildings can be expensive.
- Delicate Material: The fibers can break if bent or pulled.
- Switching Over: Replacing old copper wires with fiber takes time and planning.

But scientists and engineers are finding cheaper and stronger solutions every day—something that you might invent one day!

The Future is Bright (and Light-Filled!)

The next big thing in fiber optics is multi-core fibers—cables that can send even more data at once. Scientists in India are also exploring green fiber optic networks that use less electricity and cost less to run.

With Digital India, 5G, and smart classrooms, fiber optics will soon reach every corner of the country—even in remote villages. That means more students like you can access online science labs, coding classes, and competitions.

Dr. Narinder Singh Kapany

An Indian Legacy to Be Proud Of

Dr. Narinder Singh Kapany, who studied in Punjab and later worked in the US, always believed that light could be bent—and he proved it! He not only changed science but opened a path for future Indian innovators.

So next time you stream a video, attend an online class, or research a science project—remember that it's possible because of an Indian who dreamed big.

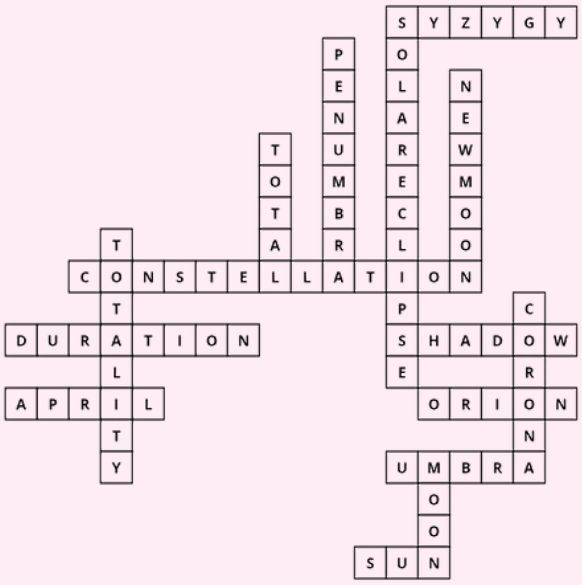
And maybe one day, you'll invent something just as powerful. Keep asking questions. Keep experimenting. Keep believing in your ideas.

Key for Brain Teasers

Solution
Sudoku Challenge 2504

3	8	7	9	6	4	2	1	5
5	4	9	2	1	8	7	3	6
1	6	2	3	7	5	9	8	4
4	2	6	8	9	3	5	7	1
9	1	8	5	4	7	6	2	3
7	5	3	1	2	6	8	4	9
6	3	5	7	8	1	4	9	2
2	7	4	6	3	9	1	5	8
8	9	1	4	5	2	3	6	7

Solution
Word Search 2504



Riddle 2504 Answers: **1. Teeth** **2. Your fingers** **3. Puppies** **4. Your breath**

Innovation Quotes

Innovation is seeing what everybody has seen and thinking what nobody has thought.

Don't wait for the right opportunity. Create it.

Creativity is thinking up new things. Innovation is doing new things.

When you fall off your bike, you learn balance. When You Fail in Science, you learn innovation.

Innovation Treasure Hunt Activity

How to Play: Place clues about famous inventions, inventors, or science terms around the school.

Students follow hints and complete short tasks (like naming who invented electricity or building a paper bridge).

Encourages: Exploration, curiosity, collaboration.

Science & Innovation Competitions to Watch

inspire — अभिप्रेरित अनुसंधान के लिए विज्ञान खोज में नवोन्मेष — Innovation in Science Pursuit for Inspired Research

NATIONAL CHILDREN'S SCIENCE CONGRESS

GYS Avishkar AWARDS 2025

VIGYAN MANTHAN — SCIENCE TALENT SEARCH — INDIA'S LARGEST SCIENCE TALENT SEARCH FOR NEW INDIA USING DIGITAL DEVICES

GYS Avishkar AWARDS 2025

A National Science Projects Competition

Theme: Low Cost Grassroots Innovation

Mode: Online Video Submission (3 to 7 mins)

Eligibility: Students from Classes 6 to 12

Winners: Certificates, Trophies, Cash Prizes

Attention: Guide Teachers are Rewarded

Rs. 1,00,000
One Lakh
Rupees
Cash Prizes

1 ₹ 20,000 for Student
₹10,000 for Guide Teacher

2 ₹ 15,000 for Student
₹10,000 for Guide Teacher

3 ₹ 10,000 for Student
₹10,000 for Guide Teacher

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