



# Integrating AI and Tinkering with Pedagogy (AIoT)





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# Acknowledgement

Sincere gratitude to **Mr. Parameswaran Iyer**, CEO, NITI Aayog and **Ms. Nidhi Chhibber**, IAS, Chairperson, Central Board of Secondary Education for the launch of this compendium on the occasion of the showcase of Integrating AI and Tinkering with Pedagogy (AIoT) on Tuesday, January 24, 2023.

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# MESSAGE



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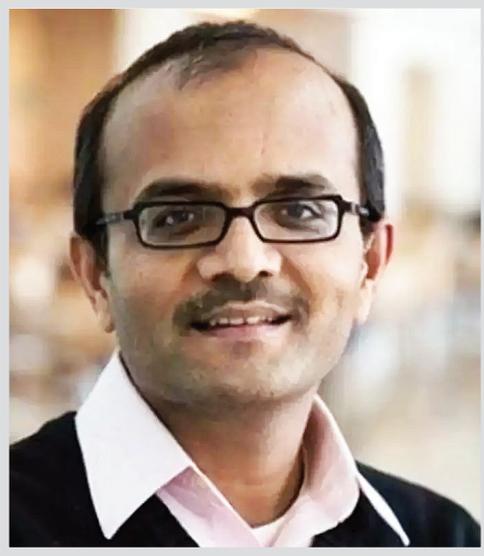
Chairperson  
Central Board of Secondary Education

CBSE envisions a robust, vibrant, and holistic school education that will engender excellence in every sphere of human endeavour. It works towards evolving a learning process and environment, which empowers future citizens to become global leaders in the emerging knowledge society. With this guiding principle in sight, we have partnered with Atal Innovation Mission, NITI Aayog, and Intel India and launched the 'AIoT Integration in Curriculum' program.

By integrating AI and Tinkering, we aim to develop the learner's mindset and skill set towards leveraging AI through experiential learning methods to create social impact. We hope that this Compendium inspires teachers to build upon the lessons shared and innovate teaching-learning practices using AIoT to deliver enhanced learning outcomes for students.

I congratulate all the schools and educators who have contributed to this effort which will boost India's readiness for a digital economy. I am thankful to Dr. Chintan Vaishnav, Mission Director, Atal Innovation Mission, NITI Aayog, and Ms. Shweta Khurana, Senior Director, Asia Pacific Japan, Government Partnerships & Initiatives, Global Government Affairs Group, Intel, for providing the right direction to this effort. I would also like to extend my congratulations to the Lead Coaches and extended team members for training teachers and guiding them to create lesson plans and implementation strategies.

# MESSAGE



**Dr. Chintan Vaishnav**

Mission Director  
Atal Innovation Mission, NITI Aayog

As emerging technologies like Artificial Intelligence and the Internet of Things reshape our world, it is vital to integrate them with Tinkering and make this a part of formal pedagogy.

Atal Innovation Mission (AIM), NITI Aayog, partnered with CBSE and Intel India to implement 'AIoT Integration in Curriculum' to make 'Tinkering' a part of the formal pedagogy and connect it with emerging technologies like Artificial Intelligence. By leveraging infrastructure of the Atal Tinkering Labs (ATLs) to demystify AI, teachers can use this integration to improve learning outcomes of their students.

It is well known that learning a concept in multiple ways with multiple modes strengthens the understanding of the concept. A lot of effort has gone into creating the exercises produced in this book to facilitate such multi-modal learning. I have no doubts that it will help foster curiosity, creativity, and imagination in young minds; and teach skills such as design mindset, computational thinking, adaptive learning, physical computing, and so on.

I congratulate CBSE and Intel India and all the participating schools who were part of the pilot of the 'AIoT Integration in Curriculum' program, on being the trailblazers and hope that this compendium of AIoT integrated lesson plans created by educators encourages teachers across the country to explore AIoT exemplar lesson plans and implement them in the classrooms.

# MESSAGE



## Ms. Shweta Khurana

Senior Director - Asia Pacific Japan,  
Government Partnerships & Initiatives  
Global Government Affairs Group, Intel

Technology is becoming increasingly central to every aspect of human existence. Intel's goal is to make technology fully inclusive and expand digital readiness for all.

'AloT Integration in Curriculum,' is a collaborative effort between AIM - NITI Aayog, CBSE - Ministry of Education, and Intel India. Our goal is to empower teachers with appropriate, skillsets, mindsets and toolsets to integrate AI and Tinkering in the way the curriculum is transacted in order to improve the learning outcomes for the students. We hope that through this methodology, the students will gain a comprehensive understanding of how emerging technologies work and can be used impactfully and responsibly.

This Compendium contains lesson plans created jointly by subject teachers, ATL in-charge, tinkering experts and AI teachers who were trained to build relevant AloT skills connected with the school curriculum. We hope that these exemplars will inspire more teachers to join this movement and help their students learn relevant skills and become ready for Future of Work.

We thank Dr. Chintan Vaishnav, Mission Director, Atal Innovation Mission, NITI Aayog, Ms. Nidhi Chhibber, Chairperson CBSE, and Dr Biswajit Saha, Director, Skills Education, Central Board of Secondary Education, for this collaboration and their constant guidance to help build an AI-ready generation. We would also like to extend our gratitude to all participating teachers and school principals for contributing to this compendium. We sincerely hope that the schools enjoy implementing these lesson plans as much as we did during the journey of curating it together!



# ABOUT

## Integrating AI and Tinkering with Pedagogy (AIoTT)

National Education Policy 2020 aims at developing talent for the Fourth Industrial Revolution by preparing students for an economy that is driven by emerging technologies like Artificial Intelligence (AI), blockchain, IoT (Internet of Things), and 5G which are fundamentally altering the landscape and reshaping the world.

With the aim to bring these new technologies such as AI and IoT and integrating them with subject pedagogies, Atal Innovation Mission - NITI Aayog, Central Board of Secondary Education - Ministry of Education and Intel India collaboratively launched AIoT integration in the curriculum to help integrate AI and tinkering with subject pedagogies.

Aligned with the larger goal of mainstreaming emerging technologies and improving student learning outcomes, the key objectives of the program are

- To nurture the spirit of innovation, invention & discovery in youth and develop a design mindset.
- To provide opportunities for students to demystify tinkering while using AI.
- To democratize skills of tinkering and AI and make it accessible for all.
- To enhance the learning outcomes of the students and make them future-ready.

To help educational institutions systemically integrate tinkering and AI skills and leverage the ATL infrastructure as part of their regular teaching-learning activities, a manual highlighting the need, process, and some sample lesson plans were compiled and made available on the CBSE and NITI Aayog website.\* The objective was to provide direction to teachers to explore the exemplar lesson plans and develop their own lesson plans in collaboration with the AI and Tinkering lab teachers and subsequently implement them in the classroom.

To help set the pace, a pilot was initiated with a select set of 50 schools having ATL labs and affiliation for AI as a skill subject. Beginning in October 2022, four workshops of 2-3 days each were conducted in Chandigarh, Delhi and Bangalore, attended by 147 educators. During the workshop, the participants were made familiar with integration, the pedagogical aspect, the process to converge curricular concepts, AI and tinkering for building an AIoT integrated lesson plan, aligned with NCERT learning outcomes.

This book is a collection of 70 such AIoT integrated lesson plans. These lesson plans are in two sections which are further categorised grade and subject wise

- **Section 1:** AIoT Integrated Lesson Plans developed and implemented by practicing teachers
- **Section 2:** AIoT Integrated Lesson Plans in process of implementation

These lesson plans can be used by teachers in schools having an ATL lab and AI as a skill subject. The book contains the synopsis of the lesson with a QR code for detailed lesson plan.

Each lesson plan consists of

- Concepts from the curriculum
- Practical real-life problem related to the concept
- Design thinking activity where students analyze the problem and ideate a solution
- Activity to develop AI and tinkering enabled solution

\* QR Code to access the AIoT Integration manual



# Journey of the program

Outcome

Working group of practicing CBSE subject teachers, AI & ATL teachers, pedagogists, ATL and AI coach was formulated. In series of face to face and online workshops they:

1. Conceptualized the framework for the program
2. Developed 20 exemplar lessons plans showcasing integration of AIoT with multi-disciplinary approach
3. Reviewed, validated and finalized the lesson plans

AIoT integration in Curriculum manual was developed with 20 lesson plans

Launch

4. The program was launched jointly by NITI Aayog, CBSE and Intel India on September 15, 2022 at NITI Aayog, New Delhi.

AIoT Integration in Curriculum manual was uploaded on CBSE and NITI Aayog website

Schools and Teachers Nomination

5. One face to face and two Principal Virtual Session were conducted

50 schools nominated teacher representatives – 1 Science, 1 Social Science, 1 AI and 1 tinkering expert

### Capacity building of the teachers of 50 pilot schools

6. Four workshops of 2-3 days each were conducted in Chandigarh, Delhi and Bangalore, attended by 147 educators
7. In school wise groups, teachers developed AIoT integration ideas

147 teachers underwent training

### Program Implementation in School by teachers in their schools

8. Teachers developed lesson plans on new AIoT ideas
9. Teachers trained other teachers of their school
10. Few teachers have started implementing AIoT integrated ideas in the teaching and learning process

50 new AIoT integration lessons plans developed by the trained teachers

### AIoT Integration Showcase

11. A showcase event held in collaboration with AIM, NITI Aayog, CBSE and Intel India on January 24, 2023

A compendium consisting of 70 AIoT integrated lesson plans launched. 100 teachers showcased their AIoT integration ideas and journey

### Way Forward

12. All 50 schools to start using AIoT integration methodology in teaching and learning practice
13. School level showcase events to be conducted by May and June 2023
14. Mentoring of selected student projects for National showcase in September 2023

# Skill Outcome Map for AIoT Integration in Curriculum

Tech Skills	
Tinkering	Artificial Intelligence
Digital Literacy	
Algorithmic thinking	
Data Gathering	
Pattern Recognition	
Model Optimization	
Design Thinking	AI Project Cycle
Ideation Innovation Prototyping	Data Cleaning Data Labelling Data Visualisation Data Analysis
Physical Computing	
Basic Electrical & Electronics Mechanics Circuit Building Knowledge of Sensory networks	AI Domains  AI for Data AI for Computer Vision AI for Natural Language Processing
Computational Thinking	
C Programming (Arduino)	

Mathematical and Quantitative skills	
Linear Algebra	Probability
Graphical Inference	Statistical Analytics

Social Skills	
Critical Thinking , Logical Reasoning , Decision Making	
Interpersonal Skills	Intrapersonal Skills
Collaboration Team work and team building Empathy Leadership	Creative Mindset Out of the Box Thinking Organizational Skills Effective Communication Effective documentation Observation Skills Broad Mindset Persuasion

Social Impact Solution Building	System Mapping
	Problem identification
	Problem Scoping
	Problem Solving
	Prototyping the AI and Tinkering Solution

This section contains AIoT Integrated Lesson Plans developed and implemented by practicing teachers

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# An AIoT Integrated Lesson Plan

Class 6, Science

Implemented by:

**Ms. Yukti**

AI Teacher

**Ms. Arushi**

Social Science Teacher

Army Public School  
Meerut, Meerut, UP

## Body Movement: Correct Body Posture

### Problem Statement

Lakshya who spends a lot of time using electronic gadgets, complains of frequent back pain. His teacher and parents are worried. The discussion in science class led to the conclusion that improper posture may be the reason for Lakshya's back pain.

### Solution

- Students work on a project to create a system that will detect correct and incorrect postures.
- **Tinkering Integration:** A device is built with motion sensors, camera, Arduino and LED, wherein the LED glows red if the sensor detects incorrect posture and glows green when it detects correct posture. This is recorded over a period of time.
- **AI Integration:** Using an online dataset or the self-collected dataset a machine learning model is developed that recognizes and predicts if the postures are incorrect or correct while working on electronic gadgets.

### Students Learning Outcomes

- Develops knowledge of C Programming (Arduino), Data Collection, and Model Optimization.
- Social skills like Empathy, Team Work, and Creative Mindset are also inculcated in the students.



QR Code to open  
the detailed lesson plan

# An AIoT Integrated Lesson Plan

Class 6, Social Science

Implemented by:

**Ms. Debasree Chatterjee**

Social Science Teacher

**Ms. Kavita**

ATL Teacher

Delhi Public School  
Bengaluru East, Karnataka

## India: Climate, Vegetation, and Wildlife

### Problem Statement

Rahul grows plants in his summer vacation. As winter approaches, despite the same watering routine, his plants start dying.

### Solution

- Students analyze the problem and identify that overwatering of the plants is the root cause. To solve this, they develop a soil health monitoring system to predict the plant's health.
- **Tinkering Integration:** Using a moisture sensor and Arduino UNO (tinkering tools), they develop a prototype to record the moisture level of the soil.
- **AI Integration:** Based on the statistical data for the AI domain, they develop a supervised AI model to predict the plant's health by utilizing the recorded data.

### Students Learning Outcomes

- Develops an understanding of the soil moisture sensor, Data Collection, and the development of an AI model.
- Empathy, problem scoping, problem solving, and observation skills are developed in the students.



QR Code to open  
the detailed lesson plan

# An AIoT Integrated Lesson Plan

Class 8, Science

Implemented by:

**Ms. Kritika Gupta**  
Science Teacher

**Ms. Anju Bala**  
ATL Teacher

OS DAV Public School,  
Kaithal, Haryana

## Crop Production and Management

### Problem Statement

Raju is a farmer from Hoshiarpur who is well-versed in the modern techniques of farming. These techniques have helped him increase his crop yield. But despite using high variety seeds and properly preparing the soil before sowing, he is obtaining poor crop yields of sugarcane.

### Solution

- Students brainstormed and deduced that low nutrients in the soil can be the reason for the problem. They decided to develop an automated system that can provide qualitative analysis of soil profile.
- **Tinkering Integration:** Using soil NPK sensors and Arduino Uno students develop a soil nutrient monitoring system.
- **AI Integration:** Using the data from the soil NPK sensor they develop an AI-enabled model to predict the quality of the soil.

### Students Learning Outcomes

- Students understand different sensors, use of Arduino, and how to develop an AI model using the classification method.
- Empathy, problem-solving, and critical thinking skills are developed in students.

## Our Journey

AIoT integration has transformed us as enablers and has played a major role in our professional development. Understanding the blend of AI and Tinkering with the subjects is helping us in developing skill sets in students that will prepare them for the future workforce.

Our classes have become more engaging, and the teaching-learning more productive and effective.



QR Code to open  
the detailed lesson plan

# An AIoT Integrated Lesson Plan

Class 8, Science

Implemented by:

**Ms. Sucharita Maiti**  
Science Teacher

**Ms. Mehreen Shamim**  
ATL Teacher

Delhi Public School  
Bengaluru East, Karnataka

## Microorganisms: Detecting Harmful Bacteria in Drinking Water

### Problem Statement

Rajni gets sick and has stomach ache and vomiting. This happened after drinking tap water from her school. In the next few days, many of her classmates reported sick too. Rajni's friend Sanjana is worried and wants to find out the reason for the same.

### Solution

- Using the design thinking concept process, students analyze the problem and reach the conclusion that the infection could have been caused by waterborne bacteria in the tap water.
- **Tinkering Integration:** Using a microscope/digital microscope students capture images of bacteria in different water samples from taps of the school.
- **AI Integration:** Using Teachable Machine they develop a classification model that would predict different waterborne bacteria such as cholera and E.coli in various water sample.

### Students Learning Outcomes

- Develops an understanding of Machine Learning AI Model, Data Collection.
- Social skills like Problem Scoping, Problem Solving, Observation skills gets nurtured in students.

## Our Journey

Has enabled us in integrating AIoT into lesson topics to create interactive and immersive learning experiences that engage students in a way that traditional methods can not.

We believe that these technologies will continue to play a vital role in shaping the future of education.



QR Code to open  
the detailed lesson plan

# An AIoT Integrated Lesson Plan

Class 8, Science

Implemented by:

**Ms. Aruna Singh Tomar**  
Science Teacher

**Ms. Ashna Kaushik**  
ATL Teacher

DAV Public School, Sector 49,  
Gurugram, Haryana

## Microorganisms- Detecting and Preventing Milk Spoilage

### Problem Statement

Seema forgot to drink milk served by her mother and left for school. After coming back from school, she took a sip and couldn't bear the taste and found it smelly too. She feels bad as the milk got wasted and wants to understand the reason behind the milk spoilage and prevent it.

### Solution

- Students analyze the problem and identify the reasons of food spoilage by microbes.
- Tinkering Integration:** Use of Temperature and pH sensors combined on one Breadboard to take the temperature and pH values of milk samples.
- AI Integration:** Use the collected data to create an AI model for prediction of the quality of milk based on pH, temperature, taste, odour, fat, turbidity, and colour as Bad, Moderate, or Good milk.

### Students Learning Outcomes

- Develop knowledge of Design Thinking, Algorithmic Thinking, Data Collection, Sensory Networks, and use of Statistical Data for AI in students.
- Social skills like problem scoping, problem solving, prototyping ai and tinkering solutions are nurtured in students.

## Our Journey

AIoT integration training has given a new dimension to our 4 years journey of tinkering and AI. The training has given a new vision of how to inculcate innovative spirits in our young learners.

It not only makes the class interactive but also promotes innovation and discovery. The students will be future-ready in the VUCA (volatility, uncertainty, complexity, and ambiguity) world with AIoT-integrated activities.



QR Code to open  
the detailed lesson plan

# An AIoT Integrated Lesson Plan

Class 8, Social Science

Implemented by:

**Ms. Preeti Sharma**  
Social Science Teacher

**Ms. Akshi Bhatia**  
ATL Teacher

DAV Public School Pushpanjali  
Enclave, New Delhi

## Why Do We Need A Parliament?

### Problem Statement

After the State election Ravi, sees the news on the TV where the opposition leaders were talking about an unfair election. As the class monitor election was coming up he was interested in deducing how fair elections can take place.

### Solution

- Students brainstormed various options to ensure a fair election in class and decide to develop a monitoring system that can ensure fairness of the election system while casting votes.
- AI Integration:** Developed an AI model for identifying the symbol of candidates nominated for class monitors position.
- Tinkering Integration:** Developed a Scratch code for students to vote and select their monitor.

### Students Learning Outcomes

- Learns how to create an AI model based on Computer Vision, Data Collection, Data Labelling, and how to prototype tinkering solutions using AI data.
- Skills like leadership, creative mindset, organisational skills are developed in students.

## Our Journey

We initiated our journey with AI in the year 2019. But the real essence of using AI in the subject became clear during AI Integration sessions. Now, with AIoT integration it feels like a perfect synergy has been established between subject topics, AI, and tinkering.

We feel more accomplished as a teacher now wherein we are enabling our students to empathize and able to address issues using evolving technologies.



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the detailed lesson plan

# An AIoT Integrated Lesson Plan

Class 8, Social Science

Implemented by:

**Ms. Vidushee Mathur**  
Social Science Teacher

**Ms. Sonu Lohchab**  
ATL Teacher

DAV Public School, Sector 49,  
Gurugram, Haryana

## Industries: Respiratory Diseases caused by Air Pollution

### Problem Statement

Sanya who lives near an industrial area, gets sick every month with respiratory symptoms like shortness of breath, coughing, wheezing, etc. She visits a doctor who details her on particle pollution causing respiratory symptoms. She is intrigued.

### Solution

- Students use the design thinking concept to infer that the key factor affecting Sanya's health was particle pollution caused by SPM (Suspended Particulate Matter) and smoke.
- **Tinkering Integration:** Using the MQ Series gas sensor a device is developed that detects and records data of smoke.
- **AI Integration:** An AI model is developed using the Statistical Data domain to predict the air quality as healthy, moderately polluted, or severely polluted.

### Students Learning Outcomes

- Develops knowledge of Design Thinking, Data Collection, Sensory Networks, and use of Statistical Data for AI.
- Social skills like empathy, problem scoping, problem solving, and teamwork are developed in students.

## Our Journey

As teachers, the whole experience of AIoT integration in the curriculum has opened a new window of exploration and ideas that will not only help the students but institutions and the nation together. This is the beginning of a pathbreaking concept in the teaching-learning process.

Integration of AIoT in the mainstream will engage and groom each and every child in the class.



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# An AIoT Integrated Lesson Plan

Class 9, Science

Implemented by:

**Ms. Charu Sabharwal**  
Science Teacher

**Mr. Akhil R**  
ATL Teacher

DAV Public School Pushpanjali  
Enclave, Delhi

## Why do we fall ill?: Prevention of Communicable Diseases

### Problem Statement

Samarth noticed that many students were absent due to illness. He got worried and talked to his mother about his concern.

### Solution

- Students brainstormed and deduced that the illness was transmitted through one student to another. They decide that ensuring wearing a mask can mitigate the problem.
- **AI Integration:** Using PictoBlox students develop an AI model for classification and identifying people wearing masks and not wearing a mask.
- **Tinkering Integration:** Using data from PictoBlox in Arduino and utilizing a Servo motor they develop a prototype that stops a person from entering a room if the mask is not worn on the nose and mouth.

### Students Learning Outcomes

- To create AI models based on Computer Vision, modes of collection data, Data Labelling, how to prototype AI and tinkering solutions, and knowledge of Sensory networks
- Social skills like empathy, problem identification, problem solving, observation skills gets nurtured in students

## Our Journey

As teachers, we always had the feeling of teaching the concepts in isolation. Until we were fortunate to be a part of AIoT Integration training which changed our whole perspective. We feel energized and teaching has become more meaningful.

It is the beginning of a new era of teaching wherein we are able to teach concepts to students that are relate to their real life.



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# An AIoT Integrated Lesson Plan

Class 9, Social Science

Implemented by:

**Ms. Leena Khetrapal**  
Social Science Teacher

**Mr. Arul Kumar**  
ATL Teacher

Stepping Stones Senior  
Secondary School, Chandigarh

## The Story of Village Palampur: Improving Agriculture Yield

### Problem Statement

Dala is a small Indian farmer who wants to increase his income from his fixed piece of land, similar to the yields of farmers of other countries.

### Solution

- Students analyze the problem and identify that NPK content of the soil directly affects the crop yield. To address this, they develop a system to automatically calculate the Nitrogen, Phosphorus, and Potassium (NPK) content in the soil.
- **Tinkering Integration:** Using NPK Soil Testing Kit and Arduino UNO students develop a prototype to record the NPK levels of soil.
- **AI Integration:** Using the RGB values of the Statistical Data domain of AI, they develop a supervised AI model to predict the soil quality for better yields.

### Students Learning Outcomes

- Learns about Data Collection, Data visualization, and Statistical Data for AI, use of sensors to collect data.
- Empathy, problem-solving logical reasoning are some of the skillset that gets developed in students.

## Our Journey

Over the years we have had the most joyful experiences while training and molding young minds to think scientifically and critically about problems. The integration of AI and Tinkering in Social Science is what we would call a Renaissance, which will change the way the subject will be viewed at the school level, making it much more interesting and useful for the learners and society.



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# An AIoT Integrated Lesson Plan

Class 9, Social Science

Implemented by:

**Ms. Sarita Singh**  
Social Science Teacher

**Ms. Ankita Sethi Sahni**  
**Ms. Anshu Banerjee**  
ATL Teacher

Uttam School for Girls Ghaziabad,  
Uttar Pradesh

## Climate: Weather Condition

### Problem Statement

In the month of November, while playing, Advait observes that there is a sudden change in the weather from a clear sky to cloudy and stormy.

### Solution

- Students brainstormed various options to deal with the problem and decide to develop a monitoring system that can predict the weather
- **Tinkering Integration:** Using the DHT11 sensor and Arduino UNO students develop a rainfall predicting system.
- **AI Integration:** Using the data from the monitoring system they develop a Machine learning model which predicts the weather.

### Students Learning Outcomes

- Develops knowledge of Sensory Networks, Data Collection, and prototyping using Tinkering and A.I.C Programming(Arduino)
- Problem scoping, problem solving, and critical thinking get nurtured in students.

## Our Journey

Towards integrating AIoT in the classroom is one of continuous learning and growth.

The use of AI and IoT in education will help us to create more engaging and personalized learning experiences for students and will support teachers in their efforts to help students achieve their learning goals.



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# An AIoT Integrated Lesson Plan

Class 10, Science

Implemented by:

**Mr. Paras Makkar**  
Science Teacher

**Ms. Manisha Guglani**  
ATL Teacher

OS DAV Public School,  
Kaithal Haryana

## Magnetic Effects of Electric Current

### Problem Statement

Karan made a simple electric circuit to make iron, with no threat of shock but one day, while ironing his clothes, he came in contact with a naked wire and got a shock. He was terrified.

### Solution

- Students brainstormed various options that could have been the reason for the shock. They deduced that the issue can be addressed by understanding and identifying AC and DC current
- **Tinkering Integration:** Through hands-on experience with an oscilloscope, students understand the difference between AC and DC forms of current.
- **AI Integration:** Using the learning from oscilloscope activity they develop an AI-enabled model to predict AC/DC current using the Teachable Machine model.

### Students Learning Outcomes

- Students understand Data Visualization, working of sensors, Pattern analysis
- Observation skills, mathematical skills, and observation skills get inculcated in students.

## Our Journey

The concept of AIoT integration has introduced us to a totally new teaching pedagogy. Enjoying delivering concepts in class while experiencing how AI and tinkering infuse life into a pedagogical concept.

A new dimension has been added to our skillset making us more complete teacher enjoying our profession more than ever and at the same time growing technically.



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# An AIoT Integrated Lesson Plan

Class 10, Social Science

Implemented by:

**Ms. Promila Bishnoi**  
Social Science Teacher

**Ms. Shilpa Sethi**  
ATL Teacher

DAV Public School, Sector 14,  
Gurugram, Haryana

## Manufacturing Industries: Water Pollution

### Problem Statement

Suresh's father, a farmer uses river water for irrigation. The river passes through the industrial area near the village. The harvest of his agricultural produce has gone down in recent years which is a worrisome situation for the family.

### Solution

- Students identify that change in the pH of the river water due to pollutants from industries is the root cause of the problem. They decide to develop a model that can predict water quality.
- **Tinkering Integration:** Using a pH Sensor and Arduino Uno students develop a prototype to record the pH level of the water.
- **AI Integration:** Using the Statistical Data for AI domain of AI, they develop a supervised AI model to predict the water quality.

### Students Learning Outcomes

- Develops knowledge of Design Thinking, Data Collection, Sensory Networks, and use of Statistical Data.
- Empathy, observation, problem scoping, and problem-solving are developed as some skills get nurtured in students.

## Our Journey

Integration of AI with subject pedagogies was the first step in using AI to enhance the teaching-learning process and help students to better understand. Adding AIoT not only makes it more interesting but also motivates students to learn innovation skillset.

AIoT integration is a different perspective that shall make the teaching-learning process more effective. The concept has added a new perspective to our thought process as teachers.



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# An AIoT Integrated Lesson Plan

Class 10, Science

Implemented by:

**Ms. R Rama**

Science Teacher

**Ms. B Moogambiga**

**Mr. Surendra Kumar**

ATL Teacher

Aditya Vidyashram Residential  
School, Puducherry

## Lifelines of National Economy: Ensuring wearing helmet

### Problem Statement

Two people on a bike were approaching at a very fast speed without wearing a helmet and met with a deadly accident.

### Solution

- Students brainstormed and understood that if the people would have been wearing helmets the injuries would have been less. They decide to develop a monitoring system that can detect helmets and enhance road safety.
- **Tinkering Integration:** Using PictoBlox software and Arduino UNO students develop a Helmet detection system.
- **AI Integration:** Using the data from the monitoring system they develop an AI-enabled model to predict if a person was wearing a helmet.

### Students Learning Outcomes

- Understand the use of sensory networks, Arduino and creating a prototype using AI and tinkering solute.
- Observation, problem identification, and empathy some skills gets developed in students.

## Our Journey

As facilitators, we feel that AIoT integration into the curriculum workshop has made us fully immersed in the process of innovative and creative thinking. Providing a clear strategy for implementing in our teaching methods.

It will develop a culture of collaborative, creative thinking, and engage the learners to equip them with the skills they need to succeed in future workplaces.



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This section contains AIoT Integrated Lesson Plans developed by practicing teachers (in process of implementation)

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# Class 6

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# Garbage in Garbage Out

Science | Class 6

Upon learning about the distinctions between biodegradable and non-biodegradable waste and the importance of proper disposal of garbage, students are presented with a problem scenario - "While driving through the city of Delhi, Varuna saw the landfills of Ghazipur. She mistook it to be Aravalli hills, only to be told later that it was a landfill. She also noticed rag pickers, especially children playing on the unhygienic garbage hills."

Using design thinking framework, an integral part of the tinkering process, students decide to develop a solution that would segregate the garbage and dispose of it safely.

The methodology applied by the students:

**Tinkering Integration:** Students develop a motor operated or manually operated Conveyor Belt for waste segregation.

**AI Integration:** Using Teachable Machine students develop a classification model for waste segregation on the basis of images of the waste object.



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# Body Movement: Joints

Science | Class 6

After gaining knowledge on the crucial role of joints in the human body, students are presented with a hands-on scenario. – "Ajay notices that his body parts can perform some movements and cannot perform some. He was able to rotate this shoulder clockwise and anticlockwise but his legs could not perform the same. He is curious to know the reason behind it."

Students analyze the scenario using the design thinking concept and deduce that different joints like Ball and socket, Fixed, Hinge, Pivotal joints, perform differently.

The methodology applied by the students:

**Tinkering Integration:** Using colored LEDs, a hardware is developed that shows the type of joint shown in any image.

**AI Integration:** Images for different types of joints present in the human body are collected and a dataset is created. Using a supervised machine learning model, joints are classified based on their type.



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# Electricity and Circuits

Science | Class 6

Post the introduction to the basics of the electric circuit and the difference between a good and poor conductor of electricity, the students were presented with a scenario - "While lighting his house for Diwali fairy lights, Ram touched an electric socket and felt a mild electric shock. His father noticed that Ram was barefoot, so he instantly advised him to wear his rubber slippers and assured him that he won't get hurt. Later on he noticed that the bulbs of the fairy lights were connected with two wires unlike other devices, such as the hairdryer or electric iron. Ram wondered about the difference."

Using the design thinking framework, an integral part of the tinkering process, the students deduce that rubber is a poor conductor of electric current. They also develop an understanding of parallel and series circuits.

The methodology applied by the students:

**Tinkering Integration:** To understand circuits, students developed a paper circuit with a switch made of copper tape.

**AI Integration:** An AI model is developed to classify objects as conductors and insulators. Students also develop a Scratch program for classifying good and poor conductors.



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# Sorting Materials into Groups

Science | Class 6

After being educated on the concepts of recyclable and non-recyclable waste, students are given the task of classifying trash – "Gagan wants to participate in a "best out of waste" competition in his school, for which the students need to build a raft that can float on water. But he is having difficulty sorting the materials to build the boat."

Through this challenge, students understand the classification of materials in groups based on their physical properties like density and buoyancy. They create an AI model that will identify household objects that can float or sink and then build a boat using suitable materials.

The methodology applied by the students:

**Tinkering Integration:** Using motors, wires, a switch, and a battery, students understand the creation of a basic circuit that acts as the boat propeller. And then using the materials classified by the AI model, students will create the structure of the boat.

**AI Integration:** Using the Teachable Machine Platform and Image Classification techniques, students learn about the material classification process and use the image of various household waste items to classify them into floating or sinking types of objects.



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## Components of Food

Science | Class 6

A situation from real life is presented to students after they have learned about the many nutrients found in food - "Diksha is a high school teacher in a village in Bhopal. Most of the students in her class come from families of farm workers. Many of the students seem to be tired during class and show very little energy in studying or even playing games. During lunch, she notices that most students bring dry snacks or rice or roti and achar in their tiffins. She wants her students to understand the importance of a balanced diet and how it impacts their overall health."

Using the Design Thinking framework, students create a system that can measure the height, weight and pulse rate of a student. With this information along with the age and food intake data, students create an AI model to detect whether the diet is balanced or lacks macronutrients.

The methodology applied by the students:

**Tinkering Integration:** Using Arduino Uno, a load cell, and a distance sensor (Tinkering tools), students create a Height-Weight monitoring system.

**AI Integration:** Using Machine Learning for Kids platform (AI tool), students learn about how AI can be used to create a system that can compare multiple parameters of food and health and classify the dietary intake of the student into a Balanced diet or a Malnourished diet.



QR Code to open the detailed lesson plan

## Separation of Substances

Science | Class 6

A real-world issue is provided to pupils after they have learned about basic methods of substance separation - "Bhola's family owns a farm and everyone helps with the different tasks related to farming. Bhola observes that after the harvest is done at the farm, his mother gets to work separating the grains from the chaff. It takes a lot of time for her to do this and it is tiring too. Bhola has seen videos on the internet about making machines that could do what his mother is doing. So he thinks about how he can help his mother with this task."

Through this challenge, students use the Design Thinking framework to create a mechanical winnowing machine and evaluate the separation of the grains and the chaff.

The methodology applied by the students:

**Tinkering Integration:** Using Tinkering tools like cardboard and a motor, students create a prototype of the Winnowing machine.

**AI Integration:** Using Teachable Machine (AI concept), students create a model to classify between well separated and poorly separated grains.



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# Major Landforms of the Earth

Social Science | Class 6

After studying about the main landforms, such as mountains, plateaus, and plains, students are presented with a real life scenario – “A student named Rani discovers new soil mounds in the playground of her school, which is next to the garden. To find about the reason for it she brings it up the class for investigation.”

Using design thinking framework, students think out of box and conclude that the reason for the mound of soil is leaving water pipe in one place for long duration.

The methodology applied by the students:

**Tinkering Integration:** To visualize the scenario students print two 3 dimensional landscapes using 3D printer and TinkerCad (3D design web app). They experiment and record soil moisture using Moisture Sensor and Arduino Uno (tinkering tools) in both the landscape.

**AI Integration:** Using Statistical Data domain students develop a supervised AI model that predicts which type of landscapes are prone to more soil erosion.



QR Code to open the detailed lesson plan

# From Hunting-Gathering to Growing Food

Social Science | Class 6

After learning about the transition from foraging and hunting to farming and raising livestock, students are presented with a real-world issue - “Ramu is a curious farmer who loves to learn about technology and how he can use it to improve his farm. One day, Ramu noticed that one of his cows seemed to be feeling unwell, and he wasn't sure how to tell if the cow was really sick or just a little under the weather. Ramu hopes to be able to identify any potential health issues early on and take the necessary steps to ensure the cow's well-being.”

Through this challenge, students use the Design Thinking framework to create a system for monitoring and analyzing the health of livestock and then suggest ways to optimize feeding, breeding, and other management

The methodology applied by the students:

**Tinkering Integration:** Using Tinkering tools like a Heart Rate sensor, Temperature sensor, and Arduino Uno, students make a circuit to get the heart rate and temperature values of a cow.

**AI integration:** Using BigML (AI tool), students create a model to predict if the cow is healthy or unhealthy by feeding heartbeat and temperature data to the model.



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# Class 7

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# Electric Current and its Effects

Science | Class 7

Students are given a problem statement following their study of the idea that the magnetic field is created when electricity flows through a conductor - "Rahul wants to develop an electromagnetic swing for which he has to learn the electric symbol classification along with understanding the magnetic effects of electricity."

Using the Design Thinking Framework, an integral part of the tinkering process, students analyse the problem and decide to build a perpetual swing and use simulations for classifying magnetic effects of electricity.

The methodology applied by the students:

**Tinkering Integration:** Students build a perpetual swing toy using DIY construction kits and applying electromagnetic concept.

**AI Integration:** Using machine learning for kids application and PhET simulations, students classify magnetic effect and electric symbols.



QR Code to open the detailed lesson plan

# Light

Science | Class 7

After studying the rules of reflection and refraction as well as how mirrors and lenses create images, students are presented with a problem situation - "Suhas, while making a telescope for a school science exhibition, ordered a range of different concave and convex lenses. The lenses he received didn't have the type of lenses and their focal lengths marked on them. He has to figure out a way to quickly and reliably measure the focal length of various different lenses."

Students analysed the situation applying design thinking framework and decide to apply the concepts of concave lens or convex lens and real image or virtual image for solving the problem of identifying the type of lens and their focal length.

The methodology applied by the students:

**Tinkering Integration:** Developed a LDR-based light intensity meter using Arduino to read Analog data.

**AI Integration:** Created an interactive quiz on Light using Inklewriter. While developing the quiz they understood how chatbots work.



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# Transportation in Animals and Plants

Science | Class 7

Students are given a fundamental issue to address after learning about the importance of the circulatory system across both humans and plants – “Komal wants to create a simple machine that can monitor and record some common health parameters for her grandmother in the home itself.”

Students decide to develop a monitoring system that can monitor human health.

The methodology applied by the students:

**Tinkering Integration:** Using LM - 35 sensor, pulse sensor and Arduino Uno, students develop a human health monitoring system.

**AI Integration:** Using the data from the human health monitoring system they develop an AI model to predict the health of any person.



QR Code to open the detailed lesson plan

# Wastewater Story

Science | Class 7

After learning the concept of wastewater and the importance of proper wastewater management, students will be presented with a practical problem - “Arjun is an environmentalist who is especially concerned about the quality of water. One day, while out on a hike, Arjun noticed that the water in a nearby stream looked and smelled strange. He wasn't sure about how contaminated the water was and in what amount the gases were being produced. So, he decided to investigate.”

Using the Design Thinking framework, students understand the sources and impacts of wastewater.

The methodology applied by the students:

**Tinkering Integration:** Using Sensors and Arduino Uno (tinkering tools), they develop a prototype to record the contamination level.

**AI Integration:** Teachable Machine is used to distinguish the type of contaminated water on the basis of its color.



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# Soil

Science | Class 7

Students learn different types of soils and their properties. Post it they are presented with a real-life scenario - "Samarth is a smart kid studying in school. One day while he was playing cricket on the school ground he wondered if this was the best type of soil to play cricket on because he had seen people play on different types of pitches. His curiosity took him on a mission to learn about all the different types of soil found at different depths of the earth's surface. Samarth researched and came up with a replica model depicting the different layers of earth indicating different types of soil."

Using the Design Thinking framework, students create a model replica of different layers of soil from the samples collected from their neighborhood.

The methodology applied by the students:

**Tinkering Integration:** Using Arduino Uno and ultrasonic sensors (tinkering tools), students measure the distance of different soil layers from the earth's crust.

**AI Integration:** Students use Teachable Machine to distinguish the type of soil in different layers on the basis of their color.



QR Code to open the detailed lesson plan

# Rulers and Buildings: Deteriorating Condition of Monuments

Social Science | Class 7

Students are sensitized about engineering methods used in building construction and importance of preservation of history and legacy. Then a practical problem is presented to them - "When students visited the historical monument of Red Fort in Delhi they feel concerned about the deteriorating condition of the heritage monument."

Using design thinking framework, students brainstorm reasons for deterioration of the building. They deduce that vibrations can be one of the cause of deterioration and its analysis can help in predicting the health of the building.

The methodology applied by the students:

**Tinkering Integration:** Minisense 100 vibration sensor is used to record the vibrations of buildings.

**AI Integration:** AI is used to develop a classification Statistical Data model. The values acquired through vibration sensor are compared to threshold vibration values and the model predicts whether the building is healthy or not.



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# Rulers and Buildings: Air Quality affecting monument

Social Science | Class 7

Students are sensitized about Mughal architecture and importance of preservation of history and legacy. Then a practical problem is presented to them - "On observing closely, students notice that the intricate white marble of Taj Mahal was turning yellow and it was getting tarnished."

Students brainstormed various options to understand the problem and decided that the pH in the air can be the reason for the tarnishing of Taj Mahal. So they decide to develop a pH monitoring system to predict the health of monuments.

The methodology applied by the students:

**Tinkering Integration :** Using pH sensor and Arduino students develop pH monitoring system.

**AI Integration :** Using the data from the pH monitoring system they develop an AI enabled model to predict pH value using machine learning.



QR Code to open the detailed lesson plan

# Water

Social Science | Class 7

After educating students on the importance of having access to safe drinking water, a problem scenario is presented to them - "Anith and Bhavik notice rainwater running down into the drains and getting wasted."

The students find connection of the problem with overflow of water in dams too and to take measure to solve the problem they develop a water level measurement system. The system checks the water level of the dam and alert in case of overflow.

The methodology applied by the students:

**Tinkering Integration:** Students devise a prototype to detect the water level of a Dam using a water level sensor.

**AI Integration:** Using data science domain an AI model is developed that predicts whether the water level of dam is above danger zone or not.



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# Human Environment Interactions: The Tropical and The Subtropical

Social Science | Class 7

Students are presented with a real-world issue after learning about interaction between humans and the natural environment.– “Ravi observes that fishes in his aquarium are dying. This was happening despite of changing the aquarium water fortnightly.”

Using the design thinking concept, students deduce that fishes dying could be related to the quality of the water. They also comprehend that the quality of water depends on temperature, ph level, oxygen level, TDS (Total Dissolved Solids) value. To solve this they develop an automated system in the aquarium that notifies the condition of the water environment.

The methodology applied by the students:

**Tinkering Integration:** An aquarium water monitoring system to measure the water temperature and TDS value of water is developed using Waterproof Temperature Sensor (DS18B20) and Gravity TDS Sensor.

**AI Integration:** Using the collected data an AI model is developed which can predict if the water is safe or unsafe for fish in the aquarium.



QR Code to open the detailed lesson plan

# Our Changing Earth

Social Science | Class 7

After students learn about various landforms, what affects them and how they are important and relevant to us in our everyday lives, they are presented with a practical problem - “Aditya travels to school every day by bus. During his travels, he crosses a bridge every day. Throughout the year Aditya notices differences in the flow of water and the amount of soil present. This makes him curious about what leads to erosion or deposition of soil and how it affects nature.”

Using the Design Thinking framework, students create a system to deduce whether the flow of water (pressure) is causing erosion or deposition.

The methodology applied by the students:

**Tinkering Integration:** Using pressure sensors and Arduino Uno (tinkering tools), students collect water pressure data like the speed of flow and direction of flow.

**AI Integration:** Using Machine learning, they then train the model with the collected data to predict whether the pressure of water is causing erosion or deposition.



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# Natural Vegetation and Wildlife

Social Science | Class 7

After learning about the different types of natural vegetation found in India along with the flora and fauna that are found in each ecosystem, students are presented with a practical problem - "Ram is an avid traveler. In particular, he likes going on different trekking trips throughout India. A fascinating point he noticed was that the types of animals he saw in different locations were very different from each other. He decides to look into this further."

Using the design thinking framework, students understand the type of wildlife found in different forest environments.

The methodology applied by the students:

**Tinkering Integration:** Using internet searches, students collect data from online sources.

**AI Integration:** Machine Learning for Kids is used to predict the forest an animal lives in, based on the image of that animal.



QR Code to open the detailed lesson plan

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# Class 8

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# Combustion and Flame

Science | Class 8

The following scenario is provided to students shortly after they have taught about the conditions for combustion - "While attempting her English exam, Khushboo read a comprehension passage, which talked about forest fires in India. She wondered about ways to predict and extinguish fires on large scales."

Using the design thinking framework, an integral part of the tinkering process, students decide to utilize automatic fire extinguishers to break the 'fire triangle'.

The methodology applied by the students:

**AI Integration:** Students develop an image-based AI enabled model to predict fire based on image data

**Tinkering Integration:** Using tools available in the lab students develop a fire extinguishing device that automatically gets triggered when the fire is detected.



QR Code to open the detailed lesson plan

# Pollution of Air and Water: Case Study Taj Mahal

Science | Class 8

Students learn about the effects of water pollution on land. Then they are presented with a practical scenario - "Chandan, a fourth-generation farmer resorted to modern agricultural practices and his crop produce started increasing over the years. He noticed stunted plant growth and decreased yield over the last two years following the construction of a manufacturing plant close to his land. When he got his soil tested, it indicated the soil to be in extremely acidic conditions. Chandan had been doing everything exactly the same way. He was clueless about the reasons and probable solutions."

Using the design thinking Framework, an integral part of the tinkering process, students deuced that the soil was turning acidic due to the chemicals used in the manufacturing plant.

The methodology applied by the students:

**Tinkering Integration:** Using Arduino Uno and TCS3200 colour sensor, students develop a pH monitor in the ATL lab.

**AI Integration:** Using data from the pH sensor, they create an AI Model for automatic identification of soil's acidic or basic conditions.



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# Microorganisms: Plant Disease

Science | Class 8

After students learn about microorganisms and diseases caused by them in plants, students are given a practical problem – “On a field trip to a botanical garden, Saurabh noticed that few plants had brownish spots on the leaves.”

Using design thinking framework, an integral part of tinkering students deduced that the spots were due to plant diseases. They decided to develop a monitoring system that can identify infection and classify it to a category i.e., by fungus, bacteria or virus.

The methodology applied by the students:

**Tinkering Integration:** Using various online sources students collected data on leaf infection and develop a plant infection/disease monitoring system.

**AI Integration:** Using the monitoring system they develop an AI enabled model to identify and classify plant disease using Teachable Machine.



QR Code to open the detailed lesson plan

# Pollution of Air and Water

Science | Class 8

After students learn about the impact of falling air quality, they are presented with a practical problem – “Tarun while visiting Delhi notices beeline of vehicles and traffic jams on roads. He is concerned about the level of air pollution the increasing number of vehicles on roads cause.”

Using the design thinking concept, an integral part of the tinkering process, students analyze the problem and identify the key factors affecting quality of the air leading to pollution.

The methodology applied by the students:

**Tinkering Integration:** Use of the MQ Series gas sensor to detect smoke and record data.

**AI Integration:** Using the collected data to train an AI model which can predict if the air is healthy, moderately polluted or severely polluted.



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# Microorganisms: Friend and Foe

Science | Class 8

Once students have learned about fermentation and the factors that contribute to it, they are given a problem scenario – “Kaushik is a high school teacher in a village in Uttar Pradesh. He finds that many students in his class frequently bring bread for lunch. He then asked the students if they knew how bread is made. Much to his disappointment, students were unable to answer. He then wanted to explain to the students the formation of bread and how critical it is to maintain proper temperature levels during fermentation to keep the fermenting bacteria alive.”

Through this challenge, students understand the process of fermentation, the role of CO<sub>2</sub> released during fermentation, and the temperature around it. They will also design a system to measure these factors and determine the stages of fermentation.

The methodology applied by the students:

**Tinkering Integration:** Using components such as an MQ-2 Gas sensor, Temperature sensor, Arduino, and wires, students understand the creation of a sensor system that measures the amount of CO<sub>2</sub> released during fermentation and the appropriate temperature for it.

**AI Integration:** Using the Machine learning for kids Platform, students learn about the various parameters required to predict the stages of fermentation. With the data collected by the sensors, they build an AI model to predict the stages of fermentation.



QR Code to open the detailed lesson plan

# Microorganisms: Bread Mould

Science | Class 8

After students learn about the microorganisms and fungi, they are presented with a practical problem – “Raghav bought a loaf of bread from the market. When his mother saw the bread she found a black spot on the loaf of bread. She told him that the bread was spoilt and eating spoiled bread might make him sick.”

Students brainstormed various options to deal with the problem and decide to develop a monitoring system that can classify breads as healthy and spoiled.

The methodology applied by the students:

**Tinkering Integration:** Using MQ135, MQ07, DHT11 and Arduino Uno students develop a Humidity & Temperature Sensor monitoring system.

**AI Integration:** Using the data from the Humidity & Temperature system they develop an AI enabled model to predict quality of bread using machine learning.



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# Reaching the Age of Adolescence

Science | Class 8

Students learn about the importance of balanced diet in adolescence. Then they ponder on a real life problem – “Disha is a teenager who is struggling with weight gain since last six months.”

After analyzing the problem using the design thinking concept students conclude that Disha’s weight gain can be caused by eating processed and packed food.

The methodology applied by the students:

**AI Integration:** They collect data on the packaged food consumed daily for a week along with the nutritional values. Using the data collected they develop a supervised AI model to predict whether the packaged food is healthy or unhealthy.

**Tinkering Integration:** As starchy and non starchy foods are indicators of healthy food, using Iodine test, students identify whether the food is healthy or not.



QR Code to open the detailed lesson plan

# Sound

Science | Class 8

After learning about the different concepts of sound, students will be presented with a practical problem - “Ravi is a talented musician. One day, while practicing his guitar, Ravi noticed that some notes were much harder when compared to the others, due to which he could not play his favorite song on Guitar. He wasn't sure why this was happening, so he decided to investigate.”

Using a design thinking framework, students understand the production, properties, and representation of sound. They leverage AI to distinguish between the two sound types and identification of different sound types by training the AI model with audio files.

The methodology applied by the students:

**Tinkering Integration:** Using a Raspberry Pi Terminal, students record audio.

**AI Integration:** Using Machine Learning for Kids, a web-based tool that helps to create machine learning models, students train their model to identify High Pitch, Low Pitch, and Background Noise.



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# Industries

Social Science | Class 8

Students are made aware about types of industries and factors which influence the location of industries and their distribution in different geographical regions. They are then given a problem statement - "Aditi and Kushal visit to Surajkund International Crafts Mela in Faridabad. They were curious to know how vendors estimated the quantity that needed to be produced for the fair."

Students analyze the problem and develop a model which predicts production quantity using a relative dataset.

The methodology applied by the students:

**Tinkering Integration:** IR sensor is used as a counter to detect and count objects.

**AI Integration:** Using Linear Regression Calculator and the concept of least squares method a Statistical Data model is developed for predicting production quantity.



QR Code to open the detailed lesson plan

# Land, Soil, Water, Natural Vegetation and Wildlife

Social Science | Class 8

Followed by brainstorming session about the significance of natural resources: Land, Soil and Water, students are given a problem statement - "While playing in the park, Vishal observes that some plants are not healthy. They were either dried, turned yellow in colour or their leaves appear to be damaged."

Students envision creating a plant health monitoring system that would check any leaf and predict if it is healthy or unhealthy.

The methodology applied by the students:

**Tinkering Integration :** Students collect dataset of images of healthy and unhealthy leaves online as well as from school's playground using camera and add them to the dataset.

**AI Integration :** A web-based tool- 'Teachable Machine' is used to create a machine learning model that classifies any leaf sample as healthy or unhealthy.



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# Industries: Respiratory diseases caused by Air Pollution

Social Science | Class 8

After students learn about the impact of industries on urbanization, they are presented with a practical problem – “Sanya who lives near an industrial area, gets sick every month with respiratory symptoms like shortness of breath, coughing, wheezing etc. She visits a doctor who details her on particle pollution causing respiratory symptoms. She is intrigued”

Using the design thinking concept, a fundamental part of the tinkering process, students conclude that the key factor affecting Sanya’s health was particle pollution caused by SPM (Suspended Particulate Matter) and smoke.

The methodology applied by the students:

**Tinkering Integration:** Using the MQ Series gas sensor a device is developed that detects and record data of smoke.

**AI Integration:** An AI model is developed using Statistical Data domain to predict the air quality as healthy, moderately polluted or severely polluted.



QR Code to open the detailed lesson plan

# Land, Soil, Water, Natural Vegetation and Wildlife Resources: Detecting Landslide

Social Science | Class 8

Students learn about the factors that contribute to shaping of landforms in hills and mountains. For deeper understanding they are presented with a practical problem – “Adesh lived in Pangji village, near Reckong Peo in Kinnaur district of Himachal Pradesh which receives heavy rainfall. Due to intense blasting done for construction work, the area has become prone to landslides. This has caused lots of suffering for the village people.”

Using the design thinking concept, an integral part of the tinkering process, students analyze the problem and concluded that vibrations and excessive moisture in the soil can be the cause of landslides. They decided to develop a solution that would measure the vibration and moisture content of the landform and predict landslide.

The methodology applied by the students:

**Tinkering Integration:** Using Vibration sensor and Moisture sensors students develop a hardware to collect data of vibration in a land form and the moisture of soil.

**AI Integration:** Using the data collected, they develop a supervised AI model to classify whether the landform would be prone to landslide or not.



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# Land, Soil, Water, Natural Vegetation and Wildlife Resources: Forest Fire

Social Science | Class 8

When learning about preserving forest and wildlife resources, students are presented with a practical problem to resolve – “Sonu’s father is a farmer, he cultivates different crops. After harvesting when he was clearing the farm by burning the straw stubble the fire spread uncontrollably to the adjoining forest, causing large scale destruction to the biodiversity.”

Using the design thinking concept, an integral part of the tinkering process, students analyze the problem and decide to develop a fire detection and alarm system.

The methodology applied by the students:

**Tinkering Integration:** Using Flame sensor they develop a forest fire detection system.

**AI Integration:** Using GSM/GPRS the fire detection system sends alarm to the authorities.



QR Code to open the detailed lesson plan

# Land, Soil, Water, Natural Vegetation and Wildlife Resources: Identifying Birds Sound

Social Science | Class 8

After students have learnt about Natural Vegetation and Wildlife, especially birds, they are presented with a practical problem – “Though, Riya is going for an excursion to Uttarakhand for her ‘project Variety of bird species of Uttarakhand as an integral part of the biodiversity’, she is not aware of all the types of birds she will find there.

Using the design thinking concept, an integral part of the tinkering process, students analyze the problem and deduce that as different species of birds have different chirps, bird sound can be used to identify the bird species.

The methodology applied by the students:

**Tinkering Integration:** Using KY-038 Sound sensor students develop dataset of audio clips of bird chirp.

**AI Integration:** Using teachable machine students develop a classification model that classify and predict the bird chirp with the bird name.



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# Human Environment: Settlement, Transport, and Communication

Social Science | Class 8

Following instruction on the various resources necessary for our daily survival, students are presented with a practical scenario – “Lankesh is an engineer who has come to visit his family in his village. He notices that people have to use a small boat to cross the river that runs through the village. The river gets very dangerous to cross during the rainy season. So he decides to help the villagers by using his skills to build a safe and strong bridge.”

Through this challenge, students understand the different types of bridges and how we use sensors to test their strength. They create an AI model that will analyze data from sensors which tells us about the sturdiness of the construction.

The methodology applied by the students:

**Tinkering Integration:** Using components such as an accelerometer-gyroscope, Arduino, pressure sensor, and wires, students understand the creation of a sensor system that tests the structural integrity of the bridge. Then, using the information collected by the sensors, the AI model will be used by the student to predict whether the structure is sturdy or not.

**AI Integration:** Using the Machine learning for kids Platform, students learn about the various parameters required to test the structural integrity of the bridge and use machine learning to predict the model's sturdiness.



QR Code to open the detailed lesson plan

# Making of Regional Cultures

Social Science | Class 8

Students will be given a practical issue following their study of the various regional cultures existing in India - “Arun recently visited his hometown for the first time. There, he visited an exquisite Sikh temple and was fascinated to see its unique features and how they were different from the other temples he had visited in the past. So, he decided to explore this further by researching different regional temples.”

Using the design thinking framework, students understand the type of temples found in different religions. They then create an image-based model that will identify the type of religion/culture a temple belongs to.

The methodology applied by the students:

**Tinkering Integration:** Using internet searches, students collect data from online sources.

**AI integration:** Machine Learning for Kids is used to train an image-based model for making predictions based on temple images found in particular religions.



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# Class 9

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# Improvement in Food Resources

Science | Class 9

After students learn about the pre-requisite agricultural practices that are followed to ensure high productive yield, they are presented with a scenario -“After the death of Deen Dayal, a farmer, his eldest son Ameya decided to take care of the farmlands. His family had always been a mass producer of Rabi Jowar and Kharif Jowar. Although the farming has been profitable, Ameya wanted to explore varied other cropping patterns that would go with cash crop farming”

Using the Design Thinking framework, an integral part of the tinkering process, students decide to develop an app that would suggest what type of crop should be grown based on various farming indicators.

The methodology applied by the students:

**AI Integration:** Using machine learning for kids application they develop an AI-enabled image classification model to identify and segregate crops.

**Tinkering Integration:** They develop a Farmer’s App for automatic identification of the crop and generating information about it.



QR Code to open the detailed lesson plan

# Why do we fall ill?: Identifying Stale Food

Science | Class 9

Students are presented with a real-world issue following their study of the spread of diseases and available preventative measures - “Prabhu is a chef and runs a restaurant in New Jersey. Two of his clients complained of food poisoning after having dined at his restaurant.”

Using the design thinking framework, an integral part of the tinkering process, students deduce that the food served could have been contaminated and they decide to develop a system to detect stale food.

The methodology applied by the students:

**Tinkering Integration:** Using Arduino Uno and MQ3 Gas sensor they developed a device that would act like electric nose and detect stale food based on the smell.

**AI Integration:** Using machine learning model they will enable the device to predict the quality of the food that it smells.



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# Why do we fall ill?: Predicting Malaria Outbreaks

Science | Class 9

After students learn about the causative organism for malaria, its vector, symptoms and preventions, they are presented with a practical problem – “Lots of people in Gopi’s village have been falling sick showing symptoms like high fever, shivers, headache, tiredness and diarrhea. The blood tests of the sick people reveal that they have malaria. Gopi is curious to know the reasons behind this and is fearful of his family being infected with the same.”

Using the design thinking concept, an integral part of the tinkering process, students analyze the problem and identify the stagnant water bodies as potential mosquito breeding areas leading to malaria outbreaks.

The methodology applied by the students:

**Tinkering Integration:** Collection of images of the areas with stagnant water and clean areas at different places (inside home and around).

**AI Integration:** Developing an AI classifying model using teachable machine which will indicate whether there is stagnant water or not.



QR Code to open the detailed lesson plan

# Why do we fall ill?: Predict Health

Science | Class 9

After sensitizing students about the types of diseases and the factors that can affect the health of a person, they are presented with a practical problem - “Sheetal lives in a village where there are hardly any hospitals. Due to changing weather, a lot of people in her village are not feeling well. She wants to use some basic parameters and develop a system that can say if a person is healthy or unhealthy.”

Using the Design Thinking framework, students explore the factors that can affect the health of a person.

The methodology applied by the students:

**Tinkering Integration:** Using sensors and Arduino Uno (tinkering tools), students develop a prototype to measure body temperature, SP02 levels using an oximeter, and heart rate using a Pulse Rate sensor.

**AI Integration:** Students use BigML, a Machine Learning technique to train a model to predict the likelihood of a person being healthy or unhealthy.



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# Is Matter Around us Pure?

Science | Class 9

Students are introduced to a real-world scenario upon learning about the characteristics and behaviour of several materials - "Ramu is a metalworker who is interested in understanding how different metals react to different environmental conditions. One day, Ramu noticed that some of his metal tools were starting to rust, and he wasn't sure why this was happening. To better preserve the tools, he wanted to classify and then store them based on their reaction to the environment."

Using the Design Thinking framework, students explore the factors that can affect the rusting of metal, such as humidity and temperature.

The methodology applied by the students:

**Tinkering Integration:** Using sensors and Arduino Uno (tinkering tools), students develop a prototype to measure humidity levels and collect data on the rusting of iron and aluminum in different conditions.

**AI integration:** Students use Machine Learning techniques to train a model to predict the likelihood of rusting based on the collected data. They will use tools like BigML to classify the type of rusting observed.



QR Code to open the detailed lesson plan

# Food Security in India

Social Science | Class 9

Students learn about food security and the role of the government in guaranteeing supply of food. They are then given a problem statement - "Alisha and Akshita read about spoilage and wastage of grains at a warehouse due to humidity. They were shocked to read about tons of food being wasted"

The class analyses and develops a system to detect optimum environment conditions for the buffer stock of grains.

The methodology applied by the students:

**Tinkering Integration:** Arduino Uno & the DHT11 sensor are used to make a hardware that measures ambient temperature and humidity.

**AI Integration:** An AI model is developed using Neural Network and KNN model to predict optimum temperature and humidity (environmental) conditions for the buffer stock.



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# A Story of Village Palampur: Ensuring Food Quality

Social Science | Class 9

A discussion is initiated in the class to understand the applicability of the concepts of Consumer rights and build solution to provide Quality fruits and reject others. They are given a practical scenario - "Zuhaib and Amit were eating the fruits their mothers packed for them. As the quality of both the fruits was different, they were quite confused"

Students ponder on the issue of low quality fruits and develop Fruit quality prediction system.

The methodology applied by the students:

**Tinkering Integration:** Using TCS230 / TCS3200 colour sensor (RGB sensor) with Arduino, students develop a prototype that detects the colour of fruits.

**AI Integration:** An AI enabled Computer Vision model is developed that uses the RGB data and predicts the quality of fruits using Neural Network and KNN classification model.



QR Code to open the detailed lesson plan

# Climate: Rain prediction

Social Science | Class 9

After sensitizing students about the unpredictability of weather and pattern of climate, students are presented with a practical problem – "Rohan is planning to go on a short trip with his friends to Chennai in the month of November and wants to understand the predictability of rainfall "

Students brainstormed various options to deal with the problem and decide to develop a monitoring system that can predict rainfall.

The methodology applied by the students:

**Tinkering Integration:** using Google Data Studio students collect the records of rainfall and possible weather condition of any region for a specific period.

**AI Integration:** Using the data from the google data studio they develop an AI enabled model using Data visualising.



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# Drainage

## Social Science | Class 9

A real-world problem is presented to students after they learn about India's major river systems – "Ram, while travelling from Meerut to Delhi to meet his uncle, was surprised to see the polluted water in the Yamuna River. He gets worried about the situation of river Yamuna."

While pondering on the problem using design thinking concept, students deduce that polluted water has low dissolved oxygen. They decide to develop a solution to check and predict water pollution by measuring dissolved oxygen content of the water.

The methodology applied by the students:

**Tinkering Integration:** A hardware is developed using Dissolved Oxygen sensor and Arduino Uno to measure the level of dissolved oxygen in the water sample to identify whether it is polluted or not.

**AI Integration:** Using the data collected, a supervised AI model is developed to predict water quality of any water sample as polluted or unpolluted.



QR Code to open the detailed lesson plan

# Electoral Politics

## Social Science | Class 9

Students are made aware and interested in India's electoral system. Post this they are presented with a real-life scenario to understand elections better - "Ruhi wants to conduct free and fair elections to elect the next head boy and girl in her school. She wants the students to have all the information about the various candidates so that the voters can have a good idea of who they are choosing."

Through this challenge, students apply the Design Thinking framework and are encouraged to ideate solutions for carrying out an election to elect a head boy in the school.

The methodology applied by the students:

**Tinkering Integration:** Using tinkering components such as LCD Display, Potentiometer, Arduino Uno and USB cable, students create an Electronic Voting Machine to cast votes and store the votes to be recounted later.

**AI Integration:** Using Natural Language Processing of AI, students create an AI chatbot to display information for each party/candidate automatically.



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# Natural Vegetation and Wildlife

Social Science | Class 9

After learning about the different types of vegetation and how it affects snowfall, students will be presented with a practical problem - "Aman lives in the hilly regions of the North. The place where he lives, has very varying temperatures. After his boards, Aman is planning to visit his grandparents. But he is worried that there will be heavy snowfall and the trains will be cancelled. So he decides to consider certain parameters and tries to predict when there could be snowfall, so that he can book his tickets accordingly."

Using a design thinking framework, students explore the factors that can affect snowfall in a particular region and how vegetation and temperature play an important role in this.

The methodology applied by the students:

**Tinkering Integration:** Using sensors and Arduino Uno (tinkering tools), students develop a prototype to measure temperature and collect images of the surrounding vegetation.

**AI Integration:** Students use machine learning techniques to train a model to predict the likelihood of frost or snow based on the temperature data and vegetation type identified through image classification.



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# Class 10

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# Electricity

Science | Class 10

A problem scenario is offered to pupils after they have learned about electricity and how it is used in household equipment - "Mrs Mittal, a middle-aged teacher purchases new washing machine, a mixer grinder and a vacuum cleaner to make her life more comfortable. The electricity bill increased by three times. Her son intervened and decided to call the technician who, informed them that the washing machine's motor was faulty and needed replacement. Mrs Mittal was perplexed."

Using design thinking framework, an integral part of the tinkering process, students reflect on how they can develop a system that can predict a faulty appliance by tracking power consumption.

The methodology applied by the students:

**Tinkering Integration:** Using Arduino Uno, ACS712 5A Current Sensor and 9V Battery, students develop a device to track the electrical characteristics of a device like current consumption.

**AI Integration:** Using Statistical domain students develop an AI model to predict if any appliance was faulty based on the data of current consumption recorded.



QR Code to open the detailed lesson plan

# Sustainable Management of Natural Resources

Science | Class 10

After students learn about conserving natural resources and the importance of saving water, they are presented with a problem scenario - "Manu, lives in a joint family and his family's livelihood is dairy farming and floriculture. Manu noticed increase in the water bill over the months. He observed that significant amount of water gets wasted when applying soap on hands, while brushing the teeth and not closing the tap properly. His clients also used the taps installed on his farm, and he was apprehensive about them touching the tap as the Covid 19 cases were on rise."

Using design thinking framework, an integral part of the tinkering process, students decide to develop a automatic tap that would get activated by human hand gesture.

The methodology applied by the students:

**Tinkering Integration:** Students develop an automatic tap using IR sensor.

**AI Integration:** They develop Computer Vision based AI model that enables the tap to get activated only by human hand gesture.



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## Sources of Energy

Science | Class 10

Students learn about the different sources of energy and their characteristics. They are then presented with a practical problem - "Aditya is a solar panel technician. He is responsible for maintaining the performance of the panels at his company. He has two different panels from manufacturers and he would like to choose which of the panels performs better. So he decides to develop a system considering certain factors and make a decision."

Using the Design Thinking framework, students explore the factors that can impact the performance of a solar panel.

The methodology applied by the students:

**Tinkering Integration:** Using sensors and Arduino Uno (tinkering tools), students develop a prototype to measure the temperature, voltage, and light intensity of the solar panel under various conditions.

**AI integration:** Students use BigML, a Machine Learning technique to build a model to predict the performance of the solar panel. The model is trained with the data collected on temperature, voltage, and light intensity.



QR Code to open the detailed lesson plan

## Light Reflection and Refraction

Science | Class 10

After learning the concept of light and the importance of reflection and refraction, students are presented with a practical problem - "Abhishek is studying medicine and is curious about what kind of radiation to the human body can cause cancer. One day, while he was out getting groceries, he noticed his phone warned him of harmful radiations in that area. So, he decided to investigate."

Using the Design Thinking framework, students understand the sources and impacts of skin cancer. To understand the effects of radiation better, they design a prototype that can record different intensities of light to predict the radiation level.

The methodology applied by the students:

**Tinkering Integration:** Using Lm35, UV ray sensors and Arduino Uno (tinkering tools), they develop a prototype to record the light intensity.

**AI Integration:** BigML, a Machine Learning tool is used to build a model to tell whether specific radiation can cause cancer or not.



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DEVELOPED BY

Subject Pedagogist, AI and Tinkering Experts

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# Consumer Rights

Social Science | Class 10

After learning about Consumer Protection Act, and steps that consumers can take to safeguard their interests, students are presented with a scenario - "Riya is helping her mother in the kitchen to prepare 'Kheer', a sweet dish, her mother tells her that these days milk quality is not the same as it used to be."

Using the design thinking framework students analyze the problem and decide to devise a system to check the purity of milk.

The methodology applied by the students:

**Tinkering Integration:** Using pH sensor, Salinity sensors and Arduino Uno a device is developed to extract values of pH and salinity of milk sample.

**AI Integration:** AI enabled classification model is trained with these values and it predicts the purity of any milk sample using the Neural Network and KNN model.



QR Code to open the detailed lesson plan

# Manufacturing Industries: Air Pollution

Social Science | Class 10

After comprehending the relationship between impact of industries on the growth of the national economy on one hand and its contribution to environmental degradation, students are presented with a practical scenario - "Vishal and his classmates were upset when the schools in Delhi closed due to excessive air pollution."

Students brainstormed various options to deal with the problem and decide to develop a monitoring system that can classify air quality as good, moderate or critical.

The methodology applied by the students:

**Tinkering Integration:** Using MQ135 sensor and Arduino Uno students develop an Air Quality Index monitoring system.

**AI Integration:** Using the data from the Air Quality Index monitoring system they develop an AI enabled model to predict air quality using Neural Network and KNN model.



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# Lifelines of National Economy

Social Science | Class 10

After sensitizing students about the importance of transportation and communication in a nation's economic development, a practical problem is presented to them - "Varun went through an article stating that road accidents due to drink and drive are increasing day by day."

Students brainstormed various options to deal with the problem and decide to develop a breath analyser system that can identify the presence of alcohol in humans body.

The methodology applied by the students:

**Tinkering Integration:** Using MQ3 sensor and Arduino Uno students develop a breath analyser system.

**AI Integration:** Using the data from the breath analyser system they develop an AI enabled model to predict presence of alcohol using text to speech chat bot and NLP model.



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# Development HDI

Social Science | Class 10

After students learn about the concept of development and economy, they are presented with a practical problem - "The COVID-19 pandemic resulted in loss of job for Rohan's brother. He wants to understand the factors contributing to the job loss and find a way to encourage skill development in people like his brother."

Using the design thinking concept, an integral part of the tinkering process, students analyze the problem and identify that during covid Human Development Index (HDI) went down.

The methodology applied by the students:

**AI Integration:** Use Machine Learning algorithm (Linear Regression) students collect dataset of HDI of previous years and predict and project the possible HDI for coming years.

**Tinkering Integration:** Students develop their technology skill of 3D printing to gain new skills as 3D printing is an additive process whereby layers of material are built up to create a 3D part.



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## Agriculture: Soil Fertility

Social Science | Class 10

Students learn about the factors affecting agricultural production. Then they are presented with a practical problem – “Kishan, a farmer has incurred losses with his crop production and is in debt. He wants to try multiple cropping to increase his revenue. But he is not sure which crops he should be sowing in his land.”

By means of design thinking students analyze the problem and identify that Nitrogen, Phosphorus and Potassium (NPK) content of the soil directly affects the crop yield. So they develop a system to predict which crop should be grown according to the NPK content in the soil.

The methodology applied by the students:

**Tinkering Integration:** Using Kaggle students collect dataset of NPK values of different soil samples. (alternatively they can collect NPK data from different soil samples using NPK Sensor and create their own dataset)

**AI Integration:** Using the NPK values, a supervised AI model is developed to predict which soil sample can grow which crops.



QR Code to open the detailed lesson plan

## Agriculture: Crop Prediction

Social Science | Class 10

Students are made curious about agriculture, how different crops grow and the factors that impact crop growth. They are then presented with a practical problem - “Ravi is a farmer who wants to increase the yield of his crops. He has experience with farming and has been growing bananas for many years, recently he thought he should start growing Kharif and Rabi crops too. He is not sure which crops will be most successful in his region based on the weather conditions. Ravi decides to use technology to help him predict which crops will thrive in his region.”

Using the Design Thinking framework, students explore the factors that can affect the temperature, humidity, and rainfall on different types of crops.

The methodology applied by the students:

**Tinkering Integration:** Using sensors and Arduino Uno (tinkering tools), students develop a prototype to measure temperature and humidity levels and collect data on the rainfall for their respective cities using various online sources.

**AI Integration:** Students use Machine Learning techniques to train a model to predict which crop can be grown based on the factors they have collected. They will use tools like BigML to make the prediction.



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# Globalization and the Indian Economy

Social Science | Class 10

Students will be introduced to the concept of globalization and the different ways it affects the day-to-day life of the people. They are presented with a practical challenge that will highlight the issue more effectively - "Foram's mother is a data scientist who works in a big business complex. Whenever Foram goes to her mother's office, she notices a lot of Wifi connections available at the workplace. That seems odd to her because there aren't nearly as many Wi-Fi connections accessible near her society. She wonders if that has something to do with where they are working."

Using the Design Thinking framework, students explore the correlation between economic growth and parameters such as microwave emissions from the wifi modems.

The methodology applied by the students:

**Tinkering Integration:** Using apps available on the phone (tinkering tools), students collect data about the strength and the number of wifi modems in different areas. They will have to collect data from various points and find the average for the same.

**AI Integration:** Students use Machine Learning techniques to train a model to predict the economic condition of an area based on the number and strength of wifi connections.



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“ AIoT integration in the school curriculum is indeed a great initiative conceptualized by NITI Aayog and CBSE in collaboration with Intel India making Artificial Intelligence and Tinkering a part of the formal pedagogy.

This approach has created a well-organized plan for effectively utilizing ATL labs to make teaching-learning efficient and engaging. This project-based learning approach will prove to enhance the social and tech skillset of the students. With this, the path to solving real-world problems and challenges has been paved that will equip individuals with the 21st century skills. ”

**Dr. Reeta Gupta**

Principal, Army Public School, Meerut Cantt

“ The whole concept of AIoT infuses dynamism in education as it connects subject pedagogies with AI and tinkering. I am happy that my teachers and students were trained for this programme and now our school is charged up to provide new learning opportunities for our students especially applications of their lessons learnt in real life. We are enjoying seeing our students brainstorm to solve existing problems and issues and this has enhanced the teaching-learning process. We appreciate the efforts of Niti Aayog, CBSE, and Intel India as they have provided us with this new and dynamic platform. ”

**Ms. Rashmi Raj Biswal**

Principal, DAV Public School Pushpanjali Enclave

“ Aditya Vidyashram has been spearheading the innovative embrace of cutting-edge technology adoption, advancing the 21st-century skills in our Atal Tinkering Lab of integrated learning culture fusing core subjects with Coding, 3D Design - Printing, Robotronics, Drone Technology, Data Science, Virtual Reality Expositions and the like. Taking control of our education experience with simulated research, multidisciplinary approach and testing grounds for enhanced efficiency, favoring cross-curricular learning involving science, social faculty, thanks to our unison with the experiential learning of Artificial Intelligence and Internet of Things. The pace-setting trends of the CBSE – AIM and Intel India are fostering our teaching of integrated AIoT curriculum. Its implementation has thus been facilitating hands-on skill-based learning to impart digital skills in our schooling culture, central to virtual experience at our simulated research and testing grounds. ”

**Dr. Nadesan Kanguayan**

Principal, Aditya Vidyashram Residential School - Puducherry

“ Integrating AI and Tinkering into curriculum pedagogy will enhance the learning outcomes of the students to make them ready for an AI-fueled world. This will help to nurture the spirit of innovation, invention, and discovery in students. From coming up with an idea to designing a solution using the tools of tinkering and then creating a prototype using AI will help students get a complete understanding of the application of technology for social good.

The collaboration of NITI Aayog and CBSE with Intel India to implement the ‘Experiential and Project Based Learning’ model in India has started training teachers and imparting knowledge while translating the entire learning of AIoT in the classrooms. It has not only nurtured tinkering among students but has also democratized their AI skills and therefore making it accessible for all. ”

**Ms. Aparna Erry**

Principal, DAV Public School, Sector 14 Gurugram

“ The collaboration between Intel India, CBSE, and NITI Aayog is the fruition of progressive and productive efforts to embed technologies of the future into the educational biome. In an endeavour that would truly complement the evolution of our learners into leaders of tomorrow, this amalgamation of three significant organizations will undoubtedly catalyse and effect change in the school culture. The AIoT program was structured in an exemplary and methodical manner. The first series of workshops were conducted to train the faculty. The knowledge gained transcended boundaries and other faculty members and students were thereby empowered. ”

**Mrs. Anita Bijesh**

Principal, DPS, Bangalore South

“The initiative of “AI Integration Across Curriculum” and “AIoT integration across curriculum” is the wonderful steps in the history of the Indian Education System by CBSE, Intel India, and Atal Innovation Mission. Training through these programmes helped me not only in developing my coding skills but also taught me how to look at a problem from the stakeholders’ point of view and then try to create solutions with coding and tinkering. I can teach Artificial Intelligence to my students by connecting it with other subjects and tinkering, which helps them in understanding the importance of tinkering, AI, and their usage with other subjects such as Social Science and Science.”

**Ms. Meena Bisht**

TGT Computer Science, Army Public School, Noida

“The Fourth Industrial Revolution is driven by Artificial Intelligence (AI) and Robotics. AIoT integration with subjects is an excellent concept. This integration will certainly help students in acquiring 21st-century skills. They will be empowered with skills in demand for employment. The workshop conducted by CBSE – Intel India team on AIOT integration had a lot of practical exercises and worthwhile information which we are using in our teaching now. The information and acquired skills learned in this workshop have greatly helped us in making our teaching interactive. The well-designed lesson plans are helping us in developing the critical thinking and analytical skills of students. I am thankful for having the opportunity to attend the workshop and be part of this pilot project.”

**Mr. Sonu Lohchab**

DAV Public School, Sector 49, Gurugram

“As per the NEP-2020, it is imperative to pave the way for a holistic, student-centric, flexible, and multidisciplinary educational approach to young learners. AIoT Integration has provided the teaching fraternity with such a plan to make this possible. This project will prove to create an innovative mindset among learners, thereby making them capable to work around sustainable development goals. The approach is indeed laying the foundation for democratizing Artificial Intelligence as well as Tinkering with gradually evolving the traditional education systems to cater to the needs of the 21st century.”

**Ms. Yukti**

Army Public School, Meerut Cantt

“At the onset, I would like to thank CBSE, NITI Aayog, and Intel for having launched a program for Integrating AI and tinkering into curriculum pedagogy. This will help students to come up with an idea to design a solution using the tools of tinkering and then create a prototype using AI to find a solution to the problem at hand and get a complete understanding of the subject.

I got the opportunity to attend the 2-day exhaustive workshop where we were given an insight into the integrated pedagogy plan and hands-on training on how to go about developing a lesson plan integrating AI tinkering and pedagogy, which we master trainers took back to our school and now have made sure that this percolates to all the teachers in the school and finally to the students.”

**Ms. Anshu Banerjee**

Uttam School for Girls, Ghaziabad

“The introduction of AIoT in curriculum is something that could not be imagined a few years ago. Undoubtedly, it was a thought out of the box to foster creativity, imagination, and skills. It has the characteristic of divergent views and convergent thinking. The Session of AIoT conducted by CBSE, NITI Aayog, AND Intel India in collaboration was indeed the best one that I had attended.

Back in school, the session of AIoT with students and teachers was overwhelming, they felt that they are learning something different. I could see the sparkle in their eyes and eagerness to learn. The best part of all this is that my school considers me an innovative teacher. Students of class 6 also interact with me and talk to me about their ideas. They wait outside my lab early in the morning just to tell me what progress they have made. I feel that I am a teacher who encourages curiosity in her students and this impact will last for a lifetime.”

**Ms. AP Shreelatha**

Bal Bharati Public School

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