ARTIFICIAL INTELLIGENCE INTEGRATION IN SCIENCE

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ABOUT THE BOOK

Artificial Intelligence (AI) is a Cognitive Science and the history of its evolution suggests that it has grown out of the knowledge derived from disciplines such as Science, Mathematics, Philosophy, Sociology, Computing and others. Hence, it is fair for any education system to recognize the importance of integrating AI Readiness to maximize learning across other disciplines.

AI is being widely recognized to be the power that will fuel the future global digital economy; and has gained geo-strategic importance. A large number of countries are striving hard to stay ahead with their policy initiatives, to get their youth ready to function in an environment driven by AI and other emerging technologies.

India's own AI Strategy identifies AI as an opportunity and solution provider for inclusive economic growth and social development. The report also identifies the importance of skills-based education (as opposed to knowledge intensive education), and the value of project related work in order to "effectively harness the potential of AI in a sustainable manner" and to make India's next generation 'AI ready'.

CBSE has introduced Artificial Intelligence as an optional subject at Class 9 from the Session 2019-2020 onwards and has been conducting trainings for Teachers on how to use AI in the Classroom. A Training Video has also been prepared to assist the same.

CBSE has also announced AI as a multi-disciplinary integrated pedagogical approach to further enhance teaching and learning across classes 6 to 10. This document is an attempt to propose how schools may train the trainers to match relevant topics/ themes from the curricula with AI concepts. It contains details on the importance of Artificial Intelligence and Artificial Intelligence Tools as a pedagogical support for experiential learning. Guidelines for Teachers can be found in the form of Lesson Plans integrating AI in Classroom Teaching.

How this Integration Document was created

In keeping with the vision of CBSE to introduce and train Teachers on AI readiness, and the usage of AI in classroom teaching and learning practices; a series of online webinars were conducted with AI experts and Teachers of various Subjects from CBSE Schools. (*see Figure 1*)

Lesson Plans in each Subject were discussed and written, and a suggestive list of activities and projects integrating Artificial Intelligence into regular subject teaching was curated and compiled. An AI Glossary, relevant to each Lesson Plan was created to facilitate ease of reference and usage. At the same time a comprehensive glossary of AI Tools used by all the subject teachers has been added to each of the subject document. for reflection and necessary follow up by teachers.

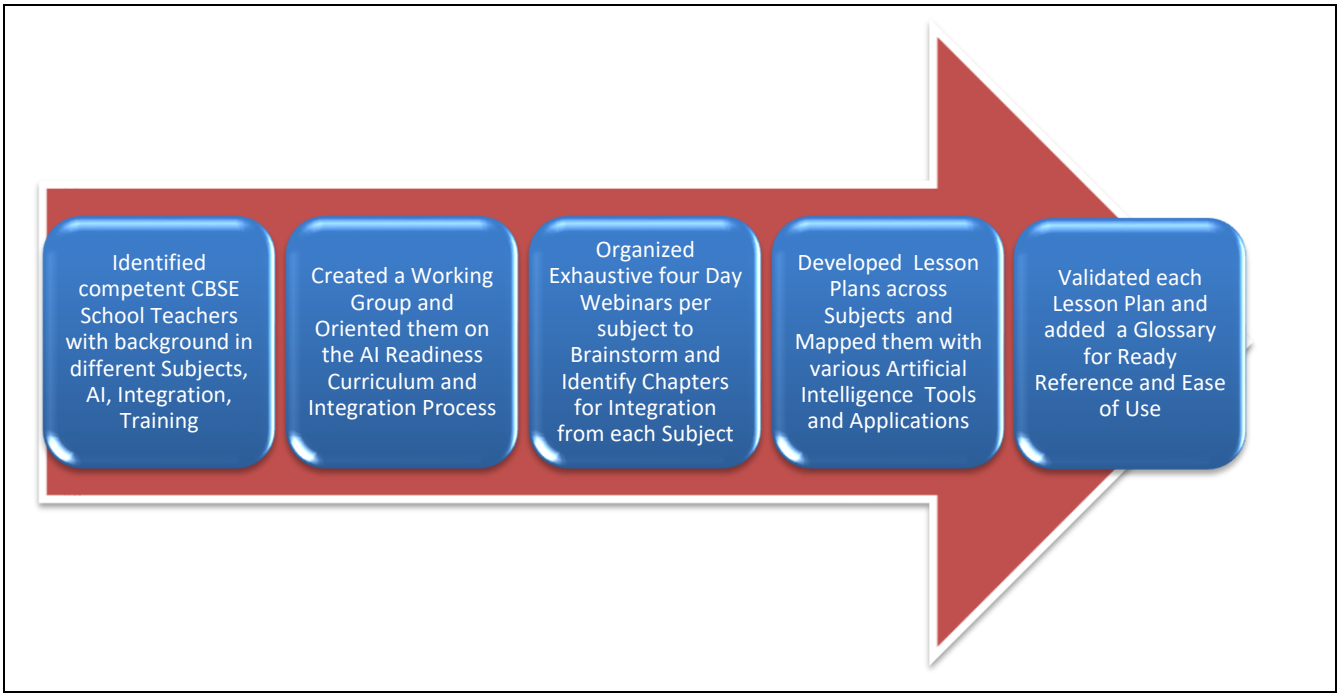


Figure 1: How this Integration Document was created

It is important to understand that AI is one of the cognitive science disciplines that provides tools to build intelligence in contrast to other disciplines that just study and analyze the external behavior of intelligent agents. Realizing this need, it has been decided that all teachers teaching in CBSE schools should familiarize themselves with the prevalent AI knowledge and use it to make learning of their subjects more effective and student centered. It is visualized that such a step would help to build larger understanding of AI among teacher and student communities.

It is highly recommended that teachers explore the Exemplar Lesson Plans and Glossary in this document, and go beyond what has been showcased, to develop more such exemplars and teaching methodologies integrating Artificial Intelligence in day to day learning across subjects, for students.

Disclaimer: **Individual lesson plans have been created and edited by the contributing teachers as per their respective beliefs and understanding. The originality of their perception has been maintained while curating this document**

CONTENTS

CHAPTER 1

AN INTRODUCTION TO ARTIFICIAL INTELLIGENCE

1.1 What is Artificial Intelligence?

Artificial Intelligence has always been a term which intrigues people all over the world. Artificial Intelligence (AI) refers to the ability of machines to perform cognitive tasks like thinking, perceiving, learning, problem solving and decision making; it is inspired by the ways people use their brains to perceive, learn, reason out and decide the action.

Various organizations have coined their own versions of defining Artificial Intelligence. Some of them are mentioned below:

NITI Aayog: National Strategy for Artificial Intelligence

AI refers to the ability of machines to perform cognitive tasks like thinking, perceiving, learning, problem solving and decision making. Initially conceived as a technology that could mimic human intelligence, AI has evolved in ways that far exceed its original conception. With incredible advances made in data collection, processing and computation power, intelligent systems can now be deployed to take over a variety of tasks, enable connectivity and enhance productivity.

World Economic Forum

Artificial intelligence (AI) is the software engine that drives the Fourth Industrial Revolution. Its impact can already be seen in homes, businesses and political processes. In its embodied form of robots, it will soon be driving cars, stocking warehouses and caring for the young and elderly. It holds the promise of solving some of the most pressing issues facing society, but also presents challenges such as inscrutable “black box” algorithms, unethical use of data and potential job displacement. As rapid advances in machine learning (ML) increase the scope and scale of AI’s deployment across all aspects of daily life, and as the technology itself can learn and change on its own, multi-stakeholder collaboration is required to optimize accountability, transparency, privacy and impartiality to create trust.

European Artificial Intelligence (AI) leadership, the path for an integrated vision AI is not a well-defined technology and no universally agreed definition exists. It is rather a cover term for techniques associated with data analysis and pattern recognition. AI is not a new technology, having existed since the 1950s. While some markets, sectors and individual businesses are more advanced than others, AI is still at a relatively early stage of development, so that the range of potential applications, and the quality of most existing applications, have ample margins left for further development and improvement.

Encyclopedia Britannica

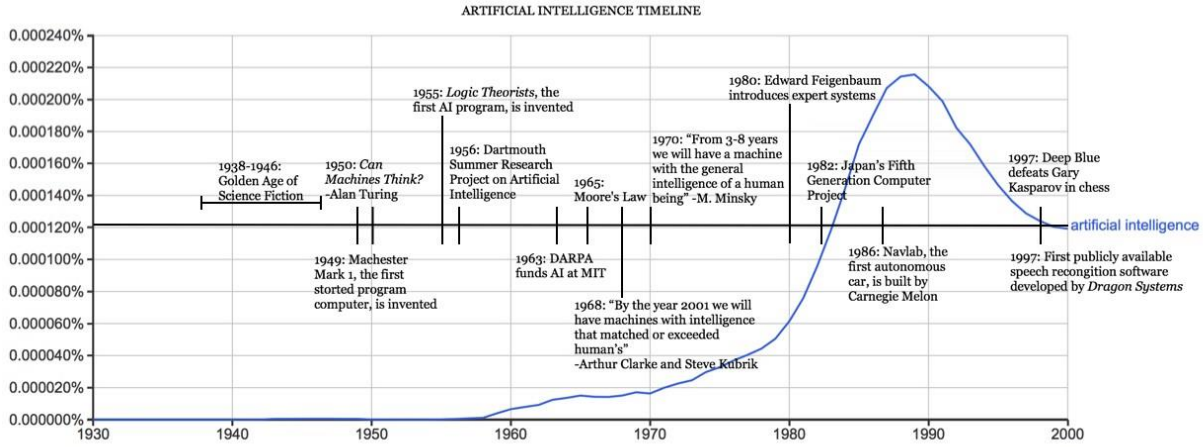
Artificial intelligence (AI), is the ability of a digital computer or computer-controlled robot to perform tasks commonly associated with intelligent beings. The term is frequently applied to the project of developing systems endowed with the intellectual processes characteristic of humans, such as the ability to reason, discover meaning, generalize or learn, from past experience.

In other words, AI can be defined as:

AI is a form of intelligence, a type of technology and a field of study. AI theory and development of computer systems (both machines and software) are able to perform tasks that normally require human intelligence. Artificial Intelligence covers a broad range of domains and applications and is expected to impact every field in the future. Overall, its core idea is building machines and algorithms which are capable of performing computational tasks that would otherwise require human like brain functions.

1.1.1 History of AI – Live Science

The beginnings of modern **AI** can be traced to classical philosophers' attempts to describe human thinking as a symbolic system. (see Annexure 4.5) But the field of **AI** wasn't formally founded until 1956, at a conference at Dartmouth College, in Hanover, New Hampshire, where the term "**Artificial Intelligence**" was coined. The graphic below appropriately explains why AI is a live science, what are the ups and downs in the pace of AI journey and how AI progressed in this domain from the year 1930-2000.

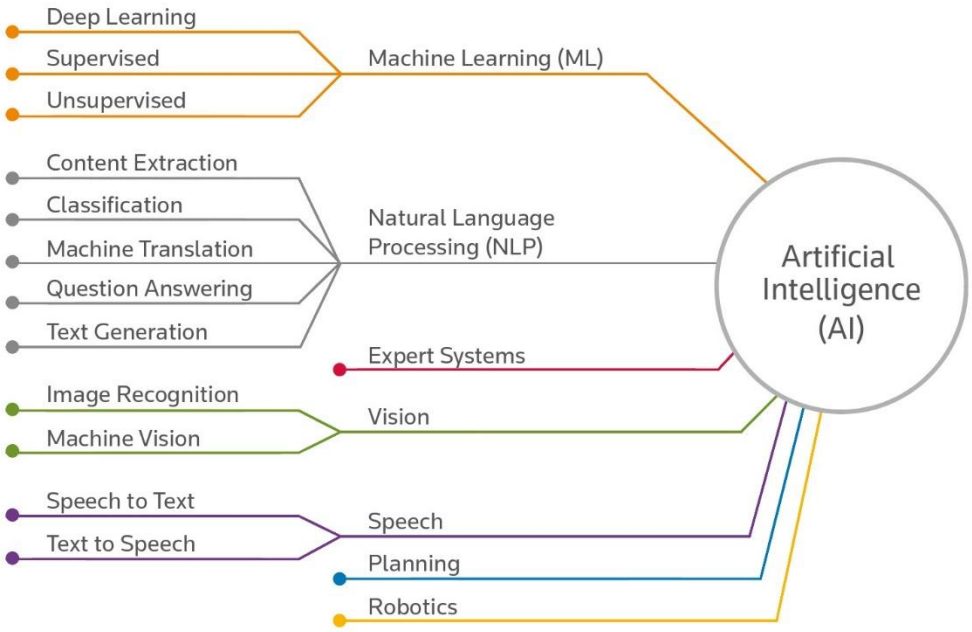


http://sitn.hms.harvard.edu/flash/2017/history-artificial-intelligence/

1.2 What do we understand by AI in EDUCATION?

An effective education system has the dual responsibility to develop the most critical resource (i e the human resource) of a nation.1-, that the younger generations must be educated in a way that they are 'ready for life' and are positive contributors to the advancement & enrichment of their nation.2- , they must be exposed to such learning environments with the help of updated tools and enlightened teachers so that their learning outcomes can be maximized and suited to the potential of every learner. In order that modern-day education achieves its goals of making its students 'AI Ready', it is imperative to know what K-12 learners must experience and confront in their day to day life.

AI is underlying the multitudes of its applications in the world; it encompasses and works on an array of capabilities which have universal application in different areas of study and operations. Some of the most important AI competencies with significant commonalities and connections with those of the other fields of study are shown in the graphic below.



http://www.fullai.org/short-history-artificial-intelligence/

A careful study of the above graph would lead us to believe that many of the technologies and the underlying principles that each of these follows, have a strong correlation with the teaching learning processes at school as well as college levels. Hence it is necessary that AI should not only be introduced as a subject in the school curricula, but also should become a link to teach other subjects at all the levels. Many of the AI based applications are now available to facilitate a learner to learn in his own unique way and at his own pace.

1.3 What is CBSE's initiative encompassing Artificial Education?

Making school students 'AI Aware' or forging 'AI Readiness' among students is a huge task indeed. Central Board of Secondary Education has taken a '***twin initiative'*** in this regard.

First is to introduce AI as an elective subject in classes 8,9 and 10. To begin with, schools have to apply to CBSE and be approved to run this course. AI curriculum for classes 8 and 9 has been chalked out and a Facilitators' Handbook has been produced. CBSE is also supporting extensive teacher training for the teaching of AI in schools.

The ***Second*** part of *CBSE* initiative deals with the premise that AI is a Cognitive Science which can be linked to various subjects that concern themselves with cognition and reasoning. Almost every one of the school subjects would fall in this domain. Be it - Mathematics, Computing, Neuro-Sciences, Psychology, Physics, Economics, Sociology, Philosophy, Languages and some others. It is, therefore, mandated by CBSE that all its schools begin to integrate AI with other disciplines from classes 1 -12.

1.4 What is the rationale for this Twin Initiative?

Initiative 1: Artificial Intelligence permeates the length and breadth of the world we live in today. Our young generation is witnessing many uses of AI every day. While Google manages our mail accounts, it also makes suggestions about what words to use to respond to a given email and/ or project follow up reminders. Facebook not only connects us with friends but also makes suggestions about our priorities, personal needs and preferences. Today we witness smart parking spaces as well as have cars that park themselves. In many advanced countries the traffic is monitored, controlled and managed by using the data collected of moving traffic and prevalent weather conditions. Chat bots collect data for big and small businesses to assess the market requirements of their products and also support the respective business houses in interaction with the customer and resultant satisfaction. There are also AI powered devices to support households in simple tasks such as cleaning etc. All the domains of life - from medicine to manufacturing to national security and defense – are currently getting impacted by the use of Artificial Intelligence. Space missions, which extensively use unmanned space shuttles and unmanned vehicles to traverse the unknown areas of other planets, collect tremendous data not only to understand the planet they go to but also to acquire intelligence about the betterment of their own operations in future. Hence, it is essential that students of today should study this domain to understand and later be able to expand this knowledge in their own interest and in the interest of humanity.

Initiative 2: It is important to understand that AI is one amongst the cognitive science disciplines that provides tools to build intelligence in contrast to other disciplines that just study and analyze the external behavior of intelligent agents. Realizing this need, it has been decided that all teachers teaching in CBSE schools should familiarize themselves with the prevalent AI knowledge and use it to make learning of their subjects more effective and student centered. It is visualized that such a step would help to build larger understanding of AI amongst the teacher and student communities.

This document is an attempt to suggest how schools may train the teachers of class 6 –10 to relate to the relevant topics/ themes from their respective curricula with technologies that AI deploys. The document will also showcase to the teachers the AI based tools that can support and augment learning across disciplines, in and out of the classrooms. The extensive AI glossary and the App Matrix is an effort to include a list of varied resources for teachers to extend the integration activity to other topics of their respective subjects.

1.5 What do we mean by AI Integrated Education?

AI integration with the other school disciplines is to be viewed from two different perspectives.

Perspective 1: While exploring the possibilities to integrate subjects with AI, it was felt that it can be a two-way process. The teacher may select a topic from the subject that easily lends itself to any one of the AI concepts. He/she would, then, either select the AI concept as a tool to teach the subject topic chosen by him/her or using the understanding of the topic, he/she may be able to show a linkage to AI knowledge and usage.

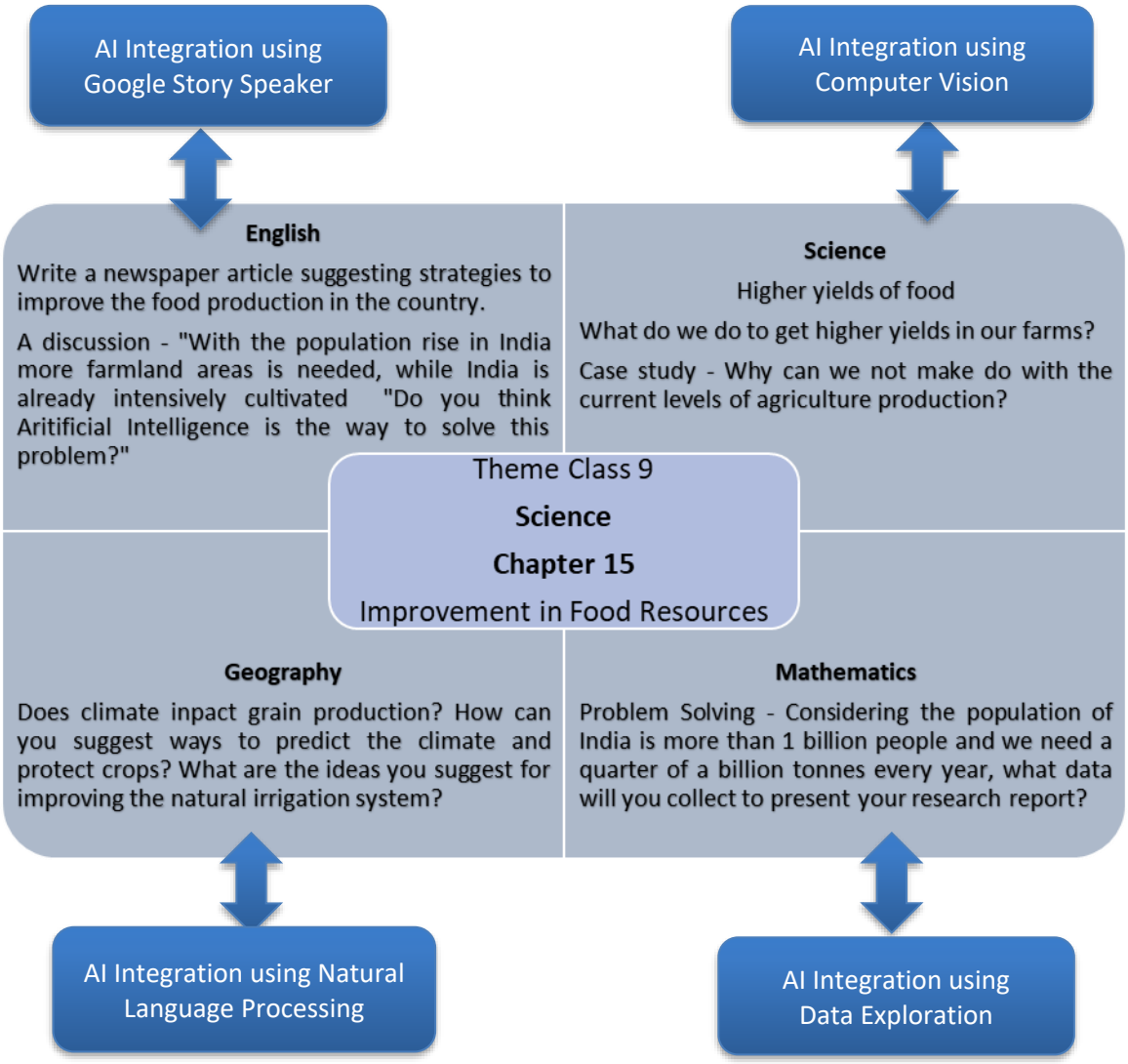
For example: 'Data Collection' is a familiar task in Mathematics and 'Data Acquisition' is an important basic AI concept. The teacher may use an AI based app to demonstrate Data collection in a Mathematics Class or teach the concept and functionality of the AI application through their understanding of the Data Collection operations in Mathematics.

Perspective 2: A practicing teacher may consider one subject +AI integration with it, which is a simpler and more functional approach.

The other approach could be to have inter disciplinary integration, in which the teacher may pick up one such topic from her own subject that has relevance to other subjects also. Then, in consultation with other teachers, the four of them could explore the same topic to achieve the learning outcomes of their respective subjects, while at the same time integrating each subject with AI. (see example 2 below)

The former approach is feasible in normal classroom teaching, the later would have to take the shape of a project and would have to be conducted in large class groups over a span of time.

Interdisciplinary Integration with Artificial Intelligence - Class 9



Since, Artificial Intelligence is a Cognitive Science and the history of its evolution suggests, it has grown out of the knowledge systems derived from other disciplines like Science, Mathematics, Philosophy, Sociology, Computing and others, it is fair for students to see the linkages. Hence, it is fair for any education system to recognize the importance of its integration with the teaching of other disciplines, to maximize learning.

1.6 What would the students do in an AI integrated Class?

A working group at CBSE has put together 7 Big Markers that may be adopted to develop a structured action plan by the teacher for K-12 learners.

Marker 1. *Identifying the problem* is the *starting point of the learning cycle*; students of all levels without any exception must be exposed to the skill of scoping and identifying the problem. Having done so, the learners of all ages must learn the way to state the problem to their parents/ teachers/ themselves/ community/ team, they are working with or working for.

Marker 2. *Data acquisition related to the identified problem is another big domain for learning* and it is a logical next step to proceed with. Such an exercise will prepare the students to attempt the nuances of problem solving which is also an important aspect of the AI project cycle.

Marker 3. *Computers are machines which can also 'see', 'hear' and 'speak'*. So, as such, they can be used to collect data for us. Many applications are now available which make our machines very useful for this purpose. An exposure to such capabilities of the machine needs to be explained to students of all grades. By using AI in teaching, the expectation is that the teacher will lead students to identify these tools and consequently use them to improve the learning process.

Marker 4. *Learners must learn to represent the collected data in the form of identifiable models*. Once the students have the data to solve the problem, they can progressively be made to develop the skill of representing the collected data in visual presentations in the form of graphs, charts etc. The understanding and skill to build such comprehensible models is critical learning for a 21st century student. *Computers are the given machines which help store data and represent models*.

Marker 5. *Computers also learn by themselves from the newer data acquired by them to build newer and better models in the future.* With interaction of inputs from the training data available to the machines, just like the human mind, the machines are able to produce entirely different models/ representations. Students of all grades need to be made aware of such capabilities which make machines "intelligent".

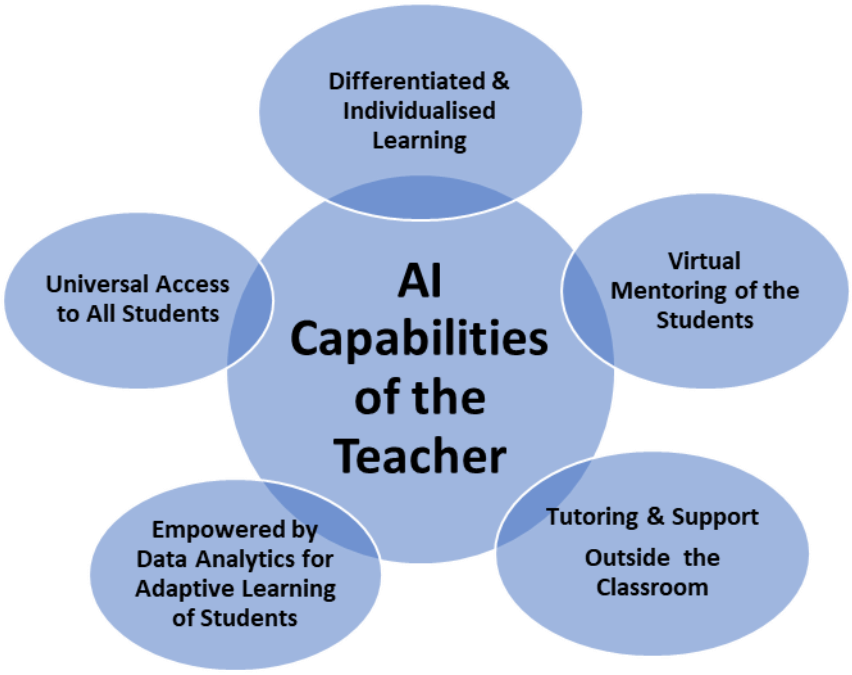
Marker 6. *For training the machine, it needs to interact with humans (intelligent agents); Though such interactions make the machine more and more intelligent, it can never be presumed that the machine would ever be as intelligent as humans are.* It is highly impossible for the machine to reach the capabilities of the human mind. The Robots (as these machines are sometimes called), would at their best be able to improve the efficiency of human beings and never really be able to replicate it. Such debates need to be part of discussions in the class when AI is integrated with other subjects.

Marker 7. *AI applications can be beneficial or harmful in the long run*. What, when, where and to what extent should these AI applications be built? At what stage and in what ways can an AI based application be used or not used? Students of all age groups in class 1-12 should be sensitized to AI ethics through different simulations, role plays, discussions and debates.

1.7 How can AI integrated teaching help teachers to achieve the desired learning outcomes?

While the debate regarding how much screen time is appropriate for children rages on among educators, psychologists, and parents, Artificial Intelligence and Machine Learning are additional emerging technologies that are beginning to alter education institutions and changing how education may happen in the future. Even though most experts believe the critical presence of teachers is irreplaceable, there have to be many changes to the way a teacher's job is done and to educational best practices.

As AI educational solutions continue to mature, the hope is that AI will help fill need gaps in learning and teaching and allow schools and teachers to do more than ever before. AI can drive efficiency, personalization and allow teachers some extra time to deploy their understanding and adaptability—uniquely human capabilities, to teach, where machines would struggle. By leveraging the best attributes of AI machines and teachers, the education system will be driven towards the best outcome for students. Since the students of today will need to work in a future where AI is no longer a notion but is the reality, it's important that our educational institutions expose students to updated technologies and their usage. No one can deny the fact that AI capabilities would help teachers to achieve desired learning outcomes, in the following five-fold ways:



Once AI tools are in operation, the teacher will be facilitated, to have more spare time in the classroom. So, she/he can now focus on unique learning styles of her students. Having assumed the AI capabilities, she/he can also in turn, focus suitably on the challenge of developing the skills of language processing, reasoning and cognitive modelling.

1.8 Does AI integration in Education promote 'Effective Pedagogy' in the classroom?

Since all cognitive domains of education relate very closely to the concept of AI, it offers ample opportunities for student engagement that cannot be found in lecturing out of the textbooks within the fixed four walls setting of the classroom. In an era termed as AI SPRING, AI and machine learning are growing dynamically, they each have the potential to propel the other forward and accelerate the learning frontiers in a synergistic fashion, along with the creation of newer innovative technologies. It is universally acknowledged that AI would be the source and the cause of improving the teaching- learning methodology in the classroom.

In many parts of the world, especially in advanced nations, Machine Learning algorithms in the education space, have already begun helping teachers fill the gaps, in the Subjects students are struggling with the most.

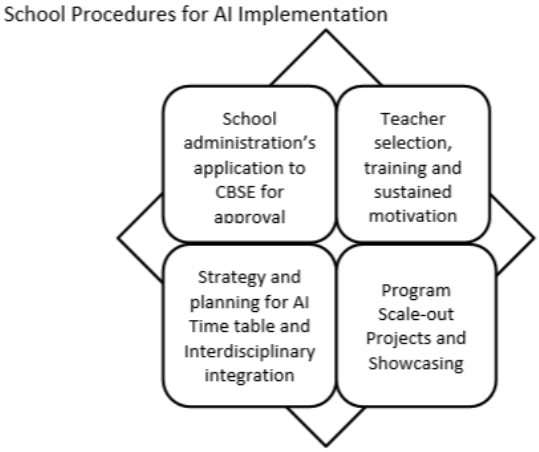
As of today, the list of such AI based pedagogical practices is long. A motivated and enlightened teacher would come across many such tools and practices during her research which can be profitably used by her from time to time in the interest of her students.

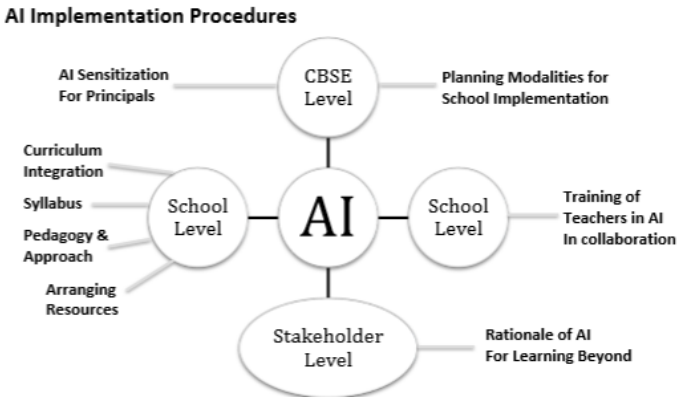
1.9 What is the role of Schools in the success of CBSE directive for AI integrated Learning?

Much of the professional world which today's student is going to face 10 or 15 years from now, will be increasingly based on and derived from AI technologies. Hence there is dire need for the present generation of young students to be exposed and empowered enough to understand and practice AI competencies in order to remain relevant to the times they live in. In doing so, while they benefit from an AI embedded world now, later in their lives, they must also learn how to identify and perceive the challenges that extensive use of AI may pose. Taking a cue from proactive thinking of CBSE about its responsibility towards the students studying in its affiliated schools, it is high time that the leadership in CBSE schools in particular, pledge their support to the task of sensitizing their students about AI in their lives and teach them to be positive contributors towards AI development in the larger interest of the society they live in.

The outcome of the twin initiatives of CBSE would depend on the way schools perceive and implement it, the way teachers engage with it and plan some of their lessons, so that the resultant understanding about AI amongst the students is logical. Once the trigger is positive, we believe a large population of students would go on an 'auto' mode to explore AI domains and get sensitized to AI applications. It has been observed that some teachers suffer from a complex that anything that is technology is computer based and anything that is computer based is beyond their comprehension or reach. It is important to reiterate here that once the teacher accepts the reality of AI inevitability in modern day living and its enhanced role in the future, she/he would view this document and the suggestions made herein with an open mind. We hope that the support material and examples provided in this document will serve as a useful trigger for practicing teachers to use AI as a tool to enhance learning. With such a positive mindset, the schools and teachers would not only augment their own AI awareness, but will also be seen empowering their students with the requisite AI capabilities. They will find umpteen examples in their respective environments to connect the knowledge of individual subjects to AI technologies. It won't be an exaggeration to state that many scenarios will be created in such a collaboration of the teachers and the learners that AI integration will be an important case in study maximizing student learning outcomes in such schools.

AI Implementation Procedures





1.10 How would this AI integrated Learning help meet the national goals-NCF/ NCERT/ NA

This thought process is completely in sync with the National Policy stipulated by NITI Aayog in '**Skilling for the AI Age – Getting India Ready for the AI Wave**'. Even the National Curriculum Framework developed as far back as 2005, and the Position Paper on Education Technology have echoed similar outcomes that AI integration is expected to achieve.

NITI Aayog Vision

"The Education sector needs to be realigned in order to effectively harness the potential of AI in a sustainable manner. In primary and secondary schools, there is a need for transition to skill-based education in subjects relevant to AI. Often criticized for being overly knowledge intensive, Indian education is in urgent need of transition in subjects relevant to STEM, or computer-based education. As jobs based on technology become prominent, so will the need to develop applied skills in a continuously changing environment.

Increased amount of project work across education levels, promoting schemes like Atal Tinkering Labs (ATL) in schools, necessary changes in curricula in schools, are some of the steps that need to be considered."

The National Curriculum Framework 2005

The aims of education as stated in the NCF are as follows:

Seeking guidance from the Constitutional vision of India as a secular, egalitarian and pluralistic society, founded on the values of social justice and equality, certain broad aims of education have been identified in this document. These include:

- Independence of thought and action
- Sensitivity to others' well-being and feelings
- Learning to respond to new situations in a flexible and creative manner
- Pre-disposition towards participation in democratic processes, and
- The ability to work towards and contribute to economic processes and social change.

NCF has laid down five guiding principles for curriculum development:

- Connecting knowledge to life outside the school
- Ensuring that learning shifts away from rote methods
- Enriching the curriculum so that it goes beyond textbooks
- Making examinations more flexible and integrating them with classroom life, and
- Nurturing an overriding identity informed by caring concerns within the democratic polity of the country.

And for the aims of teaching, NCF states that:

- No system of education can rise above the quality of its teachers, and the quality of teachers greatly depends on the means deployed for selection, procedures used for training, and the strategies adopted for ensuring accountability
- Teaching should aim at enhancing children's natural desire and strategies to learn
- Knowledge needs to be distinguished from information, and teaching needs to be seen as a professional activity, not as coaching for memorization or as transmission of facts.
- Activity is the heart of the child's attempt to make sense of the world around him/her. Therefore, every resource must be deployed to enable children to express themselves, handle objects, explore their natural and social milieu, and to grow up healthy.

The NCERT Position Paper on Education Technology (**2.6) in its section 6.4.5 on** In School Education **states that:**

- "Move from a predetermined set of outcomes and skill sets to one that enables students to develop explanatory reasoning and other higher order skills.
- Enable students to access sources of knowledge, interpret them and create knowledge rather than be passive users.
- Promote flexible models of curriculum transaction.
- Promote individual learning styles.
- Encourage use of flexible curriculum content, at least in primary education, and flexible models of evaluation."

It further clarifies that:

"Computers are programmable devices. This very fact makes it possible for users to make demands on these machines. This implies two things: first, that the computer ought to be capable of responding to intuitive demands, and second, that the user communicates in a language that the computer can interpret." and that "The creative potential of the computer, and the liberating potential of the internet can only be unleashed when we actively make these kinds of demands of these technologies. The students of the future should be oriented to this possibility, allowing them to stand their ground amidst the technology mediated onslaughts of the modern world. Integrating ICT into education will require that these aspects of the technology are catered to as a whole."

It is important to note that NCF observations were made as early as 2005 when the noise about AI was not heard much, yet the 'writing on the wall' lends itself to endorsing the recent developments of AI in Education.

Hence, **CBSE in its Circular No 14/ 2019** dated 09-03-2019 has clearly communicated that:

"Artificial Intelligence (AI) is being widely recognized to be the power that will fuel the future global digital economy. AI in the past few years has gained geo-strategic importance and a large number of countries are striving hard to stay ahead with their policy initiatives to get their country ready. India's own AI Strategy identifies AI as an opportunity & solution provider for inclusive economic growth and Social development. The report also identifies the importance of skills-based education (as opposed to knowledge intensive education), and the value of project related work in order to "effectively harness the potential of AI in a sustainable manner" and to make India's next generation to be 'AI ready'.

As a beginning in this direction, CBSE has introduced Artificial Intelligence as an optional 6th subject at Class 9 from the Session 2019-2020. To enhance the multidisciplinary approach in teaching learning and also to sensitize the new generation, it has been decided that Schools may start AI "Inspire module" of 12 hours at Class 8 itself.

1.11 OPTIMISM

It is interesting to present the following content of “Optimism” from the History of evolution of AI to add to the reader’s understanding that seemingly unimaginable and impossible events actually happen due to human effort, if a streak of positivity and optimism is maintained during the course of action.

*The Optimism

The first generation of AI researchers made these predictions about their work:

- 1958, H. A. Simon and Allen Newell: "within ten years a digital computer will be the world's chess champion" and "within ten years a digital computer will discover and prove an important new mathematical theorem."[57]
- 1965, H. A. Simon: "machines will be capable, within twenty years, of doing any work a man can do."[58]
- 1967, Marvin Minsky: "Within a generation ... the problem of creating 'artificial intelligence' will substantially be solved."[59]
- 1970, Marvin Minsky (in *Life* Magazine): "In from three to eight years we will have a machine with the general intelligence of an average human being."[60]

https://en.wikipedia.org/wiki/History_of_artificial_intelligence

The ‘Optimism’ showcased by the researchers above, has to be simulated by the practicing teacher in terms of AI Integration in their classrooms making their pedagogy more effective and maximizing the learning outcomes of their students.

1.12 National Education Policy 2020

As per the National Education Policy 2020

The world is undergoing rapid changes in the knowledge landscape. With various dramatic scientific and technological advances, such as the rise of big data, machine learning, and artificial intelligence, many unskilled jobs worldwide may be taken over by machines, while the need for a skilled workforce, particularly involving mathematics, computer science, and data science, in conjunction with multidisciplinary abilities across the sciences, social sciences, and humanities, will be increasingly in greater demand

India is a global leader in information and communication technology and in other cutting-edge domains, such as space. The Digital India Campaign is helping to transform the entire nation into a digitally empowered society and knowledge economy. While education will play a critical role in this transformation, technology itself will play an important role in the improvement of educational processes and outcomes; thus, the relationship between technology and education at all levels is bidirectional.

Given the explosive pace of technological development allied with the sheer creativity of tech savvy teachers and entrepreneurs including student entrepreneurs, it is certain that technology will impact education in multiple ways, only some of which can be foreseen at the present time. New technologies involving artificial intelligence, machine learning, block chains, smart boards, handheld computing devices, adaptive computer testing for student development, and other forms of educational software and hardware will not just change what students learn in the classroom but how they learn, and thus these areas and beyond will require extensive research both on the technological as well as educational fronts

CHAPTER 2

HOW to INTEGRATE AI in SCHOOL TEACHING – A CALL TO TEACHERS

2.1 AI is NOT ALONE

AI does not operate in silos nor is it a stand - alone field of study or practice. Many a times in Chapter 1, it has been said that it drives its knowledge as well as has its applications across other domains of knowledge. See below how the school domains of study (both formal and informal) interact with the concepts that Artificial Intelligence follows.

AI CROSS BREEDS WITH OTHER SUBJECTS

Subject Domain	What is Common with AI domain
Psychology	How people perceive information, process it and build knowledge; how they behave
Philosophy	Mind as a physical entity, methods of reasoning, basis of learning, foundations of language, rationality and logic
Neuro-Science	How the basic information processing units - neurons process information
Mathematics	Algorithms, computability, proof, methods of representation, tractability & decidability
Statistics	Learning from data, uncertainty/ certainty of modelling
Economics	Rational economic agents, usefulness of data & models, decision theory
Linguistics	Grammar, syntax, knowledge representations
Computer Science	Building computers
Cognitive Sciences	Processes & things in nature, interpretation of different phenomena & their impact

2.2 PRINCIPLES of AI INTEGRATED LEARNING

AI creates some Essential Learning Experiences which are:

- Experiences of creating through the process of problem solving
- Experiences of informed decision making
- Experiences of self-reflection, values and ethics.
- Experiences for exploring future career opportunities
- Experiences of demonstrating responsible citizenship

2.3 OBJECTIVES of AI INTEGRATED LEARNING

AI integrated learning would help to develop Key Competencies for Lifelong Learning, some of which are:

- Acquiring subject knowledge using AI as a tool
- Learning problem solving
- Innovativeness and taking initiative
- Application across key disciplines
- Developing interaction and Learning to Be
- Assuming Social responsibilities and applications
- Learning Vocational ethics
- Applying Communication skills

2.4 PRACTICE 'AI+X' PARADIGM for INTEGRATION

So, this could be the starting point for a practicing teacher. The teacher needs to go through the following steps to integrate her normal lesson plan with AI.

Step 1- Identify the topic from the subject for which the subject teacher has certain teaching pedagogy; let us call it 'X'

Step 2- Research to find 'AI' concepts that show conceptual commonality with the subject and the topic. Research to find 'AI' can be done with the help of any of the four resources given below

A) through online search
B) from the exemplars provided in this document
C) from the list of support material provided in this document in terms of 'Additional Resources' 'AI Concepts' and 'Glossary'

Step 3- Attach this 'AI' to 'X' in your lesson planning.

A) Discuss your lesson plan related requirement with your department colleagues or the computer faculty. This now becomes X+AI or AI +X, where X is your subject topic.

Such **"AI+X"** or **"X+AI" paradigm** is advocated in our national policy document also.

2.5 ARTIFICIAL INTELLIGENCE CONCEPTS PERVADE MAINSTREAM DISCIPLINES

Artificial Intelligence cannot be divorced from other disciplines; its evolution and development is mutually interlinked as shown in the table given below. Hence both the fields need to be linked for mutual benefit. As educators, it is the right step to consider integration of AI with the other school disciplines where two different approaches are possible:

a) AI as a tool to learn Mathematics, English, Science or Social Science or

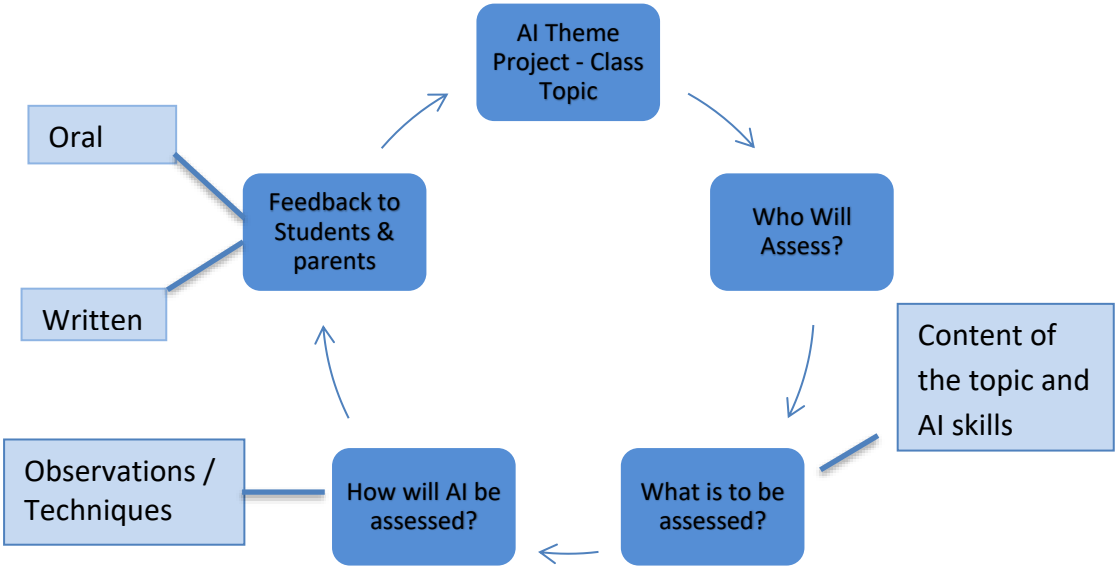
b) Language or Mathematics and other disciplines as a tool to learn Artificial Intelligence

2.5.1 Skills Assessed

After completion of each unit, the students may be evaluated for the following skills:

Conceptual Skills	Technical Skills	Life Skills
- Problem Scoping - Problem statement - Data Acquisition - Data Exploration - Graphical Representation of data/ building models - Neural networks - 3 domains of AI – Data, Computer Vision & Natural language Processing - AI Applications	- Ability to use AI powered Tools - Identifying linkage of AI Applications with knowledge systems	- Thinking skills - Problem Solving skills - Decision making Skills - Social Skills- Teamwork - Leadership - Effective Communication Skills - Oral & Written Presentation Skills

2.5.2 Suggestive Assessment Approaches for AI



2.5.3 Assessment Rubrics

SKILLS	SUB SKILL ASSESSED (from 2.5.1 above)	Highly Proficient	Proficient	Beginner	Teacher's Comments
AI CONCEPTS					
THINKING SKILLS					
LIFE SKILLS					

Also read Chapter 4 Appendix 6 for detailed Assessment Rubrics

CHAPTER 3

AI Integrated Lesson Plans

SCIENCE

Class 6

3.1 The Living Organisms-Characteristics and Habitats

Chapter Covered	**Chapter 9: The Living Organisms-Characteristics & Habitats**	**AI Concept**
Name of the book	**Science, Class 6, NCERT**	
Subject and Artificial Intelligence Integrated	Habitats of Living Organisms and their adaptation	**Unsupervised Learning** **Natural Language Processing**
Objectives	• To familiarize students with different habitats of living organisms. • To help students understand the dynamic nature of organisms' surroundings. • To make them understand the concept of adaptation and acclimatization • To awaken the students to the importance of co-existence.	
Time Required	2-3 periods of 35 minutes each	
Classroom Arrangement	• Regular classroom setup which has a Projector, computer/laptop and internet • computer lab on Day 2	
Material Required	Computers Media player with speakers, Pen, Paper, Sketch pens	
Pre - preparation Activity	● Give students images from different habitats of organisms (Around 10-15) ● Ask them to recognize the habitats in the images and try to name the organisms which live there. ● Ask them to classify the habitats based on similarities of landscape ● After collecting all the information above, the teacher introduces the topic "living organisms" – characteristics and habitats.	Unsupervised learning concept
Methodology	● Divide the class into 4 groups and assign them the task of noting down different characteristics and habits of different types of organisms. (4 habitats assigned) ● Ask the group to give their presentation one by one and ask others to note this down as information ● discuss 'Adaptation', 'Acclimatization' ● on the second day, take the children to the computer lab and make them play the Mystery Animal Game. The game may be played in pairs or small/ large groups based on the resources.	Experiencing Natural Language Processing through Mystery Animal Game
Learning Outcomes	● Students will be able to understand and differentiate between different types of habitats on the basis of their characteristics. ● Students will be able to understand the adaptation of living organisms. ● They will be able to understand the importance of co-existence of different organisms and ecological balance.	

Self-Evaluation and Follow-Up Activity	● At the end of Day 1, ask students to collect the following information from the library or through Google search: Find out what are the habitats of polar bears and penguins. For each animal, explain two ways in which it is well adapted to its habitat. ● Conduct brief discussions in small groups in the activity period and ask students to assess how much each of them understood of the topic.	

GLOSSARY:

1. AI Related Terminologies

Unsupervised Learning: While there are many machine learning models, they can be broadly classified into 3 families. They are supervised learning, unsupervised learning and reinforcement learning. Unsupervised learning focusses on finding patterns or trends out of the data fed to the machine. Every machine learning algorithm requires training data as a base to work upon. Talking about unsupervised learning, the training data fed into this machine is un-labelled i.e. the data fed into the machine is unknown or random. It has not been supervised and hence is given to the machine to get processed in such a way that some meaningful information can be extracted out of it. For example, if in a locality, there are 1000 stray dogs and they are all random bred, if the pictures of all these dogs is fed into an unsupervised learning algorithm, it would automatically cluster these images according to the features observed and would give clusters of images as output. These clusters could be based on any trend or pattern observed in the data fed. This helps in understanding the dataset better.

Natural Language Processing: Artificially Intelligent machines could be broadly classified on the basis of the type of data fed to them. One of the domains of Artificial Intelligence is Natural Language Processing. NLP refers to the algorithms which processes natural language data and makes some sense out of it. Natural language data consists of textual data, speech data, etc. and artificially intelligent machines are used to interpret this data and make several decisions/predictions. Some of the examples can be speech recognition, chatbots, auto-captioning, etc.

Mystery Animal: Mystery Animal is an AI experiment designed by Google based on Natural Language Processing. In this game, the machine acts as an animal which has been randomly picked up and the player gets 20 chances to guess that animal. The player can ask 20 yes/no questions to get hints about the animal from the machine and the machine answers either in Yes or No. In this game, the machine tries to interpret the meaning of the question which has been asked by the player with the help of Natural Language Processing and answers accordingly.

Link to the game: https://mysteryanimal.withgoogle.com/

2. AI Activity Description

Unsupervised Learning: In this activity, students will understand the concept of unsupervised learning in AI machines. Students would be given pictures of various organisms and habitats and they would be asked to label them according to their understanding. They need to name them or mention their features. With the help of this activity, students will understand how unsupervised learning works in AI. The unsupervised learning algorithm tries to make some sense out of the data provided to it with the help of common features and other parameters. Students will be able to label the images according to their understanding of organisms and habitats while the unsupervised learning algorithm does the same.

Mystery Animal: Ask the students to go to this link using Google Chrome browser: https://mysteryanimal.withgoogle.com/. Once students reach this site, they need to click on 'preview it here'. The tutorial will start on the screen. Ask the students to go through the whole tutorial. Also, make sure that the microphone is enabled for this site. The machine will act as an animal and the students need to guess that animal by asking 20 questions to the machine. The questions need to be Yes/No questions as the machine will interpret their questions and answer only either Yes or No. Students may ask questions about its diet,

surrounding, species, etc. Once students exhaust all 20 questions, the machine will reveal the animal and then the students can evaluate their questions and see how far they could reach. With the help of this game, students can understand how the machine interprets natural language and tries to converse in the same way. They will also explore various constraints which occur during the process.

SCIENCE

Class 6

3.2 Body Movements

PARAMETERS	DESCRIPTION	AI CONCEPTS INTEGRATED
Chapter Covered	**Chapter 8: Body Movements**	
Name of the Book	**Science, Class 6, NCERT**	
Subject and Artificial Intelligence Integrated	Understanding the types of joints and different types of movements using AI Experiential Applications	Supervised Learning
Learning Objectives	● To build an appreciation and awareness of Artificial Intelligence ● To identify different types of Joints in the human body ● To differentiate different types of movements that our body parts can make	
Time Required	2 periods of 40 minutes each	
Classroom Arrangement	Flexible	
Material Required	Mini skeleton, Pen, paper, blackboard, chalk, smartboard/ screen and projector & laptops.	
Pre – Preparation Activities	● The students are divided into groups for a discussion in preparation for the topic. Students will make different types of joints using newspaper, scale, ball, paper cup, thread etc. which will enhance their conceptual and practical skills related to the working of joints and human body movements. ● Students will be asked to play an online game called Rock Paper Scissors in pairs – to understand the use of various movements made by our hand using our joints	Artificial Intelligence Game- Rock Paper Scissor http://bit.ly/iai4yrps
Previous Knowledge	● Students should have knowledge related to different types of movements that take place in the body regards locomotion and functions of the human skeleton. ● They should be aware of the use of Biceps and Triceps, Ligaments and Tendons. ● Students will be asked to discuss Artificial Intelligence as they recognize it and to make a list of where they have encountered it in day to day life.	
Methodology	● Divide the class into 6 groups and assign them the task of noting down different types of movements made by the other groups and the use of joints in our body ● Ask the group to give their presentation one by one and instruct others to note down the information. ● Each group will make models of different joints and show the movements made by it. ● On the second day, children will be taken to the computer lab and will identify the joints through AI tool under supervised learning of the teachable machine. The game will be played in groups.	https://teachablemachine.withgoogle.com/

Learning Outcomes	• Students will be able to understand and differentiate between different types of Joints, on the basis of their characteristics. • Students will be able to understand the different types of movements that our various body parts can make and joint responsible for it.	
Follow up Activities	●They will also search online for AI tools that help in the identification of joints. ● Conduct brief discussions in small groups in the activity period and ask students to self-assess their learning.	Students are encouraged to explore areas of AI and Human interaction
Reflections	Discussion with Students on the role of AI application	

GLOSSARY:

1. AI Related Terminologies Rock, Paper Scissors: This rock-paper-scissors game illustrates the basic principles of adaptive artificial intelligence technology. Here, the artificially intelligent system learns to identify patterns of a person's behavior by analyzing their decision strategies in order to predict future behavior. This game is based on the domain Data for AI where the machine collects and analyzes data to predict future outcomes. Link to the game: https://www.afiniti.com/corporate/rock-paper -scissors/.The objective of playing this game is to illustrate how humans work in certain patterns and how an AI-enabled machine can detect those patterns for predicting future outcomes.

2. AI Activity Description Rock-Paper-Scissors: Ask the students to go on the link: https://www.afiniti.com/corporate/rockpaper-scissors/ and click on play the game. As soon as they land up in the game arena, they will observe 3 buttons each for Rock, Paper and Scissors. They need to choose one on the basis of the move which they want to make against AI. 47 Remember that the hand at the left is the human's hand while the one on the right side is the AI. As soon as the student makes a move, the AI will also randomly selects one out of the three and according to the conventional rules, one will win against the other. The score gets updated at the top while in the middle of the screen, one can see which round was won by whom as the red colour depicts victory. Ask students to play the 20 rounds of the game and keep checking the scores. Students will be able to identify how the AI-enabled machine is taking the choices of its opponent as data to train itself in such a way that it can predict future moves and can win against its opponent. Ask the students to try the following: 1. Try changing moves randomly and observe how the machines copes with it. 2. Try making the same moves at least 7 times and then changing it abruptly. How does the machine react to it?

SCIENCE

Class 6

3.3 Light, Shadows & Reflections

PARAMETERS	DESCRIPTION	AI CONCEPTS INTEGRATED
Chapter Covered	**Chapter 11: Light, Shadows and Reflections**	
Name of the Book	**Science, Class 6, NCERT**	
Subject and Artificial Intelligence Integrated	Shadows and conditions required for shadow formation and AI.	
Learning Objectives	The students will be able to: ● Recognize transparent, translucent and opaque objects ● To help students understand the reason behind shadow formation. ● To help the student differentiate between shadow and reflection.	
Time Required	2-3 periods of 40 minutes each	
Classroom Arrangement	Regular classroom setup having Projector, computer/laptop and internet. Computer lab visit.	
Material Required	Computers, Pen, Paper, Sketch pens Emoji Scavenger Hunt (https://emojiscavengerhunt.withgoogle.com/) Shadow experiment on the computer screen:	https://experiments.withgoogle.com/shadow-art https://emojiscavengerhunt.withgoogle.com/
Pre – Preparation Activities	Ask students to observe their own shadow while playing in the playground. Ask them to stand in front of a source of light and observe when the shadow becomes big, small? After this teacher introduces the requirements for the formation of shadows.	
Previous Knowledge	The students must be familiar with luminous and non-luminous objects. Also we should be aware of terms like transparent, translucent and opaque objects.	
Methodology	● Divide the class into 3 groups and assign them the task of observing the effect on shadow while controlling the opaque object, screen and source of light. ● Ask the group to give their presentation one by one and ask others to note down the information ● Explain to the students that a shadow grows in size when an opaque object is brought near a source of light, or smaller as it moves closer to the screen.	https://experiments.withgoogle.com/shadow-art

	● On the second day, take the children to the computer lab and make them play the shadow art game. ● The game may be played in pairs or small/ large groups based on the resources.	
Learning Outcomes	Students will be able to understand the requirements for the formation of shadow. Students will be able to relate how the movement of the object controls the size of a shadow. They will also understand the difference between shadow and image.	
Follow up Activities	A short quiz on quizzes.com or kahoot related to the shadows and light. Conduct brief discussions in small groups in the activity period and ask students to self-assess their learning.	
Reflections	Students can play the game of shadows in real life too, and observe the effect of distance on length of shadow.	https://experiments.withgoogle.com/shadow-art

GLOSSARY:

AI Related Terminologies

AI Experiments is a showcase for simple experiments that make it easier for anyone to start exploring machine learning, through pictures, drawings, language, music, and more.

Tensor Flow

Create shadow puppets with your hands in front of your laptop or phone camera. The puppets correspond to one of the lunar cycle's 12 zodiac symbols, and a TensorFlow model identifies which animal your hands are forming.

Get it right within the time limit, and you're given the next zodiac symbol to try, with the ultimate goal of completing all 12.

SCIENCE

Class 6

3.4 Fun with Magnets

PARAMETERS	DESCRIPTION	AI CONCEPTS INTEGRATED
Chapter Covered	**Chapter 8: Fun with Magnets**	
Name of the Book	**Science, Class 6, NCERT**	
Subject and Artificial Intelligence Integrated	Properties of Magnets	
Learning Objectives	Students will be able to: ● Explain how magnets were discovered ● Differentiate between magnetic & non-magnetic materials. ● Identify poles of a magnet ● State properties of a magnet	
Time Required	● 2-3 classes of 40 minutes each	
Classroom Arrangement	Regular classroom setup, Science Laboratory, Computers with internet connection for each group of students (Google story speaker installed on the systems)	
Material Required	NCERT Science textbook class 6, NCERT Science Exemplar book, Laptops/desktops, Google story speaker, inklewriter installed on computers	
Pre – Preparation Activities	● Students will be asked to bring magnets with which they usually play at home. ● Then, Groups of students will be made with each group having 4-5 students. ● Then, they will be asked to find out which material is magnetic out of the various things which they have in their pencil box and bag.	
Previous Knowledge	● Students must have played with magnets. ● Magnets attract or repel each other.	
Methodology	Begin the class by asking the students- What are the magnets? Name some of the materials which are attracted by magnets. ● Discussion on how natural magnets were discovered. ● The teacher will demonstrate the properties of a magnet using two bar magnets in the class. ● Each group of students will be given two bar magnets and asked to practice the properties of magnets e.g. like poles repel and unlike poles attract, a freely suspended magnet always points towards N-S direction.	www.inklewriter.com

	● Each student will be asked to write down the properties of magnets studied in their notebooks. ● Then, using their imagination, they will be asked to create a story which talks about the properties of magnets.	
Learning Outcomes	Students will be able to: ● Classify the materials into magnetic and non-magnetic materials. ● Explain that each magnet has two poles. ● List the properties of a magnet.	
Follow up Activities	● Each group will share the story created by them with the rest of the class. ● In the last 5- 10 minutes, teachers would hold discussions with students on topics they couldn't understand or found difficult. ● Google form test to be conducted to know whether they have achieved learning outcomes.	
Reflections	• Discussion with Students on the role of AI application- Google Story speaker, Inkle writer, Scribbling speech • Students will be asked to explore any other AI application that can be used as an alternative.	Scribbling Speech https://experiments.withgoogle.com/scribbling-speech

GLOSSARY:

Inklewriter:

Inklewriter is a free tool designed to allow anyone to write and publish interactive stories. It's perfect for writers who want to try out interactivity, but also for teachers and students looking to mix computer skills and creative writing.

https://www.inklestudios.com/inklewriter/

Scribbling Speech

Language and images are closely intertwined: We think in pictures and we explain facts as spatial constellations. What if the spoken word could be transformed into dynamic visual worlds in real time? Speech input, machine learning and recurrent neural networks for image generation allow computers to generate complex imaginary worlds that follow the narrator and thus create complex animations controlled by linguistic structures.

https://experiments.withgoogle.com/scribbling-speech

SCIENCE

Class 6

3.5 Electricity and Circuits

PARAMETERS	DESCRIPTION	AI CONCEPTS INTEGRATED
Chapter Covered	**Chapter 12: Electricity and Circuits**	
Name of the Book	**Science, Class 6, NCERT**	
Subject and Artificial Intelligence Integrated	• Dry Cell, Electric Bulb and Electric Circuits. Insulators and Conductors of electricity • My Story Time (AI tool)	
Learning Objectives	• To familiarize students with the internal structure of the dry cell and bulb. • To help students understand an electric circuit and its components. • To classify different materials as conductors and insulators and their application in daily life. • To instill in the students the value of saving electricity.	
Time Required	3 periods of 40 minutes each	
Classroom Arrangement	Regular classroom Day 2 - Projector for Storytelling Day 3 - Computer lab (Assessment through Quizizz) & My Story Time	
Material Required	NCERT Book Cut Dry cell (as per the no. of groups), electric wires, dry cell, small bulb (as per the number of groups) and Big bulb. Projector on Day 2 Computer lab on Day 3	
Pre – Preparation Activities	• Class is divided into groups of 4 -5 based on the resources. • Each group is provided with a cut dry cell and asked to observe the various parts of the dry cell. Students then draw the structure in their notebook.	
Previous Knowledge	Have you observed the cell used in the Television remote control or a cell in any other electrical device or gadgets?	

Methodology	• Students will label each part of the dry cell in their notebook as the teacher discusses in the class. • Students will be shown the bulb for studying its various parts. Discuss parts of a bulb and electric circuit. • The teacher will demonstrate an electric circuit and its components. • Students will sit in their groups and study the various components of an electric circuit by connecting wires according to different arrangements as shown in the Figure 12.5 of the book and conclude the reason for the bulb glowing or not. • Sitting In the same group they will find whether the given materials are insulators and conductors. They will note their observations. The observations will be discussed within the group as well amongst the different groups. • Assessment –Based on their observation they will answer which material will be used in real life cases (gloves or slipper for electrician, switch, wire and wire covering) and the reason for the same. • Assessment by the teacher with the help of Quizizz.	
Learning Outcomes	• Students will be able to draw an electric cell and label its components. • Students will be able to predict whether a particular electric set up will be functional or not. • Students will be able to classify insulators and conductors and also explain their application in real life.	
Follow up Activities	Students will create their own story on My Story Time. (Imagine there is no electric supply for a month. How would it affect your and others daily life activities? Then the teacher will relate it with the need of saving electricity.)	
Reflections	Discuss with the students AI based on the My Story Time.	https://experiments.withgoogle.com/my-storytime

GLOSSARY:

AI Terminology

My Storytime

My Storytime is a new Google Experiment web application which allows users to record stories to play back on Google assistant devices. Record stories from anywhere and play them back at home with Google assistant.

https://experiments.withgoogle.com/my-storytime

SCIENCE

Class 6

3.6 Getting to Know Plants

PARAMETERS	DESCRIPTION	AI CONCEPTS INTEGRATED
Chapter Covered	**Chapter 7: Getting to Know Plants**	
Name of the Book	**Science, Class 6, NCERT**	
Subject and Artificial Intelligence Integrated	Flower: Identification of its parts and their functions.	
Learning Objectives	Learners will be • able to identify the four whorls of a Hibiscus flower • able to understand various functions of all the parts of the flower	
Time Required	4 sessions (35 minutes each)	
Classroom Arrangement	Learners flexible sitting in a group of 2	
Material Required	Hibiscus flower, scalpel (used only by teacher), notebook, pen or pencil and sketch pens, A4 white sheets, scissors, plastic sleeve	
Pre – Preparation Activities	Each learner will be asked to arrange a fresh Hibiscus flower on the day of the activity	
Previous Knowledge	Learners have a general idea about plants, with regards to stems, roots and leaves.	
Methodology	The learners will sit in a group of 2. This pairing will be in effect till the end of the activity. Day 1 (2 sessions) • Each group will first work on one flower and keep aside the second one. The flower will be carefully placed on an A4 white sheet. • The facilitator will instruct the learners to identify the center (vertical) of the flower. • Further, the learners will be asked to identify the concentric circular features (2 whorls, i.e.,sepals and petals), and the projection originating from the center. • Without affecting the projection surface, the learners will be asked to remove the outer whorls and neatly place them on a white A4 sheet. The other learner will help in pasting the parts with the help of glue or cellophane tape. • Next, the learners will be asked to identify the variations present on the projection surface as well as the width. • A smaller tubule tethering from the projection will be plucked, and mashed between the fingers. More such tubules can be collected and pasted on the white sheet.	

	• Further, the facilitator will arrive at every learner's station, and carefully dissect the lower part of the project, longitudinally, with the help of a scalpel. • The learners will be allowed to observe the revealed portion and then paste on the white sheet. • The learners will now be allowed to help his/her peer to repeat the activity using another flower and a white sheet. • The children will place their A4 sheet in the plastic sleeve, seal it and take home. Day 2 • The facilitator will now explain about the various parts of the flower, and ask the learners whether the model could identify their dissected plant parts. • The learners will use the Storytelling tool to learn more about flowers from AI. Few keywords will be prompted by the facilitator, in context to the flower parts and their functionalities. • Finally, the learners will be verbally asked few questions that summarize the topic 'flower'. • How smart is this AIhttps://play.aidungeon.io/main/landing	https://teachablemachine.withgoogle.com/train/image
Learning Outcomes	• Learners will learn - Flower-parts vocabulary - Recognize the placement of 4 whorls - Understand the functions of each part of a flower	
Follow up Activities	• The learners will be instructed to provide stimulus (A4 sheets containing flower parts) to a custom-made AI model, where the parts of the plant will be recognized by the AI tool. • The learners will be asked to draw Hibiscus on an Autodraw tool, and present the result the next day. If not, they need to draw better so that the tool can identify the flower.	https://www.autodraw.com/ https://app.quillionz.com/Question/Index/#home https://app.raptivity.com/interactions
Reflections	Students will learn about parts of flower and its functions.	

GLOSSARY:

1. AI Related Terminologies:

AI model Training: An algorithm is said to be artificially intelligent if it gets trained and can make decisions/predictions on its own. The intelligence which a machine gains comes by training the machine with the appropriate dataset. For example, a machine is to be created which needs to classify an image as either an apple or a banana. To achieve this task, the machine is trained with hundreds of images of apples and bananas each. While training, the machine extracts features from the image dataset of apples which would help the machine classify any image of an apple as an apple. The same is done for the banana dataset. Finally, after training, the machine is tested by providing an image of either an apple or a banana. If the machine can classify it correctly, the efficiency is said to be good else it gets re-trained on a better dataset.

Training an AI model requires two datasets: Training Data and Testing Data. The machine is first fed the training data from which it makes its own rules which help it to predict the output. Then the testing data is used to check the efficiency of the model. Once training and testing is done, the model is deployed for use.

Classification: Machine Learning algorithms can be broadly classified into three families: Supervised learning, Unsupervised learning and Reinforcement learning. Classification is a part of supervised learning model. Classification models work on labelled datasets and are used to predict the label of the testing dataset. For example, 100 images of apples and 100 images of bananas have been taken as a training dataset for the AI model. These 200 images have been labelled as apples or bananas respectively. This labelled data is then fed to the machine which trains itself by extracting common features from the dataset and understanding which features come under the apple label and which ones come under the banana label. At the time of testing, the machine takes an input image and extracts features from it which are then compared with the features marked under both the labels. On the basis of the degree of similarity, the machine will label the testing image as either apple or banana. This process is known as Classification.

Natural Language Processing: Artificially Intelligent machines could be broadly classified on the basis of the type of data fed to them. One of the domains of Artificial Intelligence is Natural Language Processing. NLP refers to the algorithms which processes natural language data and makes some sense out of it. Natural language data consists of textual data, speech data, etc. and artificially intelligent machines are used to interpret this data and make several decisions/predictions. Some of the examples can be speech recognition, chatbots, auto-captioning, etc.

Unsupervised Learning: While there are many machine learning models, they can be broadly classified into 3 families. They are supervised learning, unsupervised learning and reinforcement learning. Unsupervised learning focuses on finding patterns or trends out of the data fed to the machine. Every machine learning algorithm requires training data as a base to work upon. Talking about unsupervised learning, the training data fed into this machine is un-labelled i.e. the data fed into the machine is unknown or random. It has not been supervised and hence is given to the machine to get processed in such a way that some meaningful information can be extracted out of it. For example, if in a locality, there are 1000 stray dogs and they are all random-bred, if the pictures of all these dogs are fed into an unsupervised learning algorithm, it would automatically cluster these images according to the features observed and would give clusters of images as output. These clusters could be based on any trend or pattern observed in the data fed. This helps in understanding the dataset better.

2. AI Activities Description:

Identification of 4 whorls: To train the model, teachable machine-AI tool https://teachablemachine.withgoogle.com/ from google is used, to train a model to identify the 4 whorls of a flower. Following, the flower-dissection activity, and pasting on a white A4 sheet is concluded, and learners take it home. Before leaving, the facilitator provides the learners the link to access the model. At home, the learners are expected to test the parts of flower, using the model, and write down the percent accuracy, by which the model could identify the flower parts. Following, the learners will update the facilitator, the output that the model could generate and with what accuracy. This data can further be used to improve the AI tool image recognition and learning.

Interactive storytelling session for e-learning: The learner is provided with the link for the AI tool:https://play.aidungeon.io/main/landingThe learner should enter the link, start a new game, as a single player, with custom settings. They may not begin conversing with the AI. The facilitator prompts certain keywords that can be used by the learners, to initiate a conversation with the AI. The response from AI is noted by the learner and discussed with the facilitator.

Practicing drawing using machine learning software: Learners will open the linkhttps://www.autodraw.com/, an A.I. experiment to identify scribbles done by the user, as art, or an object, a concept. This tool can also be used to help a picturesque improve his/her drawing, till the point the tool can detect the expected image. Such as, the learners can be asked to draw a hibiscus flower, and retry till the tool identifies it as a hibiscus flower.

Quillionz- an AI-Powered Question Generator: For assessing and improving the efficiency of question generation (except HOTS), this software can be used to generate questions efficiently. https://www.quillionz.com/

SCIENCE

Class 6

3.7 Water

PARAMETERS	DESCRIPTION	AI CONCEPTS INTEGRATED
Chapter Covered	**Chapter 14: Water**	
Name of the Book	**Science, Class 6, NCERT**	
Subject and Artificial Intelligence Integrated	Importance of water and students will be guided how AI is helping in water sustainability.	
Learning Objectives	• To help students understand the importance of water. • To make them aware about the places facing scarcity of water. • To help student understand about water pollution and threat to marine life. • To make students aware about role of technology in water sustainability.	
Time Required	2-3 periods of 40 minutes each.	
Classroom Arrangement	Regular classroom setup having projector, computer/laptop and internet.	
Material Required	Day 1: Paper and pen. Day 2: Computer and internet.	
Pre – Preparation Activities	Day 1: • **Individual Activity:** To estimate the use of water by the student and his/her family. • *Students will collect the data on amount of water used by one person in a day for various activities like: • i)Washing hands • ii)Bathing • iii)Flushing • iv)Drinking • v)Any other Day 2: **Group Activity: CASE STUDY.** Divide the class into two groups A and B. Group A will work on a case study on a city/village in India facing water scarcity. Group B will work on a city outside India facing acute water shortage.	

Previous Knowledge	For what all activity we use water? How is water useful to us? Is water adequately available everywhere to all living organisms? Name the animals that migrate from one place to another in search of water?	
Methodology	Day 1: i) Students will be taken to computer labs and asked to play the game individually and write the words which are related to water. ii) Based on data collected by students regarding usage of water at home by every individual, the teacher will take the name of one student who consumed most water and the one who consumed less amount of water. And the teachers will ask the reason behind it. (students will explain about the amount of water available to them on daily basis) *After collecting the information from all students, the topic "WATER" will be introduced. And also cover the points given below: • Discuss the importance of water. • How can water be used in a limited amount. • Define water pollution. • Showing the video **AI for Good – Sustainability** Day 2: After collecting the information, students will be asked to present their case study. Other groups will be taking notes of the information shared by other groups. After the discussion of the case study, students will be taken to a computer lab and asked to visit the AI website. Students will further explore on YouTube how AI is playing a major role in Sustainability. Showing them video **Countdown to Day Zero: Cape Town's Water Crisis** making them realize that saving water is need of the hour. Students can explore the below videos: *AquaGen AI &IoT Based Water Management System:https://youtu.be/8ZlakBbKC08 *World Cities Day: AI empowers urban wastewater treatment in China:https://www.youtube.com/watch?v=1ykR7n76_yI&feature=youtu.be https://www.youtube.com/watch?v=EZmxEY6QoUY Exploring these videos, students will understand the importance that we use water carefully and not waste it.	https://research.google.com/semantris/ Diving into acidifying ocean: https://artsexperiments.withgoogle.com/diving-into-an-acidifying-ocean/
Learning Outcomes	Learners will be able to understand the importance of water and the need to save water.	
Follow up Activities	• Ask them about steps taken to save water on an individual level. • Fun water game- WATERTYPE: https://experiments.withgoogle.com/water-type	

Reflections	Importance of conserving water and AI steps towards sustainability.	

GLOSSARY:

AI tool

Diving into acidifying ocean

It is an interactive data visualisation, inviting you to dive into the ocean and explore the impact of rising temperatures on marine life. All data and analysis provided by the artist.' Using these ink students will learn about global warming causing threat to aquatic life and how will it affect the human life.

https://artsexperiments.withgoogle.com/diving-into-an-acidifying-ocean/

Semantris

A Google experiment, Semantris is a word association game powered by machine learning. Each time you enter a word that is associated with the target word, the AI looks at all the words in play and chooses the ones it thinks are most related.

https://research.google.com/semantris/

SCIENCE

Class 6

3.8 Motion and Measurement of Distances

PARAMETERS	DESCRIPTION	AI CONCEPTS INTEGRATED
Chapter Covered	**Chapter 8: Motion and Measurement of Distances**	
Name of the Book	**Science, Class 6, NCERT**	
Subject and Artificial Intelligence Integrated	Motion - Types of translatory motion ● Rectilinear motion ● Curvilinear motion	
Learning Objectives	• Students will be able to • Define motion as the change in position of an object with time. • Understand the state of motion or rest with respect to other objects • Compare the two types of translatory motion - rectilinear and curvilinear.	
Time Required	2 periods of 40 minutes.	
Classroom Arrangement	Seating in a group of 3-4 students.	
Material Required	● Notebooks ● A4 size sheets, pens,sketch pens ● A computer/laptop with a projector/ smartboard with an internet connection. (this activity can also be done in a computer lab a computer is not available in the classroom)	
Pre – Preparation Activities	The students are asked to revisit the concept of a body being in a state of motion or rest. The students are asked to get familiar with the Google Maps application, so that they can use it in class for an activity.	https://www.google.com/maps
Previous Knowledge	Knowledge about a body being in a state of motion or rest.	
Methodology	**Day 1-** ● The class is divided into groups of 3-4 students. They are asked to work in groups to observe/think about different objects and classify them based on their state of motion or rest. ● The groups will share their findings and examples of different bodies in a state of motion/rest or stationary.	Unsupervised learning.

	● Discuss about any object or body being in the state of rest or motion with respect to another object (e.g. a person seated in a moving car. He is in a state of motion with respect to the stationary tree, but is in a state of rest with respect to another person in the same car) ● Ask students to give examples of objects which are in continuous motion example - Earth, moon, air, blood in our veins, etc. **Day 2-** ● On the classroom floor make a circle and a straight line. ● Call out 2 volunteers to demonstrate two types of motion by moving along these lines. ● The other students will observe and tell the difference between the two types of motions. ● Ask the groups to make a list of objects moving in a straight line and moving in a curved line. They should also record whether all the parts of the object are moving together in the same direction or not. ● Discuss that when all parts of the object are moving together either in a straight line or a curved line (unlike the blades of a fan when it is switched on) the motion is called translatory motion; such objects moving in straight line show rectilinear motion and those moving in curved path show curvilinear motion. ● The students will be asked to classify the motion of the objects listed by them as rectilinear or curvilinear. **Google Maps Activity.** ● The students should explore Google Maps and make a list of routes between any two sets of places in their city. They should identify the routes where the vehicle shows rectilinear and curvilinear motion respectively.	https://www.google.com/maps
Learning Outcomes	Students will be able to • Define motion as the change in position of an object with time. • Understand the state of motion or rest with respect to other objects • Compare the two types of translatory motion - rectilinear and curvilinear.	
Follow up Activities	The students will work in groups and find answers to the following questions: • Which of the following show rectilinear/ curvilinear motion - Elevators in a shopping mall. - An apple falling from a tree. - A child skating in a skating rink. - A car moving uphill on a winding road. - A ball hit by a batsman for a six. - A ball hit by a batsman for four. - A carom coin hit by the striker.	

	• Students to visit the site for a simulation of the different type of translatory motion https://www.physicsclassroom.com/Physics-Interactives/Circular-and-Satellite-Motion/Roller-Coaster-Model/Roller-Coaster-Model-Interactive • The students will be asked to understand and appreciated the role of AI in enhancing the viewing experience/decision making in sports by discussion about the “hawkeye” feature used in cricket matches to adjudge an ‘LBW’ decision based on the ball-trajectory predicted by the hawkeye technology used by the 3rd Umpire of the game.	
Reflections	Discussion with students on the role of AI being explored in managing traffic and discussion about various other places where it can be used.	

GLOSSARY:

1. AI Related Terminologies

- **Unsupervised Learning:** While there are many machine learning models, they can be broadly classified into 3 families. They are supervised learning, unsupervised learning and reinforcement learning. Unsupervised learning focuses on finding patterns or trends out of the data fed to the machine. Every machine learning algorithm requires training data as a base to work upon. Talking about unsupervised learning, the training data fed into this machine is un-labelled i.e. the data fed into the machine is unknown or random. It has not been supervised and hence is given to the machine to get processed in such a way that some meaningful information can be extracted out of it. For example, if in a locality, there are 1000 stray dogs and they are all random-bred, if the pictures of all these dogs are fed into an unsupervised learning algorithm, it would automatically cluster these images according to the features observed and would give clusters of images as output. These clusters could be based on any trend or pattern observed in the data fed. This helps in understanding the dataset better.
- **Google Maps**
  Google Maps: Google Maps (link: https://www.google.com/maps) is a web mapping service developed by Google. It offers satellite imagery, aerial photography, street maps, 360° panoramic views of streets (Street View), real-time traffic conditions, and route planning for traveling by foot, car, bicycle and air (in beta), or public transportation. Google maps effectively use AI in calculating the estimated time of arrival with the help of real-time traffic conditions.

2. AI Activity Description: Google Maps

Ask the students to go to the following link: https://www.google.com/maps.

Once the page opens, click on the small blue square with a white arrow on the top left corner of your screen to get the directions from one place to another. This will open a panel on the left side of the screen and will ask you to enter the source (name of the place to start the journey) of the route you want to find and also the destination (name of the place you wish to go to).

On this panel enter their home address as the source and the school address as the destination and search for the routes.

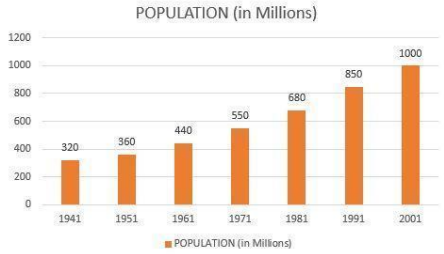
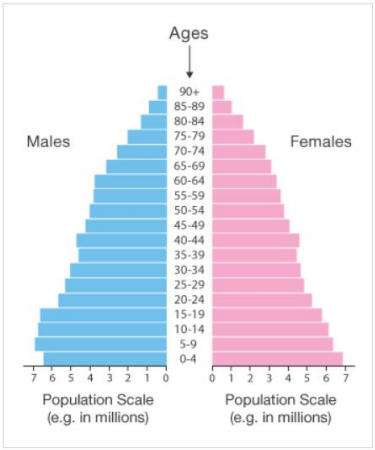
Click on any route and zoom in to view the street names. The students then need to observe the routes where the roads are straight and the ones which are curved. The students will then make a list of the roads.

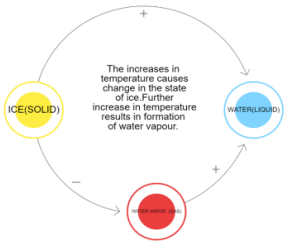
This activity will help them to identify the kind of motion (rectilinear / curvilinear) the vehicles will show on which kind of roads.

SCIENCE

Class 6

3.9 Changes Around Us

PARAMETERS	DESCRIPTION	AI CONCEPTS INTEGRATED
Chapter Covered	**Chapter 6: Changes Around Us**	
Name of the Book	**Science, Class 6, NCERT**	
Subject and Artificial Intelligence Integrated	What is a change?  	https://datavizcatalogue.com/
Learning Objectives	• To help the students understand the meaning of change. • To make them understand the difference between reversible and irreversible changes. • To familiarize with the ways of producing change in a substance.	
Time Required	2-3 periods of 35 min each.	
Classroom Arrangement	Regular classroom setup having computer/laptop and internet.	
Material Required	Computers, Pen, Paper, and Sketch pens.	
Pre – Preparation Activities	Bowl with chits.	

Previous Knowledge	Basic knowledge is required.	
Methodology	Students will be provided with a bowl with chits. Each of the chits contains a text/topic/word. Each student will pick a chit and think of a change caused by it. Like- deforestation, pollution, eating junk, etc. The students will be asked if the change they have stated is reversible or irreversible.  https://ncase.me/loopy/	
Learning Outcomes	Students can visualize and understand the meaning of reversible or irreversible change.	
Follow up Activities	 Students will be asked to use the loop tool and draw different objects or materials and factors affecting that change. https://ncase.me/loopy/	
Reflections	This will help students to think out of the box and understand the concept of reversible and irreversible changes.	

GLOSSARY:

Data Exploration and Visualisation

https://datavizcatalogue.com/

Data Exploration refers to visualize the data to determine the pattern, relationships between elements and trends in the dataset that gives a clear meaning and understanding of the dataset. Data exploration is important as it helps the user to select an AI model in the next stage of the AI project cycle. To Visualize the data, various types of visual representations can be used such as diagrams, charts, graphs, flows and so on. The representation of concept mapping can be specified for the particular chapter.

SCIENCE

Class 6

3.10 Motion and Measurement of Distance

PARAMETERS	DESCRIPTION	AI CONCEPTS INTEGRATED
Chapter Covered	**Chapter 10: Motion and Measurement of Distances**	
Name of the Book	**Science, Class 6, NCERT**	
Subject and Artificial Intelligence Integrated	Concept of motion and distance integrated with AI using Google maps.	
Learning Objectives	Students will be able to: • Understand the importance of the invention of wheels which revolutionized the level of progress in human life. • Understand the need to set up a standard unit of measurement. • Develop the skill of measuring the length of a curved line. • Identify different types of motion.	
Time Required	4-5 periods of 40 minutes each	
Classroom Arrangement	Flexible seating	
Material Required	• Smartboard/screen, projector, laptop and internet connection. • Rulers or metre scale and string. • Different objects at rest and in motion. • A chair without wheels and a chair with wheels.	
Pre – Preparation Activities	The students will be divided intogroups (for second period).	
Previous Knowledge	In the first Period: To trigger the previous knowledge, the class will be asked a few questions: • What is easy: - To move a chair without wheels. Or - To move a chair with wheels. • Why do we have tires in our vehicles? In the second period: The Class will be divided into two groups. Group A will measure the length of the table and a book with rulers. Group B will measure the length of the table and a book with their hands. On the basis of this activity they will be asked the following questions group wise:	

	• What is the length of the table and the book? • What are the different things we can measure with rulers? In the third period: The teacher will initiate the class by asking the below questions: 1.Have you ever used a map while traveling? 2.How we can go anywhere these days without having physical maps?	
Methodology	The students work in groups to measure different things present around them. Students will measure the lengths of irregular shaped objects. Students will be asked to do conversion sums. (They will be shown online conversion of units) Unit convertor: https://www.unitconverters.net/ Students will be shown how to use google maps to search their favorite places to visit. Link the types of motion with real-world examples. https://www.youtube.com/watch?v=I6CVEphVZvY	Students learn how to use Google map. https://www.google.co.in/maps.
Learning Outcomes	Students will be able to: • Understand how the invention of the wheel revolutionized the level of progress in human life and set the pace for future developments. • Reflect upon the different means of transportation. • Understand the need to set up a standard unit of measurement. • Develop the skill of measuring the length of a curved line. • Identify different types of motion.	
Follow up Activities	To study the motion of the Earth around the Sun and on its own axis. Questions on conversion of units.	
Reflections	The students will learn to measure with standard units. They will learn about the conversion of units so as to have accuracy and avoid confusion in measurement. Students will be asked to fill the data on their own whenever they will order from swiggy next time:	https://www.swiggy.com/

GLOSSARY:

AI Related Terminologies

1. Google Maps

Google Maps is a web mapping service developed by Google. It offers satellite imagery, aerial photography, street maps, 360° interactive panoramic views of streets, real-time traffic conditions, and route planning for traveling by foot, car, bicycle and air, or public transportation.

2. Swiggy

Swiggy is India's largest and most valuable online food ordering and delivery platform. Once you enter your preferences, youwill get the delivery of food at your doorstep.This is one of the AI tools as it takes the data from the user according to his liking and delivers the food items.

For the concept of motion, a delivery person can be traced at every point.

AI Activity Description:

1. Students will be asked to enter their favourite place to visit. Once they entered the specific location, they will get the estimated distance and time between their present location and the destination point they have entered.

They can change their preference of means of transport and can get estimated time. Now, ask the students to convert the units of the data obtained.

2. Students will be asked to convert some basic units into other manually first. e.g. meters centimeters, kilograms to grams, and vice versa.Then they will be asked to check the result by using online unit convertor.

3. User needs to enter the data and the system will generate the bill.

SCIENCE

Class 6

3.11 Separation of Substances

PARAMETERS	DESCRIPTION	AI CONCEPTS INTEGRATED
Chapter Covered	**Chapter 5: Separation of Substances**	
Name of the Book	**Science, Class 6, NCERT**	
Subject and Artificial Intelligence Integrated	Methods of separation ofvarious kinds of mixturesof solid with other solids • Handpicking • Winnowing • Threshing • Sieving	Unsupervised learning, AI based talking avatar tool named VOKI
Learning Objectives	• To enable the students understand the two types of mixtures . • To familiarise the students about pure and impure substances • To enable the students to identify the different kinds of materials or substances to be separated • To familiarise the students with the concept of separation and why it is needed • To help the students describe the methods of separation according to the properties of mixtures given to them • To help the students to record their observation of the various activities conducted during the teaching process	
Time Required	4 periods of 35 minutes each	
Classroom Arrangement	Seating arrangement - • Regular classroom setup with a blackboard for concept explanation • The classroom will be setup according to the strength of the class by dividing the students in a group of 5 students each for smooth conduction of activities related to the concepts • Computer lab visit on the day 3	
Material Required	• Computers lab visit. • Kidney beans, pulses, buttons, thermocol balls, wheat grains, husk, sugar, sieve, sup, etc. fordifferent activities. • Different coloured papers to classify the different kinds of materials or substances shown in the form of images as per their properties	

Pre – Preparation Activities	• The students are given the images of different kind of pulses, grains, and other solid materials of different sizes and characteristics • The students are asked to classify and name the materials on the basis of their shape, sizes and other characteristics. • The students are then given mixtures of different materials.For example- kidney beans and other pulses orthermocol ball and rice grains, grains and husk etc. • The students are then asked to separate them first by using hand,then by a sieve or sup made out of paper • After conduction of above mentioned activity the teacher introduces the concept of mixtures and the separation techniques to the students	Unsupervised learning concept
Previous Knowledge	The students have knowledge of various kinds of pulses, grains, and other materials.	
Methodology	• The students will be divided into a group of 5 students each and each group will be given 2 mixtures. • Each group is asked to record their observation on the basis of their previous knowledge. • On the third day of the discussion of the concepts the students are taken to the computer lab and each group of 2 students each is asked to make their own presentation on any one of the topics studied using an AI-based application tool named 'VOKI' (Talking avatars).	https://www..voki.com/
Learning Outcomes	• The students will be able to understand the two types of mixtures. • The students will be able to familiarise themselves with pure and impure substances • The students will be able to identify the different kinds of materials or substances to be separated. • The student will be able to familiarise themselves with the concept of separation and why it is needed. • The students will be able to describe the methods of separation according to the properties of mixtures given to them • The students will be able to record their observation of the various activities conducted during the teaching process	
Follow up Activities	• The students will be given worksheets to solve. • The students will be asked to find out 5-5 examples of each techniques of separation taught.	
Reflections	Discussion with Students on the role of AI application	

GLOSSARY:

AI Related Terminologies

Unsupervised Learning : While there are many machine learning models, they can be broadly classified into 3 families. They are supervised learning, unsupervised learning and reinforcement learning. Unsupervised learning focusses on finding patterns or trends out of the data fed to the machine. Every machine learning algorithm requires training data as a base to work upon. Talking about unsupervised learning, the training data fed into this machine is un-labelled i.e. the data fed into the machine is unknown or random. It has not been supervised and hence is given to the machine to get processed in such a way that some meaningful information can be extracted out of it. For example, if in a locality, there are 1000 stray dogs and they are all random bred, if the pictures of all these dogs are fed into an unsupervised learning algorithm, it would automatically cluster these images according to the features observed and would give clusters of images as output. These clusters could be based on any trend or pattern observed in the data fed. This helps in understanding the dataset better.

VOKI: Voki is an AI based educational tool for teachers and students that can be used to enhance instruction, engagement, and lesson comprehension. Voki can be used in class (for student work), as an animated presentation tool, for student assignments, and as a virtual supervised discussion forum (Voki Hangouts).

Voki characters can look like historical figures, cartoons, animals, and more.

Link to the tool: https://www..voki.com/

YouTube Link for the use of tool**:**https://youtu.be/pZwQTm_5s6Q

SCIENCE

Class 6

3.12 Fun with Magnets

PARAMETERS	DESCRIPTION	AI CONCEPTS INTEGRATED
Chapter Covered	**Chapter 13: Fun with Magnets**	
Name of the Book	**Science, Class 6, NCERT**	
Subject and Artificial Intelligence Integrated	● Various artificial Magnets. ● Strength of a magnet. ● How does a freely suspended magnet rest? ● Interaction between bar magnets. ● Properties of a bar magnet.	
Learning Objectives	Students will be able to- ● Visualize the different types of magnets. ● Understand the strength of the magnet. ● Justify the position of a freely suspended magnet. ● Understand the attraction or repulsion between the magnets when two or more magnets are kept close to each other. ● Visualize and understand the different properties of magnets.	
Time Required	3 periods of 40 minutes each.	
Classroom Arrangement	Normal class arrangement with a smart board having internet.	
Material Required	● Smart board with net connection ● Different types of magnets. ● Pen, paper, sketch pens	
Pre – Preparation Activities	● Asking the students to think upon the working of toy magnets. ● Showing them the repulsion between the two bar magnets like magic.	
Previous Knowledge	Students know about- ● the origin of magnets ● The concept of natural magnet	
Methodology	● The class will be divided into four groups and each group will be provided with a pair of a bar magnet, a horseshoe magnet, a circular magnet and a magnetic compass each. ● The various magnets will be rotated in each group. The students will be able to visualize the magnets carefully. ● The demonstration of freely suspended bar magnet will be done for a better understanding of the concept. ● The demonstration of various properties will be done amongst the students.	https://lab.hakim.se/magnetic/02/

Learning Outcomes	Students will be able to ● Differentiate between the different shapes of artificial magnets. ● Understand the concept of strength of a magnet ● Show the interaction between the two magnets by sketching and performing activities. ● Perform and know the various properties of magnets along with the concept behind them.	
Follow up Activities	A brief class discussion will be held on the same topic and will observe what the students say and which concepts are still not clear to them.	
Reflections	Students will be asked to make a video of them performing various activities related to magnets.	

GLOSSARY:

Magnetic Experiment

Particles orbit around magnets which can be dragged around and by double click students can add more magnets. They can change skin with keyboard left / right.

https://lab.hakim.se/magnetic/02/

SCIENCE

Class 7

3.13 Weather, Climate and Adaptation of Animals to Climate

PARAMETERS	DESCRIPTION	AI CONCEPTS INTEGRATED
Chapter Covered	**Chapter 7: Weather, Climate and Adaptation of Animals to Climate**	
Name of the book	**Science, Class 7, NCERT**	
Subject and Artificial Intelligence Integrated	Science and AI importance of data acquisition and data exploration for Artificial Intelligence.	
Objectives	Students will be able to understand the concept of • What is Weather? • How is Climate defined? • Ways in which Animals adapt to climate in different regions.	**Data acquisition & data exploration to identify pattern recognition**
Time Required	2-3 periods of 40 minutes each	
Classroom Arrangement	Flexible seating	
Material Required	Chart Paper pen, pencils, sketch pens, scale ; laptops/desktops; screen; projector; Internet connection	
Pre- Preparation Activity	The students are divided in groups of 4 and asked to visit the following and discuss about what they understand regards weather and how it can be predicted.	https://interestingengineering.com/ai-might-be-the-future-for-weather-forecasting
Introduction	Students given newspapers in their pre preparation groups and asked to find the weather report in each newspaper and tabulate it. Students then present their findings from the video they have watched and the weather reports they have tabulated	
Methodology	The Students are guided in the larger class discussion on the introduction and pre preparation activities. They are introduced to how Artificial Intelligence is playing a major role in collection, collation and analyses of data to predict weather in the form of weather forecasts. https://interestingengineering.com/ai-might-be-the-future-for-weather-forecasting	
Discussion on the Text	Students will be made to realize that the average weather pattern taken over a long time, say 25 years,is called the climate of the place. They will be guided to understand how climate of a place influences all living organisms and how animals adapt to the climate of a place. An AI Game Mystery Animal will be played to reiterate this in a fun manner	https://experiments.withgoogle.com/mystery-animal
Learning Outcomes	Students will be able to understand • What is Weather and how it is forecast? • How Climate is determined and defined • Ways in which Animals adapt to climate	
Self-Evaluation and Follow-Up Activity	Group task by students:	

	• Collect weather reports of seven successive days in the winter months (preferably December). Collect similar reports for the summer months (preferably June) and prepare a table for sunrise and sunset times They will try to answer the following questions: - Is there any difference in the time of sunrise during summer and winter? - When do you find that the sun rises earlier? - Do you also find any difference in the time of sunset during the month of June and December? - When are the days longer? - When are the nights longer? - Why are the days sometimes longer and sometimes shorter? - Plot the length of the day against the days chosen in June and December. (Instructions for plotting graphs are given in Chapter 13.) • Collect information about the Indian Meteorological Department by visiting its website: http://www.imd.gov.in Write a brief report about the things this department does. Students will make a video of themselves reading out the weather report and present it in the class	

GLOSSARY:

1. AI Related Terminologies

Data Acquisition: Data acquisition refers to acquiring authentic data crucial for the AI model from reliable sources. The data acquired could be then divided into two categories: Training Data and Testing Data. The AI model gets trained on the basis of training data and is evaluated on the basis of testing data.

There can be various ways in which students can collect data. Some of them are:

- Surveys
- Web Scraping
- Sensors
- Cameras
- Observations
- Application Program Interface

Data Exploration: After acquiring data there comes the need to analyze the data. For this, they need to visualize the acquired data in some user-friendly format so that they can:

- Quickly get a sense of the trends, relationships and patterns contained within the data.
- Define strategy for which model to use at a later stage.
- Communicate the same to others effectively.

To visualize data, various types of visual representations could be used by the students like diagrams, charts, graphs, flows, etc.

2. AI Activity Description

In this activity, divide the students into groups and all the groups need to browse various reliable sources from where they can get authentic data for the weather conditions of a place. You can also divide the students into groups and assign them different States of India to gather data. Once the students have acquired the dataset ask them to explore the same with the help of any visual representation (pictorial/graphical) and explain various patterns and trends observed in the same. Also, ask the students to brainstorm on how can AI be used to help in such situations to predict the weather and climatic conditions of the place.

SCIENCE

Class 7

3.14 Weather, Climate & Adaptation of Animals

PARAMETERS	DESCRIPTION	AI CONCEPTS INTEGRATED
Chapter Covered	**Chapter 7: Weather, Climate and Adaptation of Animals to Climate**	
Name of the Book	**Science, Class 7, NCERT**	
Subject and Artificial Intelligence Integrated	Understanding the concept of adaptation of animals to climate	Unsupervised Learning Natural Language Processing
Learning Objectives	● To familiarize students with different habitats of living organisms. ● To help students understand the dynamic nature of organisms' surroundings. ● To make them understand the concept of adaptation and acclimatization. ● To awaken the students to the importance of co-existence	
Time Required	2-3 periods of 35 minutes each	
Classroom Arrangement	Regular classroom setup having Projector, computer/ laptop and internet - computer lab on Day 2	
Material Required	Computers Media player with speakers, Pen, Paper, Sketch pens	
Pre – Preparation Activities	● A fun activity using butter and ice to tell the effect of blubber in polar regions ● Give students images from different habitats of organisms (Around 10-15) ● Ask them to recognize the habitats in the images and try to name the organisms which live there. ● They have to draw an imaginary animal, if it changes its habitat, then what features it has to adapt to fit into the environment.	
Previous Knowledge	● Students should have knowledge related to weather and climate. ● They should be aware of the factors determining the climate.	
Methodology	● Divide the class into 6groups and assign them the task of noting down different types of adaptations by the different animals on earth. ● They will be guided to understand how the climate of a place influences all living organisms and how animals adapt to the climate of a place. An AI Game Mystery Animal will be played to reiterate this in a fun manner ● Poaching is a major cause of the extinction of species. Watch the video and discuss https://youtu.be/yYY0Jg)qGH0	https://mysteryanimal.withgoogle.com/

	• Reflective video demonstrating how wildlife can be protected using Artificial Intelligence	
Learning Outcomes	• Students will be able to understand and differentiate between different types of habitats on the basis of their characteristics. • Students will be able to understand the adaptation of living organisms. • They will be able to understand the importance of the co-existence of different organisms and ecological balance.	
Follow up Activities	At the end of Day 1, ask students to collect the following information from the library or through Google search: Find out what are the habitats of polar bears and penguins. For each animal, explain two ways in which it is well adapted to its habitat.	
Reflections	Conduct brief discussions in small groups in the activity period and ask students to assess how much each of them understood the topic.	

GLOSSARY:

1. AI Related Terminologies

Unsupervised Learning: While there are many machine learning models, they can be broadly classified into 3 families. They are supervised learning, unsupervised learning and reinforcement learning. Unsupervised learning focusses on finding patterns or trends out of the data fed to the machine. Every machine learning algorithm requires training data as a base to work upon. Talking about unsupervised learning, the training data fed into this machine is un-labelled i.e. the data fed into the machine is unknown or random. It has not been supervised and hence is given to the machine to get processed in such a way that some meaningful information can be extracted out of it. For example, if in a locality, there are 1000 stray dogs and they are all random bred, if the pictures of all these dogs are fed into an unsupervised learning algorithm, it would automatically cluster these images according to the features observed and would give clusters of images as output. These clusters could be based on any trend or pattern observed in the data fed. This helps in understanding the dataset better.

Natural Language Processing: Artificially Intelligent machines could be broadly classified on the basis of the type of data fed to them. One of the domains of Artificial Intelligence is Natural Language Processing. NLP refers to the algorithms which processes natural language data and makes some sense out of it. Natural language data consists of textual data, speech data, etc. and artificially intelligent machines are used to interpret this data and make several decisions/predictions. Some of the examples can be speech recognition, chatbots, auto-captioning, etc.

Mystery Animal: Mystery Animal is an AI experiment designed by Google based on Natural Language Processing. In this game, the machine acts as an animal that has been randomly picked up and the player gets 20 chances to guess that animal. The player can ask 20 yes/no questions to get hints about the animal from the machine and the machine answers either in Yes or No. In this game, the machine tries to interpret the meaning of the question which has been asked by the player with the help of Natural Language Processing and answers accordingly.

Link to the game: https://mysteryanimal.withgoogle.com/

2. AI Activity Description

Unsupervised Learning: In this activity, students would understand the concept of unsupervised learning in AI machines. Students would be given pictures of various organisms and habitats and they would be asked to label them according to their understanding. They need to name them or mention their features. With the help of this activity, students will understand how unsupervised learning works in AI. The unsupervised learning algorithm tries to make some sense out of the data provided to it with the help of common features and other parameters. Students are able to label the images according to their understanding of organisms and habitats while the unsupervised learning algorithm does the same

Reflective video demonstrating how wildlife can be protected using Artificial Intelligence: https://www.youtube.com/watch?v=yYY0Jg0qGH0 Students can find the video on the link mentioned above. This video is about reducing illegal poaching activities in an area where illegal poaching is a critical problem. The device named 'Train Guard' has been powered with computer vision-based AI which can identify if any suspicious activity takes place. It ensures only authorized people get near to the animals. The device is small enough to be easily hidden in natural surroundings.

SCIENCE

Class 7

3.15 Light

PARAMETERS	DESCRIPTION	AI CONCEPTS INTEGRATED
Chapter Covered	**Chapter 15: Light**	
Name of the Book	**Science, Class 7, NCERT**	
Subject and Artificial Intelligence Integrated	Mirrors and reflections Image formation by a plane mirror. Characteristics of an image formed by a plane mirror.	
Learning Objectives	Students will be able to- • Recall reflection. • Observe and describe image formed by a plane mirror • To be able to identify light as a form of energy • To be able to carry out simple experiments with light • State the laws of reflection • Discuss the characteristics of an image formed in a plane mirror.	
Time Required	2-3 periods, 40 minutes each.	
Classroom Arrangement	Flexible seating	
Material Required	Pens, paper, plane mirror, computer/ desktops.	
Pre – Preparation Activities	Students will be told to perform this simple activity at home and recall the concept of rectilinear propagation of light. ACTIVITY: Bent pipe/tube, straight pipe/tube, and candle. • Fix a candle on a table. • Look at the flame through the straight pipe. • Now look at the flame through the bent pipe. Ask the students to record their observations and deduce which previously learnt concept is associated with it.	
Previous Knowledge	Students must be familiar with the terms like image, reflection, and know about rectilinear propagation of light.	
Methodology	The students will observe the image formation taking place in a plane mirror, and note down the characteristics of the image formed. The characteristics of the image formed in a plane mirror are discussed in the class, like the image formed is always erect, at the same distance as is the object, virtual and laterally inverted. On the second day the students are taken to the computer lab, and they play the move mirror game. Here the reflection of us controls the formation of GIF, and finds similar-looking pictures from the database.	Emoji Scavenger Hunt (based on Computer Vision - CV) (https://emojiscavengerhunt.withgoogle.com/) Move mirror game https://experiments.withgoogle.com/move-mirror

Learning Outcomes	Students will be able to understand and • Recall reflection. • Observe and describe image formed by a plane mirror • To be able to identify light as a form of energy • To be able to carry out simple experiments with light • State the laws of reflection • Discuss the characteristics of the image formed in a plane mirror.	
Follow up Activities	Conduct brief discussions in small groups in the activity period and ask students to self-assess their learning/understanding. A quiz will be taken on quizzes.com to assess the learning of the students. They will also search online for more AI tools that help in the detection of images and accordingly respond.	
Reflections	Students will explore more tools like https://experiments.withgoogle.com/move-mirror, based on reflection.	

GLOSSARY:

AI Related Terminologies

AI Experiments is a showcase for simple experiments that make it easier for anyone to start exploring machine learning, through pictures, drawings, language, music, and more.

Move Mirror lets you explore pictures in a fun new way. You turn on your webcam and move around, and the computer pulls up pictures of poses that match yours in real-time. The image database is made of more than 80,000 pictures we pulled together - of people dancing, doing karate, cooking, walking,skiing and so on.

This experiment was a collaborative effort by PAIR, Research, and Creative Lab teams at Google and friends at Use All Five.

Tensorflow.js, PoseNetPose estimation have the ability to detect humans and their poses from image data, is one of the most exciting and most difficult topics in machine learning and computer vision. Recently, Google shared PoseNet: a state-of-the-art pose estimation model that provides highly accurate pose data from image data (even when those images are blurry, low-resolution, or in black and white). This is the story of the experiment that prompted us to create this pose estimation library for the web in the first place.

Move Mirrorthat lets you explore images in your browser, just by moving around. The experiment creates a unique, flipbook-like experience that follows your moves and reflects them with images of all kinds of human movement — from sports and dance to martial arts, acting, and beyond. Typically, working with pose data means either having access to special hardware or having experience with C++/Python computer vision libraries. It is a unique opportunity to make pose estimation more widely accessible by porting an in-house model to TensorFlow.js, a Javascript library that lets you run machine learning projects in the browser.

SCIENCE

Class 7

3.16 Physical and Chemical Changes

PARAMETERS	DESCRIPTION	AI CONCEPTS INTEGRATED
Chapter Covered	**Chapter 6: Physical and Chemical Changes**	
Name of the Book	**Science, Class 7, NCERT**	
Subject and Artificial Intelligence Integrated	Physical and chemical changes and AI.	• Supervised learning • My story time tool on AI chatbot
Learning Objectives	Students will be able to : ● Identify physical changes around us. ● Understand the characteristics of physical and chemical changes. ● Distinguish between physical and chemical changes ● State examples of chemical changes taking place in everyday life.	
Time Required	2-3 classes of 40 minutes each	
Classroom Arrangement	Regular classroom setup, Computers with internet connection for each group of students(with AI tools installed)	
Material Required	NCERT textbook, NCERT Science exemplar book, Computers with AI tool installed	
Pre – Preparation Activities	● Students will be asked to identify at least five changes taking place around them. ● Ask them to classify each change on the basis of change in shape, size, colour, smell, physical state, temperature or gas released.	
Previous Knowledge	● Change is the only constant ● Students know about a variety of changes taking place around them. ● Examples: Day and night, inflating a balloon, stretching a rubber band, boiling an egg ● Certain things expand on heating and contract on cooling. ● Some changes can be reversed easily while others cannot.	
Methodology	● The teacher will introduce the topic by telling children that there is a cause for every change. The teacher will initiate the topic by showing a video: https://www.youtube.com/watch?v=NRCn8z8gb1w ● Different ways to bring about changes will be discussed in the class. ● The characteristics of physical and chemical changes will be explained to the students. ● On the next day, the students will be taken to the Computer laboratory.	

	● Groups of students will be formed in the class with 4 students in each group. ● Each group will be asked to think/identify one interesting change taking place around them and then each group will be asked to build a story on the AI tool.	
Learning Outcomes	Students would be able to ● State the characteristics of chemical changes. ● Distinguish between physical and chemical changes. ● State examples of chemical changes taking place in everyday life. ● Categorize the change as physical or chemical- based on the difference in the characteristics.	
Follow up Activities	● Oral discussion on different types of changes by posing questions to students. ● Google form test to be conducted to know whether they have achieved the desired learning outcomes. ● Students will be encouraged to find out some of the more uses of AI technology.	
Reflections	● Discussion with Students on the role of AI application- Supervised learning, My story time tool on AI chatbot ● Students will be asked to and try and find one more application on supervised learning in AI.	https://experiments.withgoogle.com/my-storytime

GLOSSARY:

AI Related Terminologies

1. My story time tool on AI chat bot

It is an AI experiment that is available as an add-on to Google Docs. It lets anyone create an interactive story with no coding required. It is easy to install and easy to use the tool and comes in handy when the user wants to create a story that changes according to the user's input.

2. Natural Language Processing: It is the ability of a program to understand human language. Human language data can be fed to the machine in the form of text or speech. Natural Language Processing is one of the subfields of Artificial Intelligence wherein the machine interprets human language and produces intelligent output.

3. Supervised Learning: Supervised learning is an approach to creating artificial intelligence (AI), where the program is given labeled input data and the expected output results. Classification is a part of the Supervised learning model. Classification models work on labelled datasets and are used to predict the label of the testing dataset. For example, 100 images of apples and 100 images of bananas have been taken as a training dataset for the AI model. These 200 images have been labelled as apples or bananas respectively. This labelled data is then fed to the machine which trains itself by extracting common features from the dataset and understanding which features come under the apple label and which ones come under the banana label. At the time of testing, the machine takes an input image and extracts features from it which are then compared with the features marked under both the labels. On the basis of the degree of similarity, the machine will label the testing image as either apple or banana. This process is known as Classification.

SCIENCE

Class 7

3.17 Heat

PARAMETERS	DESCRIPTION	AI CONCEPTS INTEGRATED
Chapter Covered	**Chapter 4: Heat**	
Name of the Book	**Science, Class 7, NCERT**	
Subject and Artificial Intelligence Integrated	Topic- Transfer of heat	
Learning Objectives	• To familiarize the students with the concept of heat transfer. • To understand the three ways of transfer of heat. • To relate the concept with real-life examples.	
Time Required	4 periods of 40 minutes each	
Classroom Arrangement	Regular classroom. Lab visit on Day 2	
Material Required	Experimental set up - Beaker containing cold water with a laboratory thermometer and another beaker containing hot water with a laboratory thermometer Computer/projector Material for Activity- hot water,container, spoons (plastic, steel, wood)	
Pre – Preparation Activities	An experiment will be set up in the class. There will be a beaker containing cold water with a laboratory thermometer and another beaker containing hot water with a laboratory thermometer Students will observe the experiment set-up and note down the temperature in both the cases in their notebook under the supervision of the teacher.	
Previous Knowledge	Students know how to read the thermometer.	
Methodology	• The temperature reading by the first and the last child will be announced in the class. • Brainstorming on questions like - Why is there a difference in the temperature reading by the first and the last child? • Why does the temperature increase in the case of cold water and a decrease in the case of hot water? • Roleplay on distribution of notebooks in three ways (1. passing it to the child and then him further passes it to the next child and so on. 2. Giving the notebook to one child who moves and passes it on to the other children. 3. Directly giving it to the child)	https://smprobotics.com/security_robot/thermal-security-robot/

	and drawing analogy with the three ways of heat transfer. • The teacher will show the video for better a understanding of the concept of conduction: https://www.youtube.com/watch?v=w_IbPRNZ6ho • Activity - Put spoons of a different material (plastic, steel, wood) in hot water. Students will be asked to find out which spoon was hot to touch. With this activity, the concept of conductor and insulator of heat will be taught. Brainstorming - - Why handles are made of wood? - Why water from steel containers storing water is cold during winters as compared to a plastic container? • Activity for convection: Hold a paper strip above a lighted candle. Students will observe that the paper moves by convention currents.. Video on convection currents can be shown as well as in the lab. https://www.youtube.com/watch?v=0BdRaWFR2IM https://www.youtube.com/watch?v=HsfkPTnWuhQ Students will note down their observations in the notebook. Activity 4.10 and 4.11 will be conducted. • Real-life examples will be told- tawa being black, colour of clothes as per the season, use of hollow bricks and thermos flask. • A video will be shown to the students to show how AI, at the time of COVID 19, is helping in detection of a high temperature of visitors in the hospitals and other public places with no contact.	
Learning Outcomes	Students will be able to understand and relate the three ways of heat transfer with real-life examples. They will know the role of AI in temperature scanners with no contact.	
Follow up Activities	https://www.youtube.com/watch?v=Zhs1DwQB85c (How a thermal image camera work) Students will visit the above link and record their learning and make portfolios with pictures.	
Reflections	Discuss with students how thermal scanners work. AI guided missiles can be discussed.	

GLOSSARY:

AI Related Terminologies

1. https://smprobotics.com/security_robot/thermal-security-robot/

The new security robot Argus is proposed for delivery from mid-2020.

The robot is equipped with a dual-spectral PTZ prompt camera located on the top of the mast. This arrangement of the PTZ camera allows circular scanning of the surrounding area in the thermal and visible spectrums. Thermal video surveillance provides reliable detection of people and cars at night with little artificial lighting or its complete absence.

The camera of a visible spectrum forms a high-resolution image; it uses a new high light sensitivity sensor. The video image from both the thermal camera and the camera of the visible range is processed by the on-board computer. It provides PTZ camera control, human detection, and tracking.

(A new temperature screening device powered by artificial intelligence (AI) could reduce the time and manpower needed to detect those who are running a fever. The device, developed by Integrated Health Information Systems and local start-up KroniKare, is being piloted. Called iThermo, the real-time screening device uses thermal cameras, 3D laser cameras and an artificial intelligence app to measure forehead temperatures within a three-metre range. The device is still being refined, but the team expects to produce 200 units by March to meet demand from retail centers and healthcare facilities.)

Thermal imaging surveillance in an AI robotic security team

When patrolling in conditions where there is sufficient illumination, it is advisable to use intelligent robots equipped with high-resolution visible-spectrum cameras. The S5.2 IS Prompt robot is designed to patrol pedestrian passageways and recognize people in the robot's immediate vicinity. The AI S5.2 PTZ IS Picard robot was created to detect people and perform smart video surveillance at distances up to 100 meters.

Skillful use of the features inherent in each robot model allows fitting out even the most complex facilities with robotic security. The unique AI capabilities inherent in the management of patrol routes and determining the positions used for surveillance provide a very high level of security.

Thermal dual-spectrum robots, like robots of other models, are equipped with powerful built-in artificial intelligence. This makes robotic security extremely reliable. Each robot autonomously makes decisions, depending on the location of other robots and the results of big data analysis of risk assessment. The failure of one or several robots, as well as the absence of a single management server, does not lead to a fatal loss of security for the area under guard.

2. https://www.analyticsinsight.net/ai-missiles-will-be-developed-by-the-us-army-to-locate-their-own-targets/

Artificial intelligence may before long be choosing who lives or passes on. The U.S. Army wants to come up with an intelligent, cannon discharged missiles that will utilize AI to choose their objectives, far from human oversight.

While the U.S. Armed forces as of now utilize a missile which uses infrared sensors to find and attack tanks at a range of around 200 meters, this new smart projectile could fill in as a more drawn out range alternative. The Cannon-Delivered Area Effects Munition (C-DAEM) system will utilize GPS to identify enemy tanks and heavily clad shells, which will be scanned ahead of time from the skies.

The weapons will have a range of as much as 60 kilometers and will almost certainly look through a zone of more than 28 square kilometers for their targets.

If this is effective, the C-DAEM weapon will supplant cluster warheads. These weapons work by dissipating numerous grenades over wide territories. While effective, cluster warheads as often as possible leave unexploded grenades following an attack.

Beforehand, the U.S. armed forces built up a missile that utilized infrared sensors to find and attack vehicles, however, it had a restricted reach if only 200 meters. The new rockets will be undeniably increasingly ground-breaking, sources state.

SCIENCE

Class 7

3.18 Electric Current and its Effects

PARAMETERS	DESCRIPTION	AI CONCEPTS INTEGRATED
Chapter Covered	**Chapter 8: Electric Current and its Effects**	
Name of the Book	**Science, Class 7, NCERT**	
Subject and Artificial Intelligence Integrated	Heating effect of current Classification based on supervised learning.	Supervised learning
Learning Objectives	● To revive the previous knowledge about electric circuit, circuit components and their functions ● To explain the phenomenon of the heating effect of electric current ● Find applications in daily life	
Time Required	3 sessions (35 minutes each)	
Classroom Arrangement	Flexible seating Science Laboratory on day 1	
Material Required	*Cell or battery, bulb, connecting wires, nichrome wire, 15 pictures of electrical appliances, screen, projector and internet connection*	
Pre – Preparation Activities	Students will be ● Divided into groups, and provided basic material to construct a basic working circuit. ● Asked to touch the bulb and check if it is producing any heat. ● Facilitator will ask questions Under the guidance of the facilitator, the learners will ● Demonstrate a similar activity, this time using nichrome wire. ● Learners will be asked to touch the nichrome wire and check if it is producing any heat. ● The facilitator will ask if they detect any difference in the heat produced.	
Previous Knowledge	● Students are having good knowledge about electric circuits, circuit components and construction of a simple circuit ● Understand the components of an incandescent bulb	

Methodology	Day 1 After the pre-activity, the learners will ● Discuss why wires made of alloys like tungsten and nichrome heats up much faster than normal copper wire. ● Discuss resistance and how it's related to the heating effect. ● To make the concept more clear open-source tool loopy will be used. ● https://ncase.me/loopy/v1.1/?data=[[[3,524,157,0.16,%22Current%22,1],[7,821,186,0.16,%22Heat%22,0],[9,248,203,0.16,%22voltage%22,3],[12,369,433,0.16,%22Resistance%22,5],[13,734,427,0.16,%22Heat%22,0]],[[9,3,52,1,0],[3,7,52,1,0],[12,13,-113,1,0]],[],15%5D Day 2 ● Students will be divided into groups of four and each group will be provided with 15 pictures of appliances used in daily life. ● They will be asked to classify them as to whether the heating effect is pro or con in each case ● Advantages and disadvantages of heating effect of electric current ● Applications of heating effect in daily life appliances like electric heater, electric iron, fuse will be discussed.	https://teachablemachine.withgoogle.com/train/image
Learning Outcomes	Students will ● understand the heating effect of electricity ● Obtain a general idea on the relationship. between material and resistance ● Be able to identify various electric appliances where heating effect is applied. ● Be able to identify cases where here heating effect of electricity are detrimental for the functioning of the electric appliance where the heating effect is applied.	
Follow up Activities	Students are to investigate how electric fuse and modern MCB works for the same purpose and also their differences. Learners will be instructed to provide stimulus image of an appliance at home to custom made AI models to identify whether the heating effect in the appliance is a pro or con.	
Reflections	Students will be asked to collect the data of the appliances which are using the heating effect from the time they wake up till they reach school.	

GLOSSARY:

1. AI Related Terminologies

AI Model Training: An algorithm is said to be artificially intelligent if it gets trained and can make decisions /predictions on its own. The intelligence which a machine gain comes by training the machine with the appropriate dataset. For example, a machine is to be created which needs to classify an image as either an apple or a banana. To achieve this task, the machine is trained with hundreds of images of apples and bananas each. While training, the machine extracts features from the image dataset of apples which would help the machine classify any image of an apple as an apple. The same is done for the banana dataset. Finally, after training, the machine is tested by providing an image of either an apple or a banana. If the machine is able to classify it correctly, the efficiency is said to be good else it gets re-trained on a better dataset. Training an AI model requires two datasets: Training Data and Testing Data. The machine is first fed the training data from which it makes its own rules which help it to predict the output. Then the testing data is used to check the efficiency of the model. Once training and testing is done, the model is deployed for use.

Classification: Machine Learning algorithms can be broadly classified into tree families: Supervised learning, Unsupervised learning and Reinforcement learning. Classification is a part of the Supervised learning model. Classification models work on labelled datasets and are used to predict the label of the testing dataset. For example, 100 images of apples and 100 images of bananas have been taken as a training dataset for the AI model. These 200 images have been labelled as apples or bananas respectively. This labelled data is then fed to the machine which trains itself by extracting common features from the dataset and understanding which features come under the apple label and which ones come under the banana label. At the time of testing, the machine takes an input image and extracts features from it which are then compared with the features marked under both the labels. On the basis of the degree of similarity, the machine will label the testing image as either apple or banana. This process is known as Classification.

2. AI Activity Description

To train the model, a teachable machine-AI tool from google is used, to train a model to identify the appliances as whether heat produced in the appliance is beneficial or AI model will have two classes as Beneficial or Not Beneficial each consisting sample of appliances of each category. Learners will be provided with a list of 5 appliances in each category. Before leaving, the facilitator provides the learners the link to access the model. At home, the learners are expected to test the appliances (only from the provided list) and check which class it belongs by noting the percentage accuracy. Following, the learners will update the facilitator, the output that the model could generate and with what accuracy. This data can further be used to improve the AI tool image recognition and learning.

SCIENCE

Class 7

3.19 Soil

PARAMETERS	DESCRIPTION	AI CONCEPTS INTEGRATED
Chapter Covered	**Chapter 9: Soil**	
Name of the Book	**Science, Class 7, NCERT**	
Subject and Artificial Intelligence Integrated	Exploring types of soil.	
Learning Objectives	Students will learn about: • Soil particles can differentiate by their size. • On the basis of size, colour and texture of soil particles, students can categorize the soil into sandy, silt and clayey soil. • Different plants grow well in different types of soils.	
Time Required	2 periods of 40 minutes each.	
Classroom Arrangement	Regular classroom setup having a projector, computer/laptop and internet.	
Material Required	Day 1: Field visit collection. (Plastic jar, pen, paper and magnifying lens) and the computer lab. Day 2: Computer and internet.	
Pre – Preparation Activities	Day 1: **Group Activity:** Students will be divided into 3 groups A, B and C. They will be taken to nearby places like the garden, roadside, construction site etc., and will be asked to collect a good amount of soil from these areas. Day 2: **Group Activity:** Divide the class into four groups A, B, C and D. They will work on North, South, East and West India respectively with the help of google earth.	
Previous Knowledge	• Define soil. • Soil profile / Different horizon of soil.	
Methodology	Playful starting and keen observation: Students will open the experiment link and they will play the game and along with it they will be asked to observe the soil around the toy. The teacher will ask whether the soil observed here is different from the one you observed in the field study. Day 1: Using the collected sample from the field teacher will ask students to observe different samples of soils, and write their observation on paper. Observations should include:	https://experiments.withgoogle.com/garden-friends

	• What colors are the soils? • What stuff can you find in soil? • Does all soil feel the same when rubbed in hands a little? • Are all soils the same? On the basis of their different observation, teachers will introduce the topic and will help students to understand the difference in soil color and texture. The teacher will show the below diagram and explain the properties of different types of soil.  Day 2: Students on the basis of groups divided will find out the colour of soil they are observing through google earth. And will choose the particular place from google earth and from the specific region given and will search out the type of soil and the crop particularly grown in that soil. Students will create their own project on google earth. By this activity students will learn about region having different type of soil in India and crops grown in that particular soil.	https://www.google.com/intl/en_in/earth/
Learning Outcomes	Learners will be able to differentiate soil on the basis of size and texture.	
Follow up Activities	• Students will watch the video Health-check soil and water with AI. • Students can collect more samples from some other places and prepare a table stating the place from where the soil is collected and name the type of soil. https://www.youtube.com/watch?v=H9M1EIPVk-U&feature=youtu.be	
Reflections	Students will collect knowledge about types of soil based on colour, size and texture of particles and different group growing associated with it.	

GLOSSARY:

AI Related Terminologies

- **Google Earth**

Google Earth is a computer program that renders a 3D representation of Earth based primarily on satellite imagery. The program maps the Earth by superimposing satellite images, aerial photography, and GIS data onto a 3D globe, allowing users to see cities and landscapes from various angles. I used google earth in this lesson plan so that students can make work on basis of color identification of India and identify the type of soil. And then further they can research on the state where they can observe the soil colour. They can make their own project in that google earth page and pin it with details they collected on a particular pace soil type.

https://www.google.com/intl/en_in/earth/

- **Garden Friends (AR Experiments)**

Garden Friends is an experiment in which you help grow personalized trees and flowers through a conversation with a quirky character. Just used for students' keen observation to observe the soil around the cartoon character.

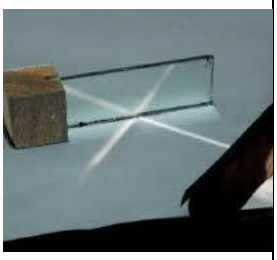
https://experiments.withgoogle.com/garden-friends

SCIENCE

Class 7

3.20 Light

PARAMETERS	DESCRIPTION	AI CONCEPTS INTEGRATED
Chapter Covered	**Chapter 15: Light**	
Name of the Book	**Science, Class 7, NCERT**	
Subject and Artificial Intelligence Integrated	Light and AI	
Learning Objectives	● To understand the rectilinear propagation of light. ● To understand the difference between the real image and virtual image. ● To understand the properties of the image formed by the plane mirror.	
Time Required	3 periods of 40 minutes each.	
Classroom Arrangement	Seating arrangement - • Theory Sessions - flexible seating • Activities Sessions - Science lab, in group or 3-4students.	
Material Required	● Science NCERT Class 6 book ● Notebooks ● A4 size sheets, Graph paper ● 3 no. of 6 by 6 inch cardboard pieces. ● A plane mirror with a stand, a torch or a candle ● A computer/smartboard with an internet connection.	
Pre – Preparation Activities	To observe themselves and some objects in a mirror and note down as many observations as they can make about the images they see. The students will be divided into groups of 4-5 students to carry out a series of activities in the science lab. They will also be asked to bring small mirrors(1 mirror per group)	
Previous Knowledge	The students have learned about how light travels in straight lines and that a polished surface is able to reflect the light. They also have made a pin-hole camera in the previous grade so are familiar with the term image formation.	

Methodology 	**Day 1** Start with a discussion about any observations that the students had regarding the light rays, images and mirrors. **Activity 1 : Light travels in a straight line** Make a small hole in the 3 cardboards in the same position. Arrange them standing vertically (using stands) in such a way that all the 3 holes are aligned in a straight line. ● Now flash a torch light/candle from one side and observe from the other side. ● Shift one of the cardboard and then try to see again. Discuss why they can't see the torch/candle once any one of the cardboard is shifted. They should be able to infer that this is because light travels in a straight line. **Activity 2: Reflection of light** Put up a mirror on a stand over a graph paper. Mark the position of the mirror with the straight line. Put a paper with a thin slit over the torch. Through this thin slit in the paper shine the light of a torch on the mirror such that it strikes the mirror at an angle.The ray of light can be seen being reflected by the mirror. ● The students should trace the path of the ray of light coming from the torch and the one reflected by the mirror. ● Measure and note the angle made by the mirror with the ray coming from the torch and with the ray reflected by the mirror. Rotate the mirror / the torch and repeat the above steps to note the angles made. Repeat the experiment 3-4 times to get the angels in different cases. Discuss with the students what they observe about the data obtained. The students should be able to infer that the reflected ray leaves the mirror at the same angle at which the ray from the light source strikes it. Discuss about the real and virtual images formed- Explain that the image formed on a screen (as in the case of a projector displaying an image on a screen in cinema hall) is a real image. The image that we see in a mirror seems to be forming behind the mirror, but when we go behind the mirror there is nothing. Such an image that cannot be formed on a screen is called a virtual image. **Day 2 (2 back to back periods)** **Activity 3: Properties of the image formed by mirror** The students will perform the following activities: Activity 15.2, 15.3 and 15.4 as given in the NCERT Grade VII Science textbook. (**Activity 15.2:** to observe that the image formed is erect. **Activity 15.3:** to observe that the image is at the same distance behind the mirror as the object is in front of it. **Activity 15.4:** to observe that the image formed in mirror is laterally inverted) Discuss about what the students understand from the above activities. They should be able to infer that the image formed by the plane mirror is ● Virtual ● Erect	Teachable Machines https://teachablemachine.withgoogle.com/

	● of the same size as the object ● Appears to be at the same distance behind the mirror as the object is in front of the mirror. ● The image is laterally inverted. **Activity 4: Teachable Machines** For this activity, the students will log in the given link. The students will try to teach the machine to identify different objects by placing those objects in front of the camera. They will observe the mirror images being captured by the machine while training it. The students can observe the above mentioned properties of the images therein.	
Learning Outcomes	The students will be able to understand that: • The light travels in straight lines. • The light is reflected from the mirror at the same angle at which it strikes the mirror. • The image formed by the plane mirror is virtual, erect, of the same size, at the same distance behind the mirror as the object is in front of it and is laterally inverted.	
Follow up Activities	The students do perform an activity where they will need to write some text in such a way that it can be read easily while seeing its image after reflection from a plane mirror Visit the site https://www.physicsclassroom.com/Physics-Interactives/Reflection-and-Mirrors/Who-Can-See-Who/Who-Can-See-Who-Interactive To play a simulated game. https://www.physicsclassroom.com/Physics-Interactives/Reflection-and-Mirrors/Plane-Mirror-Images/Plane-Mirror-Interactive	
Reflections	Discussion with Students on the role of AI application being used in different areas.eg in online shopping portals for clothes and spectacles etc.	

GLOSSARY:

1. AI Related Terminologies

Teachable Machine: Teachable Machine is a web-based tool that makes creating machine learning models fast and easy. You train a computer to recognize your images, sounds, and poses without writing any machine learning code.

Link to the game: https://www.teachablemachine.withgoogle.com

2. AI Activity Description

Teachable Machine: Ask the students to go on the link: https://teachablemachine.withgoogle.com/ and click on “Get started” a new page will open. On this page Click on - “Image Project”

You will get 2 boxes on the left side of the screen. You will need to click on “Webcam”.

Press ‘Hold to record’ and put an object (for example: a book) in front of the web camera of the device you are using. This will capture a number of images of the object. You may move the object in various directions so that the camera can capture the image from different angles. The button ‘Hold to record’ needs to be pressed for as long as you want the images to be captured.

Once you have captured enough images then you may release the button, and then name the Object Class as “Book” or any other name.

Repeat the above mentioned process to add more object classes.

Once all the classes have been added, click on “Train the machine” it will take some time for the process to finish. Once the machine is trained click on preview and bring one of the objects (for which the machine is trained to identify) in front of the camera and let the machine predicts what object is shown there.

Here the students can see a number of images formed, they can move around the object at different angles to see what changes are occurring in the images with any change in the position of the object.

SCIENCE

Class 7

3.21 Transportation in Animals and Plants

PARAMETERS	DESCRIPTION	AI CONCEPTS INTEGRATED
Chapter Covered	**Chapter 11: Transportation in Animals and Plants**	
Name of the Book	**Science, Class 7, NCERT**	
Subject and Artificial Intelligence Integrated	Heartbeat Pulse – Definition, effect of body activities on the heart rate. Different components of blood and their function.	Data Exploration. The data visualization catalogue. Mind master
Learning Objectives	• To make students understand the concept of heartbeat. • To help student understand pulse and pulse rate. • How to measure heartbeat and pulse rate. • To familiarize different types of blood cells.	
Time Required	2 periods of 35 min each.	
Classroom Arrangement	Regular classroom setup.	
Material Required	Computers, Pen, Paper and Sketch pens.	
Pre – Preparation Activities	Students will collect the data. • Heartbeat of people of different age group.(1 year, 10 year, 20 year, 40 year, 70 years) • Heartbeat of people while sleeping, while walking, after exercise, after eating food.	
Previous Knowledge	Students are aware about the functioning of the heart from the discussion in previous classes.	
Methodology	• Students will be divided into a group of 5 students each. • Each group will be asked to collect the information based on any one parameter. • The will be asked to present the data using 'The data visualization catalogue'. • Students will be asked to explain the relation between age and heart rate. • Use of a stethoscope will be discussed using a video. • Process of measuring pulse rate will be explained by the teachers to the students. Day- 2 Different blood corpuscles and their functions will be discussed. Components of the blood. https://www.youtube.com/watch?v=qrE6Y0Se8bw Students will be asked to make a mind map based on the discussion.	https://datavizcatalogue.com/ Mind Master. https://www.edrawsoft.com/mindmaster/?gclid=EAIaIQobChMImJPCoujY6wIV034rCh2FJAZDEAAYASAAEgJSYvD_BwE

Learning Outcomes	By the end of the class, students will be able to: • Explain the factors affecting heart rate. • Explain the types and functions of different types of blood cells.	
Follow up Activities	Students' analyses will be done using the quizzes application.	
Reflections	Students will be able to do different activities Using AI tools.	

GLOSSARY:

AI Related Terminologies

1. Data Exploration: After acquiring data comes the need to analyze the data. For this, they need tovisualize the acquired data in some user-friendly format so that they can:

- Quickly get a sense of the trends, relationships and patterns contained within the data.
- Define strategy for which model to use at a later stage.
- Communicate the same to others effectively.

To visualize data, various types of visual representations can be used by the students like diagrams,charts, graphs, flows, etc. An online open-source website is available at

https://datavizcatalogue.com where the students can observe various types of representations thatcan be used in data visualization. On this platform, the students will be able to get the descriptionof any graph they select and the website will also guide them to various software/online toolswhich can be used to generate the same.

2. Mind master: MindMaster is designed for creating fresh new visual innovations, integrating your bullet points to structure an overall mind map. It is convenient and helpful for you to use MindMaster to sort out your thoughts or ideas in order to find solutions to problems. Students can insert different kinds of objects into topics and mind maps in MindMaster, including relationship line, callout, boundary, summary, mark, clipart, picture, hyperlink, attachment, note, comment, and tag.

SCIENCE

Class 7

3.22 Fibre to Fabric

PARAMETERS	DESCRIPTION	AI CONCEPTS INTEGRATED
Chapter Covered	**Chapter 3: Fibre to Fabric**	
Name of the Book	**Science, Class 7, NCERT**	
Subject and Artificial Intelligence Integrated	Application of AI in selection of fabric.	
Learning Objectives	• 1Students will learn about different types and sources from where we get fiber. Sources are: - Animal sources - Plant sources • Learn about the process of converting fiber into fabric. - Processing of fiber into wool. - Life history of a silk moth	
Time Required	4 periods of 40 minutes each.	
Classroom Arrangement	Flexible seating.	
Material Required	• Smartboard/screen, projector, laptop and internet connection. • Samples of: - Fibers - Fabrics - Chart paper - Glue and - sketch pens	
Pre – Preparation Activities	The students will be asked to bring samples of different fabrics in groups.	
Previous Knowledge	To trigger the previous knowledge of the students: The teacher will collect pieces of three different kinds of fabric, students will be asked to fill the information in a table on the basis of fabric shown: • How does it feel? • Does this fabric stretch? • Can you see through it?	
Methodology	Students will be asked to explore about fibers and fabrics in the groups. They will be asked to bring interesting facts about fabrics (in groups) and discuss them in the class. For more concept clarity students will be shown: https://www.youtube.com/watch?v=d6Xi7xHIoeU Students will be asked to try a virtual mirror by Vero Moda.	AI tool: http://blouze.github.io/projets/harmonogrammes/ Virtual mirror/virtual trial room link: https://www.veromoda.in/upto-50-vm?gclid=CjwKCAjwkdL

	Students will be asked to explore myntra.com	6BRAREiwA-kiczPCPI0wIaRgEZEsk1Wvl4r6jq6vPVCuKEf0Pl1GNOB7ruNTUr0e5KhoCcXEQAvD_BwE AI tool used for selection of dresses: https://www.myntra.com/
Learning Outcomes	Students will learn about that different types and sources of fabrics. Students will be able to identify different fabrics. Students will learn the process of converting fiber into fabric. Students will learn about different properties of fabrics. On the basis of these properties they will be able to select: • Fabric according to the weather. • Fabric according to their comfort.	
Follow up Activities	Every group will bring different fabrics and all will be pasted on a chart (collage making)	
Reflections	Students will learn to identify different fabrics used for different purposes.	

GLOSSARY:

AI tools

1. Virtual mirror/Virtual trial room: Globally, the fashion industry is a huge industry so it's no surprise that AI technologies are being used across a wide range of applications from helping design clothes, optimizing manufacturing, and hyper-personalized marketing.

2. Myntra: The textile industry in India traditionally, after agriculture, is the only industry that has generated huge employment for both skilled and unskilled labour in textiles. The textile industry continues to be the second-largest employment generating sector in India. It offers direct employment to over 35 million in the country.

The fashion industry is just as much about creating demand and brand awareness as it is about the manufacturing of fashion products. Clothing and apparel brands are constantly looking for new ways to get their goods in front of buyers and create awareness and demand in the market. Increasingly, fashion brands are using AI and machine learning to maximize users' shopping experience, improve the efficiency of sales systems through intelligent automation, and enhance the sales processes using predictive analytics and guided sales processes.

SCIENCE

Class 7

3.23 Motion and Time

PARAMETERS	DESCRIPTION	AI CONCEPTS INTEGRATED
Chapter Covered	**Chapter 13: Motion and Time**	
Name of the Book	**Science, Class 7, NCERT**	
Subject and Artificial Intelligence Integrate	AI integrated with speed, distance and time.	● Data acquisition ● Data exploration ● Google map
Learning Objective	● To familiarise the students with the concept of speed. ● To make help them to understand the units of speed. ● To understand how to measure speed. ● To understand and analyse distance-time graph. ● To understand data acquisition and data exploration part as AI model with the help of Google map application	
Time Required	3 periods of 35 minutes each.	
Classroom Arrangement	Flexible seating arrangement	
Material Required	● NCERT textbook, laptop, internet connection, blackboard and chalk. ● Project if possible for the display of google map and graphs	
Pre – Preparation Activities	• Ask students to gather some data from the dashboard of their cars or from the meter fitted on top of a scooter. (Actually what the meters indicates) • Ask to students try to explore the Google map app.	
Previous Knowledge	● The learner should know about motion, different types of motions like circular motion, straight or periodic. ● Some questions can be asked to students based on motion.	
Methodology	● Divide the students into 4 groups for discussion on speed. ● Display a picture of vehicles moving in the same direction on road at some instant of time ● Display another one picture of the same vehicle but differ in positions. ● Ask to students observe these two pictures and ask questions to them like which one is the fastest or slowest.	AI enabled google map https://www.google.com/maps https://datavizcatalogue.com/

	● Then introduce term speed,how to measure speed and how speed is related to distance and time **AI Activity** ● **Relate the** concept of speed distance and time with Google map. ● After the exploration of the map, ask to them observe the value of time taken for the same distance but a change in the mode of transportation like by car, by bicycle. ● They can collect data for variation of distance and time at a uniform speed. ● For visualization of graph and understanding of graphs,introduce the link.	
Learning Outcomes	● Students would be able to understand the concept of speed ● They would be able to understand units of speed. ● They would be able to know how to measure the speed. ● They would be able to know that motion of objects can be represented in pictorial form. ● They would be able to understand the significance of odometer,speedometer fitted on the dashboard of a car or any vehicle.	
Follow up Activities	● Ask students to explore more app those shows relation between speed distance time.	
Reflections	Tracking,GPS speedometer	

GLOSSARY:

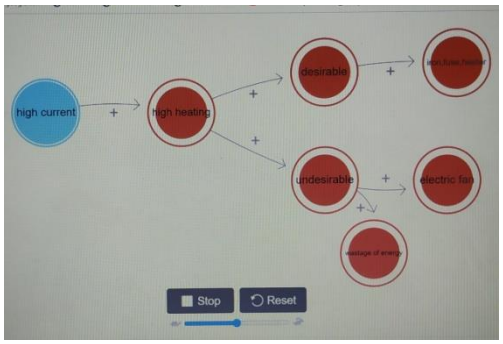
AI Related Terminologies

1. **Data Acquisition:** Data acquisition refers to acquiring authentic data from reliable and reliable sources/platforms that are required for the AI model. There can be various ways to collect data.
2. **Data exploration:** Data exploration refers to visualizing the data to determine the pattern, relationship between elements, and trends in the dataset that gives clear meaning and understanding of the dataset. Data exploration is important as it helps the user to select an AI model in the next stage of the AI project cycle.
3. To visualize the data, various type of visual representation can be used and such as diagram, chats, graphs, flows and so on https://datavizcatalogue.com/.

SCIENCE

Class 7

3.24 Electric Current and its Effects

PARAMETERS	DESCRIPTION	AI CONCEPTS INTEGRATED
Chapter Covered	**Chapter 14: Electric Current and its Effects**	
Name of the Book	**Science, Class 7, NCERT**	
Subject and Artificial Intelligence Integrated	● Heating effects of electric current. ● Working of a heater ● Working of an electric iron ● Working of an electric fuse 	https://ncase.me/loopy/v1.1/
Learning Objectives	Students will be able to: ● Visualize the heating of various electrical devices. ● Know how this effect is made into use in heating devices like electric geysers, electric iron, heater etc. ● Understand the working of electric heater, electric iron and electric fuse.	
Time Required	4 periods of 40 minutes each.	
Classroom Arrangement	Regular classroom arrangement.	
Material Required	● Smart board with net connection ● Electric fuse	
Pre – Preparation Activities	The working of electric heater, electric iron and an electric fuse will be demonstrated through the YouTube video on the smart board. https://www.youtube.com/watch?v=BLIYsRwKrkE	
Previous Knowledge	The students are supposed to know about electric current, conductors and insulators, cell, battery and electric circuits.	
Methodology	● Fussing with definitions ● Think-Pair-Share ● Demonstration method ● Lecture-discussion method	

Learning Outcomes	Students will be able to- ● Reason out why the heat is evolved when current passes through a conductor. ● Know about the devices where this liberated heat is put into use. ● Understand the working of electric heater, electric iron and electric fuse.	
Follow up Activities	A brief discussion will be held on the same topic for recapitulation and a quiz will be conducted on smart board in the google form.	
Reflections	The working of various electrical devices based upon heating will be discussed with the students.	

GLOSSARY:

AI Related Terminologies

AI Project Cycle: AI Project cycle is a framework which is used to design an AI project taking all the crucial factors into consideration. The project cycle consists of 5 steps namely: problem scoping, data acquisition, data exploration, modelling and evaluation. Each of the stages holds importance in the framework.

Problem Scoping: Problem Scoping refers to understanding a problem and finding various factors which affect the problem. Under problem scoping, we use the framework of 4Ws problem canvas where we look into the Who, What, Where and Why of a problem. After observing these factors, students get clarity towards the issue to be solved which leads them towards data acquisition.

https://ncase.me/loopy/v1.1/

SCIENCE

Class 8

3.25 Microorganisms: Friend and Foe

PARAMETERS	DESCRIPTION	AI CONCEPTS INTEGRATED
Chapter Covered	**Chapter 2: Microorganisms: Friend and Foe**	
Name of the book	**Science, Class 8, NCERT**	
Subject and Artificial Intelligence Integrated	Science and AI	
Objectives	Students will be made to understand that there are living organisms around us which we cannot see with our naked eyes. These are called microorganisms or microbes. They will learn how to • Classify Microorganisms • Explore where they live • Differentiate between Good and Harmful Micro organisms	
Time Required	3 periods (plus 3-4 weeks pre- preparation time to observe)	
Classroom Arrangement	Flexible	
Material Required	Chart Paper pen, pencils, sketch pens, earthen pots; plant waste; waste plastic; projector; screen; laptops/desktops; Video links; Internet connection	
Pre- Preparation Activity	Students are divided into groups of four and asked to set up observation of two pots per group filled half with soil marked A and B. They are instructed to put plant waste in pot A and things like polythene bags, empty glass bottles and broken plastic toys in pot B. The pots are set aside and observed after 3-4 weeks.	
Introduction	Students are asked to list their observations with regard to the 2 Pots that they have been monitoring. The Teacher then leads a discussion on water and soil being full of tiny organisms with a focus on microbes.	
Methodology	Continuing in the same groups as earlier, students are asked to conduct an online search for various kinds of microbes and to classify them as per the table given in the book Students are guided to identify where these Microorganisms can be found and where they live. The Student groups are asked to prepare a presentation on Friendly Microorganisms and their uses and harmful Microorganisms and their effects A Microbe scanner will be introduced to the students through a video showing how Artificial Intelligence is helping in the detection of microorganisms and can advise the next course of action regards prevention of disease or infection.	https://www.geek.com/tech/wash-dry-scan-device-detects-disease-causing-germs-on-hands-1750845
Learning Outcomes	• Students will be able to understand and relate to the existence of microorganisms or microbes. • Students will be able to Classify Microorganisms; Explore where they are found and where they live. • Students will also differentiate between Good and Harmful Microorganisms and recognize how Artificial Intelligence is capable of identifying harmful Microorganisms and advising the next course of action regards prevention of disease or infection.	

Self-Evaluation and Follow-Up	The students will work in groups and find answers to the following • Can microorganisms be seen with the naked eye? If not, how can they be seen? • What are the major groups of microorganisms? • Name the microorganisms which can fix atmospheric nitrogen in the soil. • Write 10 lines on the usefulness of microorganisms in our lives. • Write a short paragraph on the harms caused by microorganisms. • What are antibiotics? What precautions must be taken while taking antibiotics?	
Follow-up Activity	Students will visit the following www.microorganisms www.biology4kids.com/files/micro_main record their learning and make portfolios with pictures They will also search online for AI tools that help in detection of disease-causing Microbes and make a record of their functioning and usefulness	https://www.geek.com/tech/wash-dry-scan-device-detects-disease-causing-germs-on-hands-1750845 https://lembergsolutions.com/blog/how-ai-can-help-monitor-hand-hygiene-compliance

GLOSSARY:

AI Case Study

“Maybe you were rushing to a meeting and just couldn’t scrub for the full 20 seconds, or maybe the commercial break in the big game wasn’t long enough and you had to rush back from the bathroom without washing your hands.”

It happens—at home and in professional kitchens. According to the CDC, 70 percent of all foodborne illness breakouts originate in foodservice.

But Schindler and Waanders don’t think we should settle for vomiting, fever, aches, and diarrhea just because someone forgot to rinse between handling raw and ready-to-eat food.

“PathSpot can fill the gap, offering a technology to ensure only clean hands are touching food, doors, tables, and utensils,” the project website said. “If handwashing is the DIY vaccine, PathSpot is the tool to administer it—protecting restaurants, employees, and customers.”

PathSpot is a wall-mounted device that screens for disease-causing germs in just two seconds. Co-founders Schindler and Dutch Waanders, former biomedical engineering students at Duke University, began testing PathSpot in restaurants early this year.

The technology relies on spectroscopy: Wavelengths beamed from a tablet bounce off the microbes on a person’s hand, reflecting back into the built-in camera. Light reflects differently based on the shape of whatever it bounces off of—including bacteria. Within seconds, the PathSpot algorithm compares those echoed wavelengths with common disease signatures (*E. coli*, *salmonella*, norovirus, hepatitis A, *listeria*) and indicates the presence of contaminants.

Know more about the device on: https://www.geek.com/tech/wash-dry-scan-device-detects-disease-causing-germs-on-hands-1750845/

SCIENCE

Class 8

3.26 Cell-Structure and Functions

PARAMETERS	DESCRIPTION	AI CONCEPTS INTEGRATED
Chapter Covered	**Chapter 8: Cell-Structure and Functions**	
Name of the Book	**Science, Class 8, NCERT**	
Subject and Artificial Intelligence Integrated	Understanding the difference between plant and animal cell	
Learning Objectives	● To familiarize students with major differences between plant and animal cell. ● To make the students understand the specific functions of organelles specifically present in plant and animal cell. ● To awaken the students on the importance and uniqueness of different organisms	
Time Required	2-3 periods of 40 minutes each	
Classroom Arrangement	Regular classroom setup having, Projector, computer/laptop and internet - computer lab clay, pizza base, dough, bread, vegetables	
Material Required	Computers Media player with speakers, Pen, Paper, Sketch pens, clay, pizza base, dough, bread, vegetables	
Pre – Preparation Activities	● Students will be divided into 2 groups to discuss the functions of parts of a cell. ● Ask them to compare the structure and function of the cell to a factory - Head office- Nucleus - Boundary- Cell membrane - Canteen- Chloroplast - Garden area between head office and main boundary- Cytoplasm - Main boundary with barbed wire-Cell wall ● Ask them to discuss and prepare a list of organelles present in animal and plant cell.	
Previous Knowledge	● Students should have knowledge of the basic structure of cell. ● They should be aware of the functions of various parts of a cell.	

Methodology	● Divide the class into 2 groups one will represent PLANT CELL and the other ANIMAL CELL ● Students will recall the structure and function of each part of the cell. ● Assign them the task of assembling all parts of a cell in the clay model. They can use pizza base, bread, snacks dough, vegetables to make edible cell-model for fun. ● After completing the task each group will show their model and the teacher will discuss the difference in plant cell and animal cell. Example: Cell wall and plastids in plant cells and specific functions of them ● Now students will be guided to draw animal and plant cell on auto draw with correct placement of different parts of cell. ● Students will visit the computer lab and with the help of teachable machine they will recognize and classify different types of animal and plant cells	https://autodraw.com. https://teachablemachine.withgoogle.com/
Learning Outcomes	• Students will be able to understand and differentiate between different types of animaland plant cell • Students will be able to understand the importance of specific parts of plant and animal cell • They will be able to understand the importance of the co-existence of different organisms and ecological balance.	
Follow up Activities	● They can be guided to collect pictures of different types of animal and plant cell ● A quiz will be conducted on www.kahoot.com to ensure achievement of desire outcomes ● They will be asked to think on the following questions - What would happen if an animal cell also had a cell wall? - Why are plastids required by plant cells only?	
Reflections	Conduct a brief discussions in small groups in the activity period and assess the understanding of students on the topic.	

GLOSSARY:

Autodraw.com: Autodraw.com is an AI enabled tool which is based on the domain of Computer Vision in which the machine identifies the pattern of your drawing and accordingly maps it with the most similar image. This tool shows various options trying to predict what the user is trying to draw.

https://autodraw.com.

AI Activity Description

For this activity, ask the students to go to https://autodraw.com. Once they land on this website, ask the students to select the first icon from the left side toolbar. This icon activates the AI element of the tool. Now, ask the students to draw any shape and let the AI algorithm detect and predict the possible drawings similar to it. The predictions will appear in the top row. After looking at the predictions and analyzing how accurate the machine is, ask them to keep an image in mind (say of a monument or a vehicle or thing etc.) and then start drawing it roughly and see at what step the machine is able to predict the image.

SCIENCE

Class 8

3.27 Friction

PARAMETERS	DESCRIPTION	AI CONCEPTS INTEGRATED
Chapter Covered	**Chapter 12: Friction**	
Name of the Book	**Science, Class 8, NCERT**	
Subject and Artificial Intelligence Integrated	● Force of friction ● Factors affecting friction ● Static, sliding and rolling friction ● Friction- a necessary evil ● Increasing and reducing friction ● Fluid friction (drag) + AI	Unsupervised learning
Learning Objectives	Students will be able to ● Understand the concept of frictional force encounter in daily life. ● Apprehend the relation between friction and nature of the surface in contact. ● State the reason for producing friction between two surfaces. ● Differentiate between types of friction. ● Learn themethods to increase and decrease friction. ● Explain the fluid friction and methods to overcome it.	
Time Required	4-5 periods of40minutes each.	
Classroom Arrangement	Regular classroom setup having Projector, computer/laptop and internet.	
Material Required	Pens, paper, computer/desktops bricks and paper, pencil cell, spring balance, jute cloth, string and polythene.	
Pre – Preparation Activities	Ask the students to think about the following: ● A vehicle slows down when brakes are applied. ● A ball moving on the ground stops after some time. ● We slip when we step on a banana peel. ● It is difficult to walk on a smooth and wet floor. After this teacher introduces the concept of frictional force.	
Previous Knowledge	The students must be familiar with the terms rest and motion, external applied force, smooth and rough surface.	
Methodology Activity-based Learning by doing	Divide the class into 3-4 groups and assign them the tasks given below: ● Release a pencil cell from an inclined plane which is placed on a tabletop. ● Now spread a sheet of cloth over the table. ● Repeat the above two steps by wrapping a piece of sandpaper around the pencil cell. ● Note down the distance covered by the pencil cell before coming to rest in all the cases.	https://experiments.withgoogle.com/tiny-sorter https://teachablemachine.withgoogle.com/

	The students will share their observations with the class. The teacher now explains that the distance covered depends on the nature of the surface (roughness or smoothness) on which the pencil cells move. Also, the smoothness of the surface of the pencil cell could also affect the distance travelled by it.	
Learning Outcomes	Students should be able to: ● Apprehend the method of measuring frictional force. ● Appreciate the importance of friction in daily life. ● Analyze the method of reducing friction. ● Correlate the concept taught with the real-life observations. ● Design creative methods to bring a positive change in life by understanding the importance of friction (be it in solids, liquids or gases).	
Follow up Activities	Hold a brief discussion on the topic of Friction and observe whether the concepts are clear or not. Ask them to self-assess themselves based on their contribution in the discussion. Identify the tools/ devices/ toys where ball bearing is used and find out - How the device would work if there were no ball bearings in it? Explore the given link: https://phet.colorado.edu	
Reflections	Students will also search online for AI tools that help in the detection of the nature of the surface.	

GLOSSARY:

AI Related Terminologies

Tiny Sorter

It is a DIY experiment connecting Arduino and Teachable Machine.

It's a little machine that you can easily make with a piece of paper — just cut, fold, assemble the motor and put in right on top of your laptop's webcam. Then use Teachable Machine to create a machine learning model (no coding required) to sort little objects – cereal, candy, paper clips, whatever you've got laying around. And just like that you have your own machine learning sorter.

It's a super simple and fun project for just about everyone - students, coders, non-coders, even if this is your first time using Arduino. Build your own Tiny Sorter and get a feeling for what machine learning and physical computing is all about.

https://experiments.withgoogle.com/tiny-sorter

Teachable Machine is a web tool that makes it fast and easy to create machine learning models for your projects, no coding is required. Train a computer to recognize your images, sounds, & poses, then export your model for your sites, apps, and more.

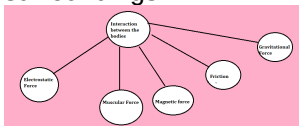
https://teachablemachine.withgoogle.com/

SCIENCE

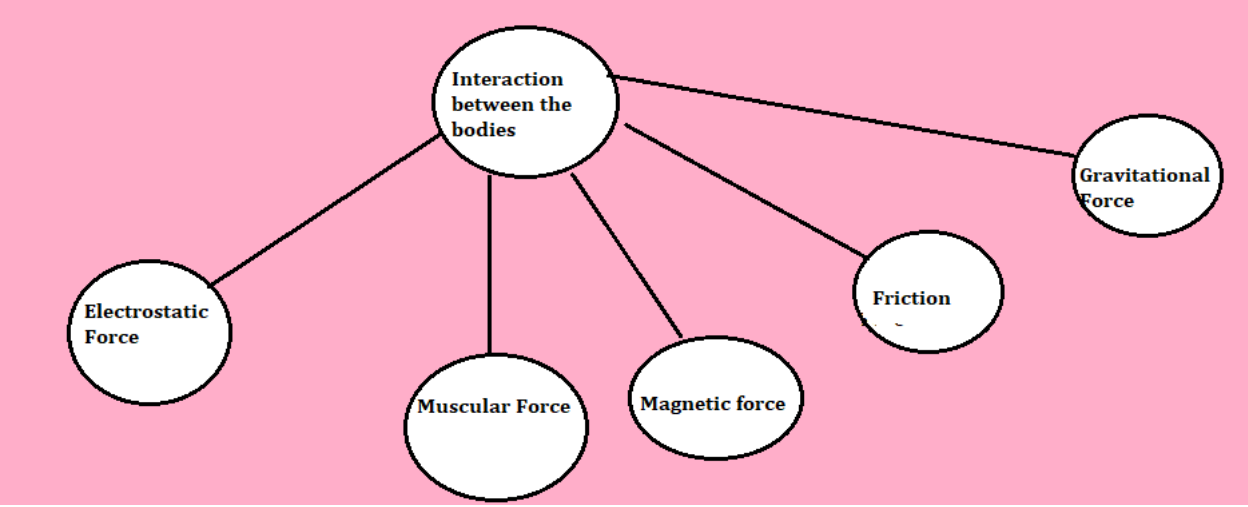
Class 8

3.28 Force and Pressure

PARAMETERS	DESCRIPTION	AI CONCEPTS INTEGRATED
Chapter Covered	**Chapter 10: Force and Pressure**	
Name of the Book	**Science, Class 8, NCERT**	
Subject and Artificial Intelligence Integrated	● Forces are due to an interaction of bodies ● Exploring forces ● Force can change the state of motion of an object. · ● Contact and Non- contact forces	**Supervised learning Neural Network (Decision Tree)**
Learning Objectives	Students will be able to : ● understand that two objects must interact for a force to come into play ● Understand the types of forces and their application. ● Classify the forces into contact and non-contact forces. ● Realize that the net force acting on an object can be zero even if forces are acting on it. ● Explain what happens when force acts on a body in the same or opposite direction of motion of the body.	
Time Required	● 2-3 classes of 40 minutes each	
Classroom Arrangement	Regular classroom setup, pair of magnets, magnetic compass, rope for tug of war.	
Material Required	laptop/desktop or smart mobile phone with internet connection, chalk, blackboard·	
Pre – Preparation Activities	Students will be asked to name the types of forces they are aware of and observe the effect of those forces around them.	
Previous Knowledge	● Students know the cause of motion of objects. ● Why a moving object like a ball rolling on the ground slows down. ● Why do bodies fall vertically downwards?	

Methodology	The teacher will introduce the topic with simple day to day life examples and videos related to this topic. https://www.youtube.com/watch?v=IoD5Ph0sY4A Activity 1: ● The students are asked to play some activities(turn by turn in groups) like- tug of war, bringing a magnet near a stationary magnet and see the effect or bringing a magnet near a magnetic compass, dropping an object,pushing or pulling heavy bodies etc. ● The teacher then directs the students to think about the cause of the motion of objects in the above activity. How does an object change its state of rest/ motion/ direction of motion? The types of forces students are aware of? ● The teacher then discusses all types of forces(muscular force, friction, gravitational force, magnetic force, electrostatic force) and their application. Students are then asked to observe - do we see the effect of the forces only when the bodies are in contact? Do we observe the forces acting from a distance? After explaining, they will be classified into contact and non-contact forces. ● The students will be able to analyze the effect of all the forces and conclude that a body moves in the direction of the net force. For example: When a body moves on a road, several forces act on the body- friction, air drag, weight of the body, normal reaction from the ground. We see the motion of the body in the direction of the net force. **Decision Tree** After understanding all the forces, students will perform an activity**.** They will be asked to make a decision tree of all the forces and classify them as contact and Non-contact forces and hence give an example of each force by observing their surroundings. 	
Learning Outcomes	· Students will be able to: ● Conclude that interaction of one object with another object results in a force between the two objects. ● Explain the types of forces and their effects. ● Describe that the change in the state of rest, state of motion and direction of motion is due to the application of force on it. ● Differentiate between contact and non-contact forces. ● Explain the effect of force on an object is due to the net force acting on it.	
Follow up Activities	● In the last 5- 10 minutes, teachers recap the topics covered in the class.	This supervised learning is supported by an AI tool https://teachablemachine.withgoogle.com/. Students will be explained how supervised learning works in AI.

		Classification or object identification is done on the basis of certain parameters.
Reflections	Discussion with Students on the role of AI application and its integration with the topic discussed.	



GLOSSARY:

AI Related Terminologies

1. **Classification**: Machine Learning algorithms can be broadly classified into three families: Supervised learning, Unsupervised learning and Reinforcement learning.
   Classification is a part of Supervised learning model. Classification models work on labelled datasets and are used to predict the label of testing dataset. For example, 100 images of apples and 100 images of bananas have been taken as a training dataset for the AI model. These 200 images have been labelled as apples or bananas respectively. This labelled data is then fed to the machine which trains itself by extracting common features from the dataset and understanding which features come under the apple label and which ones come under the banana label. At the time of testing, the machine takes an input image and extracts features from it which are then compared with the features marked under both the labels. On the basis of the degree of similarity, the machine would label the testing image as either apple or banana. This process is known as Classification.

2. **Neural Networks**: Neural networks are loosely modelled after how neurons in the human brain behave. The key advantage of neural networks is that they are able to extract data features automatically without needing the input of the programmer. A neural network is essentially a system of organizing machine learning algorithms to perform certain tasks. It is a fast and efficient way to solve problems for which the dataset is very large, such as in images.

3. **Teachable Machine** is a web tool that makes it fast and easy to create machine learning models for your projects, no coding is required. Train a computer to recognize your images, sounds, & poses, then export your model for your sites, apps, and more.

   https://teachablemachine.withgoogle.com/

SCIENCE

Class 8

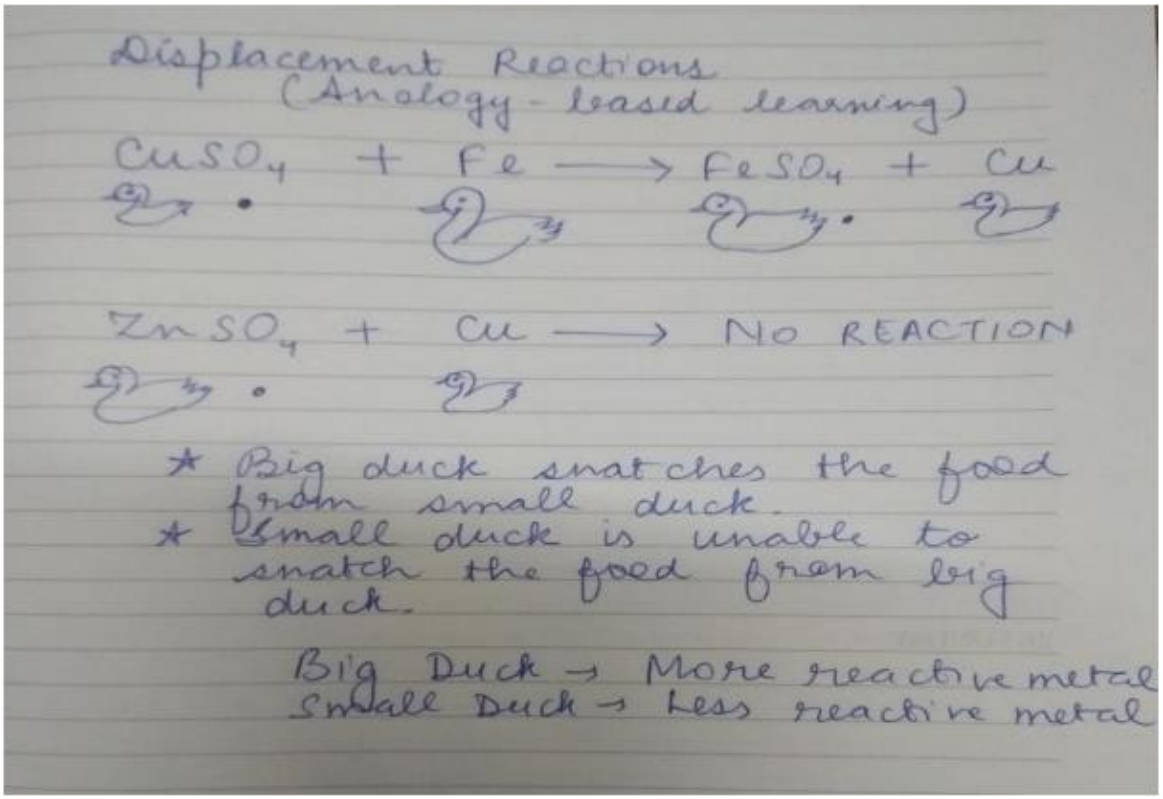
3.29 Materials: Metals and Non-Metals

PARAMETERS	DESCRIPTION	AI CONCEPTS INTEGRATED
Chapter Covered	**Chapter 4: Materials: Metals and Non-Metals**	
Name of the Book	**Science, Class 8, NCERT**	
Subject and Artificial Intelligence Integrated	● The students will be asked to use AI tool (Quickdraw) and analyses side by side which material/element is that object made up of, hence deepening their knowledge about Elements and their role in building up materials. ● Understanding of basic elements will be developed through Little Alchemy Game (Jakub Kozoil) ● Classification of Elements as metals, mon-metals and Metalloids with help of 3D Periodic Table (Sarath Saleem) (AI Google Experiment) ● Story on elements will be created by students on the following AI Tool: (short stories by Nick Rout) or Inklewriter Hydrogen was once roaming freely when he came across_____ https://youtu.be/TM1JPnu4otM	http://littlealchemy.com/ http://graphoverflow.com/graphs/3d-periodic-table.html www.inklewriter.com
Learning Objectives	The students will be able to understand: ● The correlation amongst all biotic and abiotic components of this universe on the based on the elements they are made up of. ● The concept behind the segregation of elements as metals, non-metals and metalloids. ● Students will be able to memorize and state and the symbols of a given set of elements and compounds. ● Students will be able to classify the materials like metals and non-metals on the basis of their physical properties. ● Students will be able to understand the chemical properties of metals and nonmetals. ● Students will be able to relate the presence of various metals and non-metals in their surroundings and their practical applications. ● Students will be able to frame products from the given set of reactants in displacement reactions. ● Students will be able to justify the reason behind the exceptional behavior of particular metals and non-metals. ● Students will get acquainted with various laboratory ethics as a part of Lab Demo given for chemical properties of metals and non	
Time Required	8-10 periods of 40 minutes each.	
Classroom Arrangement	Flexible seating arrangements.	

Material Required	● Screen and projector ● Laptops/desktops ● Video game/AI tool links ● Internet connection ● Materials from laboratory ● Simple circuit ● Samples of metals/non-metals.	
Pre – Preparation Activities	The teacher will prepare slideshow of questions to test the previous knowledge of learners.	
Previous Knowledge	● Why is Mars known as Red Planet? ● From where do we get gold, petroleum, coal? ● What happens when the dead bodies of plants, animals and humans decompose? ● How are fossil fuels formed? ● Students will revise the structure of atom. ● Subatomic particles, their charge, the number will be discussed followed by the concept of ion formation by gaining/losing an electron. ● Since all humans have two eyes, one nose, two ears, one mouth, yet they don't resemble each other, similarly all atoms are made up of the same set of sub-atomic particles but they vary in their characteristics due to the difference in their number. ● Emphasize that certain materials have the tendency to lose electrons and some have tendency to gain electrons and this fact differentiates them.	
Methodology	● To enhance and capture learners' interest, they will be made to learn symbols of various elements through GAME BASED LEARNING- SPIN THE WHEEL ACTIVITY ● In groups of 4-5 ask students to list their observation of these materials - iron, coal, sulphur, aluminium and copper on the basis of their appearance (shiny/dull) and hardness (very hard/not very hard). ● Continuing in the same groups, we will ask them to beat these materials with a hammer and note their observations, whether these materials flatten or break into pieces. ● Ask them to replace the switch in a simple circuit with these materials to find whether they conduct electricity or not. ● The teacher then leads the discussion on the physical properties of metals and non-metals.	Practice of chemical names of elements on Handwriting with Neural Net http://distill.pub/2016/handwriting/
Learning Outcomes	• Learners will be able to develop an understanding of the classification of metal and non-metals on the basis of their physical properties. • Learners will be able to explain the different chemical properties of metal and non-metals. • Learners will be able to understand the displacement reactions that occur due to difference in the reactivity of metals. • Learner will be able to classify metals and non-metals on the basis of their uses. • Learner would become proficient in writing chemical reactions on the basis of complete understanding.	

Follow up Activities	BALLOON POP GAME would be played to check on the following points of knowledge/ understanding of learners: • Symbols of elements and compounds • Exceptional cases in physical properties of metals and non-metals. • Reactivity series of metals. • Key points of given chemical reactions. • Wordwall tool used: www.wordwall.com	
Reflections	Students will be able to reflect upon their own level of understanding on the basis of various activities conducted during the discussion of the chapter	

- By adopting the following technique, learners will be able to understand reactivity series and Displacement Reaction in a better manner.



GLOSSARY:

AI Related Terminologies

1) Students will be asked to use AI tool (**Quickdraw**) and analyse side by side which material/element that object is made up of, hence deepening their knowledge about Elements and their role in building up materials. The teacher will act as a facilitator in enhancing the link between the object drawn and the element it is made up of. (example: Tooth (Calcium, Phosphorous), Peanut (Nitrogen), Log of wood (Carbon)

2) **Little Alchemy (**http://littlealchemy.com/) is a simple game based on the good old idea of mixing elements to create new things. It started as a simple test for the Chrome Web Store but because of the huge and unexpected popularity we redesigned it and turned into a full-size project.

3) **3D Periodic Table** http://graphoverflow.com/graphs/3d-periodic-table.htm
A 3d visualization of periodic table. This 3D representation has a table view which shows initially and an atomic view.

4) Story on elements will be created by students on **www.inklewriter.com**
Hydrogen was once roaming freely when he came across_____

5) **Handwriting with Neuralnet** to practice chemical symbols of elements
http://distill.pub/2016/handwriting/

SCIENCE

Class 8

3.30 Reaching the Age of Adolescence

PARAMETERS	DESCRIPTION	AI CONCEPTS INTEGRATED
Chapter Covered	**Chapter 10: Reaching the Age of Adolescence**	
Name of the Book	**Science, Class 8, NCERT**	
Subject and Artificial Intelligence Integrated	Science-Understanding wellness, through storytelling, data acquisition, and exploration using AI	Supervised Natural Language Processing
Learning Objectives	Learners will: • understand the various dimensions/ aspects of wellness • use discretion in assessing oneself and wellness of others wellness	
Time Required	5 sessions (35 minutes each)	
Classroom Arrangement	Day 1-Group of 2 Day 2-5: Individual (Computer lab on Day 3 and Day 4)	
Material Required	Day 1-2: Computer, speakers, projector and internet Day 3-4: (Computer lab): Pen, pencils, notebook, internet connection, computers Day 5: Pen, pencils, printouts	
Pre – Preparation Activities	Learners have been ● Asked to submit a questionnaire 'Who am I', to highlight their strengths ● Asked to rate themselves on a wellness scale. ● Asked to fill a questionnaire to evaluate their 'happiness index'	
Previous Knowledge	The learners have understood the following concepts: • Meaning of wellness. • Components of wellness. • Significance of 'Wellness' during adolescence.	
Methodology	(Day minus 7 i.e., A week in advance) Learners will be asked to record their mobile activity and sleep duration (a week in advance). (Day 1) The class will be divided into two groups, one 'for' and the other against' the notion. The learners will be presented with a series of case studies through storytelling, where a peculiar incidence related to a 'subject' will be described. The wellness state of the 'subject' will be questioned. The learners will ponder and discuss. (Day 2) ● Learners will be allowed to post questions in question box anonymously.	Mobile activity tracker: https://play.google.com/store/apps/details?id=com.mindefy.phoneaddiction.mobilepe&hl=en_IN Storytelling https://www.inklestudios.com/inklewriter/education/

Learning Outcomes	Learners will be able to: • Self-awaretheir strengths and to instill positivity. • make better choices And curiosity will be addressed and answered through 'The question box'.	
Follow up Activities	(Day 3 and 4 in Computer lab) Learners will acquire and organize data of • daily screen time (7 days) • total hours of sleep (7 days) Here, final data on total screen time and time-distribution across various apps on their mobile phones will be analysed. • Learners will be asked to identify a relation between screen times and sleep duration. Yourhour App:https://play.google.com/store/apps/details?id=com.mindefy.phoneaddiction.mobilepe&hl=en_IN	
Reflections	(Day 5) Learners will be advised to present the data by choosing from various graphical representations (printouts) and suggest to evaluate whether they are 'Addicted or obsessed' to mobile or not.	Data graphical exploration: https://datavizcatalogue.com/

GLOSSARY:

1. AI Related Terminologies

AI Model Training: An algorithm is said to be artificially intelligent if it gets trained and can make decisions /predictions on its own. The intelligence which a machine gains comes by training the machine with the appropriate dataset. For example, a machine is to be created which needs to classify an image as either an apple or a banana. To achieve this task, the machine is trained with hundreds of images of apples and bananas each. While training, the machine extracts features from the image dataset of apples which would help the machine classify any image of an apple as an apple. The same is done for the banana dataset. Finally, after training, the machine is tested by providing an image of either an apple or a banana. If the machine is able to classify it correctly, the efficiency is said to be good else it gets re-trained on a better dataset. Training an AI model requires two datasets: Training Data and Testing Data. The machine is first fed the training data from which it makes its own rules which help it to predict the output. Then the testing data is used to check the efficiency of the model. Once training and testing are done, the model is deployed for use.

Classification: Machine Learning algorithms can be broadly classified into three families: Supervised learning, Unsupervised learning and Reinforcement learning. Classification is a part of the Supervised learning model. Classification models work on labelled datasets and are used to predict the label of the testing dataset. For example, 100 images of apples and 100 images of bananas have been taken as a training dataset for the AI model. These 200 images have been labelled as apples or bananas respectively. This labelled data is then fed to the machine which trains itself by extracting common features from the dataset and understanding which features come under the apple label and which ones come under the banana label. At the time of testing, the machine takes an input image and extracts features from it which are then compared with the features marked under both the labels. On the basis of the degree of similarity, the machine will label the testing image as either apple or banana. This process is known as Classification.

Inklewriter: Inklewriter is a free tool designed to allow anyone to write and publish interactive stories. It's perfect for writers who want to try out interactivity, but also for teachers and students looking to mix computer skills and creative writing. https://www.inklestudios.com/inklewriter/

2. AI activity description

Story telling: The facilitator will create an interactive story to create a situation about ‘subject’. The learner will be asked to justify whether the subject is ‘well’ or ‘unwell’. https ://www.inklestudios.com/inklewriter/

Data Acquisition: In this activity, the learners shall search for data regarding their own sleep pattern and mobile activity. The learner will download a mobile application - https://play.google.com/store/apps/details?id=com.mindefy.phoneaddiction.mobilepe&hl=en_IN . In parallel, learners will also keep a record of their sleeping pattern (timings, duration, disturbed/peaceful etc). Post data collection, learners can begin organising the data set on an excel sheet.

Data Exploration: The learners shall explore the data through visual representations. The learners will be prompted to prepare graphical/pictorial representations using an online data visualization tool:- https://datavizcatalogue.com. The learners will use hit and trial method to test various representations types, until they achieve the most appropriate for visualizing their data. Once they finalize their graph, ask them to draw the same on a chart paper using the data which they acquired. Now that the students have drawn the graph, they need to present it to the whole class in such a way that they are able to analyze some meaningful pattern out of it. The pattern or the trend recognized out of the representation should lead them to identify any correlation between various factors such as mobile activity, sleeping pattern etc.

SCIENCE

Class 8

3.31 Conservation of Plants and Animals

PARAMETERS	DESCRIPTION	AI CONCEPTS INTEGRATED
Chapter Covered	**Chapter 7: Conservation of Plants and Animals**	
Name of the Book	**Science, Class 8, NCERT**	
Subject and Artificial Intelligence Integrated	Conservation of Forest and wildlife using AI tool and Google Earth.	
Learning Objectives	Students will be able to know and understand: • Extinct plants and animals. • Conservation of plants and animals.	
Time Required	2-3 periods of 40 minutes each.	
Classroom Arrangement	Regular Classroom having computer/laptop, and internet connection.	
Material Required	Science textbook, pen, paper, computer and internet.	
Pre – Preparation Activities	Five groups will be made and 5 different biosphere reserves assigned to search and collect information using Google Earth Voyager. (Case study)	https://www.google.com/intl/en_in/earth/
Previous Knowledge	• Define flora and fauna? • What do you mean by the conservation of plants and animals?	
Methodology	• The teacher will ask students to visit the **infinitely zooming digital botanical painting** and will show how greenery is there and different types of plant species. (Just to show imaginary greenery all over) • Have fun in inventing a brand new animal by combining the head, body, and legs of other animals. *After exploring the above links the teacher will ask students whether plants and animals can live long and are they safe on the Earth. How can you save animals and plants on the individual level? • The teacher will introduce Extinct plants and animals • The teacher will give 10 different plants and animals' pictures without a name and will ask them to use Google lens to identify the picture. Once they identify the teacher will ask them to check whether they come under extinct species or not. • By this activity they will get to know our flora and fauna are in need to conserve. • After that, they will be introduced that why there is a need to conserve the plants. • Introduction and importance of biosphere reserve.	https://experiments.withgoogle.com/arkadia https://experiments.withgoogle.com/safari-mixer https://experiments.withgoogle.com/bird-sounds

	• The teacher will also ask students to listen to 5 different sounds of birds and note down their names. And also collect information and prepare a file on it. • Based on the data collected from Google Earth case study teacher will discuss the importance conservation of flora and fauna and the need of biosphere reserve. • The Teacher will show AI for Animals: https://youtu.be/85bRbCcwiNg	
Learning Outcomes	• Students will realize the importance of plants and animals. • Students will be able to understand why the conservation of plants and animal is important.	
Follow up Activities	• Explore more biosphere reserve. • Animal detection video https://experiments.withgoogle.com/animal-detection • Project oasis: https://experiments.withgoogle.com/oasis	
Reflections	Discussion on how AI is helping the students to understand the concept of Conservation of plants and animals and help to provide data collected on different species.	

GLOSSARY:

- **Google Earth**

Google Earth is a computer program that renders a 3D representation of Earth-based primarily on satellite imagery. The program maps the Earth by superimposing satellite images, aerial photography, and GIS data onto a 3D globe, allowing users to see cities and landscapes from various angles. Students can visit the **VOYAGER** feature over here to explore the various biosphere reserves.

- **Arkadia**

Infinitely zooming digital botanical painting. This activity is for students to explore the imaginary greenery work and to look into the beauty.

- **Safari Mixer**

Safari Mixer lets you invent a brand new animal by combining the head, body, and legs of other animals. Simply tell Safari Mixer which animals you want to combine, then see (and hear) your creation comes to life. Try it on the Google Assistant by saying, "Hey Google, talk to Safari Mixer." This tool is used to create a joyful environment by making new animals and to build an imaginary animal world.

- **Bird Sounds**

Bird sounds vary widely. This experiment uses machine learning to organize thousands of bird sounds. The computer wasn't given tags or the birds' names – only the audio. Using a technique called t-SNE, the computer created this map, where similar sounds are placed closer together. This tool was used here to listen to different bird sounds and know more about them by searching for their current population rate.

As a follow up activity two activities have been introduced which are not launched yet.

1. **Animal Detection Device:** An Android Things powered device that uses cameras, sensors and neural nets to detect when a bear, moose, elk or mountain lion is present. When animals are detected it records an image as well as environmental data (humidity, temperature, air pressure, pollution and UV).
2. **Project Oasis:** Project Oasis is a self-sustaining plant ecosystem that reflects outside weather patterns by creating clouds, rain, and light inside a box. You can talk to it using the Google Assistant and ask it to create certain conditions or show you the weather in a specific place. This experiment expands our conversation with technology and the natural world.

SCIENCE

Class 8

3.32 Sound

PARAMETERS	DESCRIPTION	AI CONCEPTS INTEGRATED
Chapter Covered	**Chapter 13: Sound**	
Name of the Book	**Science, Class 8, NCERT**	
Subject and Artificial Intelligence Integrated	Characteristics of Sound waves- Amplitude, Time period, Frequency, Loudness, Pitch, Quality Human ear	Infinite Drum machine experiment Auto draw Data Exploration Sound-Controlled Intergalactic Teddy
Learning Objectives	Students will be able to: • Enlist various characteristics of sound. • Reason out how we distinguish among different sounds. • Explain every characteristic of sound. • Explain the working of the human ear and label the diagram.	
Time Required	2 periods of 35-40 mins each.	
Classroom Arrangement	Flexible seating arrangement.	
Material Required	Laptop/ desktop or smart mobile phone with an internet connection, notebook, pens, white board etc.	
Pre – Preparation Activities	Students will be asked to make to keep the following items ready: Steel plate, glass plate, some iron object, metallic stick, wooden stick etc.	
Previous Knowledge	Students must know the concept of how sound is produced and propagated through a medium	

Methodology	• Students will be divided into groups of 4-5. • They will be asked to make sounds using the material they have arranged. • They'll observe that each item produces different sounds • Children will reason out why the sounds produced are different and based on their responses, they will be introduced to various characteristics of sound. • wavelength - oscillation - frequency of sound - pitch - amplitude Direct the students to The Infinite Drum Machine activity • Students will be introduced to another game where they'll observe that whether changing the amplitude, frequency of sound will cause any change in motion of the teddy. • To have more clarity, they will watch a video • https://www.youtube.com/watch?time_continue=7&v=U0Y3XeopMHA&feature=emb_title **Day 2** Students will recall the concepts taught on day 1. They will be asked to draw wave pattern and label Amplitude, time period and frequency. They will be explained about the working of human ear with the help of a video. https://youtu.be/pXm1KOfl4TU Based on the video, they'll create an illustration diagram showing the human ear.	Infinite Drum machine https://experiments.withgoogle.com/ai/drum-machine/view/ Sound-Controlled Intergalactic Teddy https://experiments.withgoogle.com/sound-teddy AutoDraw https://www.autodraw.com/ Data Exploration https://datavizcatalogue.com/methods/illustration_diagram.html
Learning Outcomes	By the end of the class, students will be able to: • Enlist various characteristics of sound waves. • Relate loudness and pitch to amplitude and frequency. • Explain the working of the human ear. • Draw diagram and label various parts of the human ear.	
Follow up Activities	• Students will be asked to construct a mind map based on their learning of the day. • They will be asked to make a list of musical instruments (atleast 5) and note which one of them has a higher pitch.	
Reflections	• Students will learn the basics of AI with the help of apps. • Discuss the AI basis of Infinite Drum Machine. They will be asked to find out about the apps that can be used as an alternative to today's apps.	

GLOSSARY:

AI Related Terminologies

Autodraw.com: Autodraw.com is an AI enabled tool which is based on the domain of Computer Vision in which the machine identifies the pattern of your drawing and accordingly maps it with the most similar image. This tool shows various options trying to predict what the user is trying to draw. For example, if a user is trying to draw a tent and he starts by drawing a basic triangle, the machine would compare his drawing and would show the possible outcomes for the same. The user can then select out of them which one is the most appropriate form for him/her.

Data Exploration: After acquiring data there comes the need to analyze the data. For this, they need to visualize the acquired data in some user-friendly format so that they can: ● Quickly get a sense of the trends, relationships and patterns contained within the data. ● Define strategy for which model to use at a later stage. ● Communicate the same to others effectively. To visualize data, various types of visual representations can be used bystudents like diagrams, charts, graphs, flows, etc.

Infinite Drum Machine: An infinite drum machine is an AI experiment developed by Google for people to understand how unsupervised-learning works. In this machine, thousands of sounds found in our surroundings have been randomly fed for the machine to make sense out of them. The sounds are not labelled in any way nor does the machine have any other information about that sound. All that it knows is the sound clip itself. Using one of the unsupervised learning algorithms, the machine analyses the data fed to it and tries to cluster similar sounds together. These clusters are then visible with the help of colors on the user's screen. All the dots appearing on the screen are sound clips and they have been clustered together on the basis of their sound properties like amplitude, frequency and pitch with the help of which the machine is able to understand the similarity amongst different clips.
Link to Infinite Drum Machine:
https://experiments.withgoogle.com/ai/drum-machine/view/
Video to know more:
https://youtu.be/9x-_My5yjQY

2. AI Activity Description

Ask the students to go to the link: https://experiments.withgoogle.com/ai/drum-machine/view/ and click on start playing. Ask the students to do the following: Move the circles appearing on the map all over. When they move the circles, they will hear various sounds. Ask them to notice the difference in their frequencies, amplitude and pitch. Now, move a circle in just one area, where the dots are of the same color. Ask them to observe if the sounds are similar. They will notice that the sounds from the same color dots have similar properties. With the help of this experiment, explain the unsupervised learning concept to the students where the machine is interpreting sounds on the basis of various parameters like amplitude, frequency and/or pitch. On the basis of this analysis, demonstrate that the machine is able to group similar sounds and is able to cluster them together in the same color. Mention to the students that random sounds were recorded from the surroundings and were fed to the unsupervised machine learning model. The machine itself identified the pattern out of them and clustered them in different groups. Ask students to create their own beats by selecting any 4 sounds and pressing the play button shown at the bottom left corner. They can also select a filter which will highlight all those sounds which come under it

Sound-Controlled Intergalactic Teddy is an experiment that uses machine learning to let you control a video game in an unusual new way. It's an infinite runner game where you use your voice and sounds to control Teddy's movements. To jump over a green slimy alien you say "Ohhh" and to duck you simply clap your hands.

Using machine learning we have taught the game to understand different sounds. For the game to be able to recognise and distinguish between the sounds, we trained it by recording a lot of diverse "ohhh"s and claps which made it robust and easy for anyone to play.

SCIENCE

Class 8

3.33 Microorganisms: Friend and Foe

PARAMETERS	DESCRIPTION	AI CONCEPTS INTEGRATED
Chapter Covered	**Chapter 2: Microorganisms: Friend and Foe**	
Name of the Book	**Science, Class 8, NCERT**	
Subject and Artificial Intelligence Integrated	Science (Biology) and AI	
Learning Objectives	Students will be made to understand that microorganisms /microbes are living organisms that we cannot be see with naked eyes. They will learn how to • Classify Microorganisms • Explore where they live • Differentiate between Useful and Harmful Microorganisms	
Time Required	3-4 periods of 40 minutes each	
Classroom Arrangement	Flexible seating	
Material Required	Projector, smart board, laptop/desktop, internet connection, beaker, stirring rod, slides and microscope.	
Pre – Preparation Activities	Students will be divided into four groups and would be asked to observe the growth of microbes in a different medium. ● Group I -Beaker with water and hay ● Group II- Beaker with ditch water ● Group III -Beaker with curd ● Group IV -Beaker with soil and water Students will prepare temporary slides to observe microbes.	
Previous Knowledge	Students know that microorganisms are present everywhere and they are of different types. They know diseases are caused by microbes.	

Methodology	● The student in the prescribed group will make a table and note down the different types of microbes present in the medium provided.. For concept clarity:http://zenorocha.github.io/wormz/ ● Students can prepare a PowerPoint presentation on Useful and Harmful Microbes after research ● Students will play PAC MAN Doodle game: A Microbe identifying Tool will be introduced to the students. They will learn Artificial Intelligence is helping in the detection of microorganisms. Pack Man game: https://www.google.com/logos/2010/pacman10-i.html AarogyaSetu App: https://www.mygov.in/aarogya-setu-app/	AI tool used: https://teachablemachine.withgoogle.com/train/image AI tool used: https://experiments.withgoogle.com/bacterium https://www.mygov.in/aarogya-setu-app/
Learning Outcomes	Students will be able to understand the existence of microorganisms or microbes. They will be able to classify microorganisms. They will explore where they are found and where they live. They will be able to differentiate between Useful and harmful microorganisms and recognize how Artificial Intelligence is capable of identifying microorganisms.	
Follow up Activities	The students will work in groups and find answers to the following 1. Why can microorganisms not be seen with the naked eye? 2. What are the major groups of microorganisms? 3. Name the microorganism that helps in curd formation. 4. Name the microorganisms which can fix atmospheric nitrogen in the soil. 5. Make a chart to show how bacteria are harmful and useful respectively can be a multidisciplinary activity 6. Students may watch this video to know more about microbes https://youtu.be/ElEksKUGLHQ	
Reflections	Discussed with students the role of AI	

GLOSSARY:

AI Related Terminology

Teachable Machine

It is a web tool that makes it fast and easy to create machine learning models for projects. A computer to recognize your images, sounds, & poses, then export your model for your sites, apps, and more.

The teacher will create a file by showing pictures of different types of microorganisms. Students will bring their own pictures in front of the camera and will recognize what type of microorganism they have drawn.

https://teachablemachine.withgoogle.com/train/image

AarogyaSetu app:

AarogyaSetu is a mobile application developed by the Government of India to connect essential health services with the people of India in our combined fight against COVID-19. The App is aimed at augmenting the initiatives of the Government of India, particularly the Department of Health, in proactively reaching out to and informing the users of the app regarding risks, best practices and relevant advisories pertaining to the containment of COVID-19.

https://www.mygov.in/aarogya-setu-app/

SCIENCE

Class 8

3.34 Synthetic Fibres and Plastics

PARAMETERS	DESCRIPTION	AI CONCEPTS INTEGRATED
Chapter Covered	**Chapter 8: Synthetic Fibres and Plastics**	
Name of the Book	**Science, Class 8, NCERT**	
Subject and Artificial Intelligence Integrate	AI integrated with Synthetic Fibres	Natural language processing (NLP) My storytime Inklewriter Google form
Learning Objective	● To understand the concept of synthetic fibre. ● To understand the importance of polymers in real life ● To familiarise with various types of synthetic fibre on basis of chemical used for manufacturing. ● To familiarise with different properties of different types of fibres. ● To enable the students understand AI story writer.	
Time Required	3 periods 40 minutes each	
Classroom Arrangement	Flexible seating arrangement	
Material Required	● NCERT textbook,laptop, internet connection, blackboard and chalk. ● Project if possible for the display of story of synthetic fibres.	
Pre – Preparation Activities	Ask to students make a list of some common articles made from fibres and try to separate articles into those made from natural fibres.	
Previous Knowledge	● Students have learnt about natural fibres like cotton, wool, and silk in the 7th class. ● Some questions can be asked to them.	
Methodology	● Divide the students into 4-5 groups according to strength of class. ● As their pre preparationactivity, recall them about natural fibre and out of the list that they made, name the other one articles those are not natural fibre. Introduce the term synthetic fibre. ● Explain to them, what is a synthetic fibre, how they obtained, various types of fibre, different properties with the help of an AI tool. ● My story time.	https://experiments.withgoogle.com/my-storytime www.googleform

	Day 3 Students are taken to the computer lab and asked to play a short quiz using Google form. 	
Learning Outcomes	• Students would be able to understand the concept of polymers • They would be able to differentiate natural fibre and synthetic fibres. • They would be familiar with various types of synthetic fibres. • They would be able to differentiate the different types of synthetic fibres on the basis of different properties of fibres. • They would be able to create their own story with the help of AI tool my-story time.	
Follow up Activities	• Students would be asked to write a paragraph on various types of synthetic fibre using AI tool inkle writer as a follow-up activity. • Students would be asked to write a paragraph on various types of synthetic fibre using AI tool inkle writer as a follow-up activity. • Ask them to make the list of articles made by especially of rayon, nylon by exploring some textile sites.	www.inklewriter.com
Reflections	A discussion could be held over AI tool	

GLOSSARY:

AI Related Terminologies

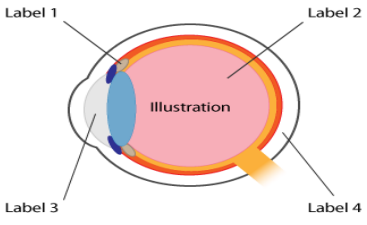
My Storytime: My story time is a new google experiment web application which allows user to record stories to playback on google assistant devices. Record stories from anywhere and play them back at home with Google assistant.
https://experiments.withgoogle.com/my-storytime

Inklewriter: Inklewriter is a free tool designed to allow anyone to write and publish interactive stories. It is perfect for writers who want to try out interactively nut also for teachers and students looking to mix computer skills and creative writing.
www.inklewriter.com

SCIENCE

Class 8

3.35 Light

PARAMETERS	DESCRIPTION	AI CONCEPTS INTEGRATED
Chapter Covered	**Chapter 8: Light**	
Name of the Book	**Science, Class 8, NCERT**	
Subject and Artificial Intelligence Integrated	● What is inside our eyes? ● Care of eyes. ● Visually challenged persons can read and write. ● Braille system	https://play.aidungeon.io/
Learning Objectives	Students will be able to ● Understand each and every part of the eye with its function. ● Draw the diagram of an eye and label it. ● Know how the care of the eyes is taken. ● Explore how the visually challenged people can read and write.	
Time Required	4 periods of 40 minutes each.	
Classroom Arrangement	Normal class arrangement with a smart board having internet.	
Material Required	● A smart board with an internet connection. ● Pen, paper, sketch pens to draw the diagram of eyes.	
Pre – Preparation Activities	● Model of an eye.	
Previous Knowledge	The students are supposed to know about- ● Reflection of light ● Laws of reflection ● Formation of image	
Methodology	● The structure and function of the eye will be made clear to the students by drawing the diagram and labelling it along with their functions on the smart board. ● The students will be asked to come out with the different ways with which the care of eyes can be taken. ● The challenges faced by visually challenged people will be discussed. ● The students will be told about the 'Seeing AI' app which is a very helpful technique for them to do various important tasks of their life. ● https://youtu.be/DybczED-GKE 	https://datavizcatalogue.com/

Learning Outcomes	Students will be able to ● Label and describe the function of each and every part of the eye. ● Take care of their eyes. ● Understand the challenges faced by visually challenged people. ● Know about the Braille script specially designed for such people. ● Explore more apps that can help those people to do important tasks.	
Follow up Activities	A google form quiz will be given to the students related to the structure and function of eyes so that they are able to retain all the topics covered in the class. https://www.youtube.com/watch?v=R0cbckyD9Q0	
Reflections	Further, they will be asked to explore more about the various new and advanced techniques used for visually challenged people. https://www.youtube.com/watch?v=eDIma_Ai1Rc	

GLOSSARY:

AI Related Terminologies

- **Data Exploration** refers to visualising the data to determine the pattern, relationships between elements and trends in the dataset that gives a clear meaning and understanding of the dataset. Data exploration is important as it helps the user to select an AI model in the next stage of the AI project cycle. To visualise the data, various types of visual representations can be used such as diagrams, charts, graphs, flows and so on. The representation of concept mapping can be specified for the particular chapter.

  https://datavizcatalogue.com/

- **AI Dungeon** is a free-to-play single-player and multiplayer text adventure game that uses artificial intelligence to generate unlimited content. It also allows players to create and share their own custom story. In this topic, we can make a story of an eye with the help of students so that the concept of the structure and functions of the eye can be made clear to the students.

  https://play.aidungeon.io/

SCIENCE

Class 9

3.36 Sound (Frequency Amplitude and Velocity)

PARAMETERS	DESCRIPTION	AI CONCEPTS INTEGRATED
Chapter Covered	**Chapter 12: Sound**	
Name of the book	**Science, Class 9, NCERT**	
Subject & Artificial Intelligence Integrated	Frequency, Amplitude & Velocity integrated with the infinite Drum Machine experiment	
Learning Objectives	● To understand and apply the principles of sound - wavelength - oscillation - frequency of sound - pitch - amplitude - concept of velocity (speed) of sound - concept of 'intensity' of sound & be able to differentiate it from 'loudness' ● The role of medium of sound in the above phenomenon	
Time Required	Two periods of 40 min each.	
Classroom Arrangement	Normal Classroom	
Material Required	laptop/desktop or smart mobile phone with internet connection, chalk, blackboard	
Pre- Preparation Activity	Read about parameters of sound like Amplitude and Frequency	
Previous Knowledge	Students know the concept of how sound is produced and propagated through a medium	
Methodology	● Lead the students to an understanding and application of the following principles of sound by relating it with demonstration of different sounds and wave diagrams - wavelength (pg. 164) - oscillation (pg. 164) - frequency of sound (pg. 164) - pitch (pg165) - amplitude (pg. 165) ● Explain the concept of velocity (speed) of sound & the role of medium of sound by diagrams and through formulas ● Make them understand the concept of 'intensity' of sound & be able to differentiate it from 'loudness' (pg. 166) ● Help them to differentiate between amplitude and frequency which otherwise have very similar characteristics of sound ● Direct the students to The Infinite Drum Machine activity ● Link how different sound sensors work in one and multiple directions by giving examples of different sound operated devices eg. a door being opened and closed in movies and an instrument turning on and off when one claps.	Infinite Drum machine
Learning Outcomes	Students will be able to ● Differentiate between amplitude and frequencies of sound waves. ● Relate performances of different musical instruments with amplitude and frequencies. ● understand and relate how sound is applied in AI based solutions	

Follow-up Activity	Hold a brief class discussion on the following topic and observe what the students say and which concepts are still not clear to them. Ask them to award a score to themselves based on how much they could contribute to the discussion “Guess which sound has a higher pitch and why - a car horn or a flute.”	

GLOSSARY:

1. AI Related Terminologies

Infinite Drum Machine: An infinite drum machine is an AI experiment developed by Google for people to understand how unsupervised-learning works. In this machine, thousands of sounds found in our surroundings have been randomly fed for the machine to make sense out of them. The sounds are not labelled in any way nor does the machine have any other information about that sound. All that it knows is the sound clip itself. Using one of the unsupervised learning algorithms, the machine analyses the data fed to it and tries to cluster similar sounds together. These clusters are then visible with the help of colors on the user’s screen. All the dots appearing on the screen are sound clips and they have been clustered together on their basis of their sound properties like amplitude, frequency and pitch with the help of which the machine is able to understand the similarity amongst different clips.

Link to Infinite Drum Machine: https://experiments.withgoogle.com/ai/drum-machine/view/

Video to know more: https://youtu.be/9x-_My5yjQY

2. AI Activity Description

Ask the students to go to the link: https://experiments.withgoogle.com/ai/drum-machine/view/ and click on start playing.

Ask the students to do the following:

Move the circles appearing on the map all over. When they move the circles, they will hear various sounds. Ask them to notice the difference in their frequencies, amplitude and pitch.

Now, move a circle in just one area, where the dots are of the same color. Ask them to observe if the sounds are similar. They will notice that the sounds from the same color dots have similar properties.

With the help of this experiment, explain the unsupervised learning concept to the students where the machine is interpreting sounds on the basis of various parameters like amplitude, frequency and/or pitch.

On the basis of this analysis, demonstrate that the machine is able to group similar sounds and is able to cluster them together in the same color.

Mention to the students that random sounds were recorded from the surroundings and were fed to the unsupervised machine learning model. The machine itself, identified the pattern out of them and clustered them in different groups.

Ask students to create their own beats by selecting any 4 sounds and pressing the play button shown at the bottom left corner. They can also select a filter which will highlight all those sounds which come under it.

SCIENCE

Class 9

3.37 Motion (Uniform and Non-Uniform Motion)

PARAMETERS	DESCRIPTION	AI CONCEPTS INTEGRATED
Chapter Covered	**Chapter 8: Motion**	
Name of the Book	**Science, Class 8, NCERT**	
Subject and Artificial Intelligence Integrated	Understanding Concept of Uniform and Non-Uniform motion using Google maps AI Applications and Data Acquisition and Data exploration	
Learning Objectives	● To understand the concept of data handling in motion ● To identify steps of data handling - Sources of data - Collection of data - Organization, representation and analysis of data ● To differentiate between uniform and non-uniform motion ● To understand application of Data Acquisition and Data exploration in real life situations	Data Acquisition Data exploration Google map Data Visualisation
Time Required	2 periods of 40 minutes each	
Classroom Arrangement	Flexible	
Material Required	Graph Paper, Colored Pen, paper, Black Board chalk, Laptops/ desktops and Internet connections	
Pre – Preparation Activities	● The students will be divided into groups for a discussion on types of motion they observe around them ● Students will be asked to collect data on the types of motion identified by them, for eg - Distance between their school and home and time taken to cover it - distance between their home and nearest shopping mall and time taken to cover it - Time taken to travel to school in traffic jam	
Previous Knowledge	● Students must possess the knowledge of initial and final position for a given motion ● Students should have knowledge of speed and distance problems ● They should be aware about speed calculations in real life.	

Methodology	● Ask students to collect data (distance and time) through Google Maps. Inform how Google maps help us to know about the real time needed to travel from one place to another on the basis of the speed of the vehicle. Ask students to calculate the time for the same distance if travelling by - Car - School Bus - On foot (walking). - Cycle ● After collecting data discuss analyze and represent data with the help of some graphical representation. Students through the graph will be able to differentiate between Uniform and Non-Uniform. Ask them to predict the type of motion before plotting graph (at the end compare their answers to see who wins) ● Ask the students to go on https://datavizcatalogue.com and explore various types of graphs and the way to use these. Ask them to select a representation which will suit their data best(line graph) Students will be able to recognize various patterns/trends out of their representations which can be used to represent this problem. Ask the students to explore the possibilities/applications of using AI in solvingthis problem.	https://datavizcatalogue.com/search.html
Learning Outcomes	• Students will be able to understand and differentiate between Uniform and Non-Uniform motion • Students will be able to understand the dependence of speed/velocity on distance travelled and time taken	
Follow up Activities	• They will explore similar AI tools to deepen the learning of this concept • Students can use other AI tools for graphical representation of complete journey of train/flight.	
Reflections	Discussion with Students on the role of AI application	

GLOSSARY:

1. AI Related Terminologies

Google Maps

Google Maps is a web mapping service developed by Google. It offers satellite imagery, aerial photography, street maps, 360° panoramic views of streets (Street View), real-time traffic conditions, and route planning for traveling by foot, car, bicycle and air (in beta), or public transportation. Google maps effectively use AI in calculating the estimated time of arrival with the help of real-time traffic conditions.

2. AI Activity Description

Data Acquisition- For this activity ask the students to go to https://maps.google.com and enter a specific source and destination. Once they have fed the input, they will get an estimated time of arrival at the destination on the basis of real-time traffic conditions. Ask the students to note down the distance shown between these 2 points and the estimated time taken for the same. Now, ask the students to check the time taken for the same distance by another means of transport. Students can change the means of transport by clicking on various icons. Ask the students to note down time taken to reach the destination by car, bike and on foot (walking). Once they have

got the information, ask them to calculate the speed of the vehicle for all the three datasets. Now, ask the students to identify the relationship between distance, time and speed.

Data Exploration: Now that the data has been acquired, ask the students to explore it through visual representations. Guide the students to visit https://datavizcatalogue.com and observe various types of graphical/ pictorial representations. As soon as they land upon the website, they need to go to some of the graphs and read their descriptions and how to create them. After exploring the resource, ask the students to select the type of representation that according to them would be most appropriate for visualizing their data. Once they finalize their graph, ask them to draw the same on a chart paper using the data which they acquired. Now that the students have drawn the graph, they need to present it to the whole class in such a way that they are able to analyze some meaningful pattern out of it. The pattern or the trend recognized out of the representation should lead them towards the concept of Uniform and Non-uniform motion and calculation of speed. Finally, ask the students to discuss how AI can be leveraged in this situation.

SCIENCE

Class 9

3.38 Work and Energy

PARAMETERS	DESCRIPTION	AI CONCEPTS INTEGRATED
Chapter Covered	**Chapter 11: Work and Energy**	
Name of the Book	**Science, Class 9, NCERT**	
Subject and Artificial Intelligence Integrated	● Power ● Commercial unit of electrical energy ● Relation between SI unit and commercial unit energy ● Numerical, integrated with supervised learning	Supervised learning 4Ws canvas https://experiments.withgoogle.com/semantris
Learning Objectives	Students will be able to: ● Identify the physical quantities which are required for expressing Power. ● Establish relation between SI and the commercial unit of energy. ● Formulate the power and state its unit. ● Explain the relation between SI unit and commercial unit energy ● Select the correct formula according to the situation given. ● Point out the necessity of uniformity in units while solving numerical.	
Time Required	2-3 periods of 40 minutes each	
Classroom Arrangement	Regular classroom setup having ● Computer/laptop and internet. ● Projector, ● Computer lab visit.	
Material Required	Computers, Pen, Paper, Sketch pens.	
Pre – Preparation Activities	Ask students to observe: ● Do all of us work at the same rate? ● Do machines consume or transfer energy at the same rate? After this teacher introduces the power and energy consumption by any appliances.	
Previous Knowledge	The students must be familiar with ● Concept of work done and energy ● Units of energy and time	

Methodology	Students will collect a monthly electricity bill for school for 2 or 3 years to observe the trend of electric energy consumption. To minimize the energy consumption by the school, student will be asked to do the following: ● Stock taking of various electrical appliances used in the school. ● Identification of old and new energy consuming appliances. ● Checking of the wiring systems in the whole school. ● Recording of unit consumption during in school hours through meter reading for at least one week. Based on the information collected students will be asked suggest ways to reduce energy consumption.	https://phet.colorado.edu https://datavizcatalogue.com/
Learning Outcomes	Students should be able to: ● Analyze the concept of power expended by any object while doing the work. ● Apply the idea of commercial unit of energy in reading the monthly electricity bill and hence be able to calculate the monthly energy consumption. Apply the right formulae with correct units ● Solve the numerical based on the topic without any difficulty. ● Create an activity to demonstrate their knowledge on the topic.	
Follow up Activities	● Short quiz on quizzes.com or kahoot related to the electric power and commercial unit of energy. ● Conduct brief discussions in small groups, in the activity period and allow students to self-assess how much each of them understood of the topic.	
Reflections	Students can also search for many AI tools related to the topics.	

GLOSSARY:

AI Related Terminologies

4Ws Problem Canvas:

The 4Ws Problem canvas helps them in identifying the key elements related to the problem.

Who?

The “Who” block helps in analyzing the people getting affected directly or indirectly due to it. The ‘Stakeholders’ in our case are the people working in the school.

What?

Under the “What” block, they need to look into what they have on hand. At this stage, they need to determine the nature of the problem. The problem at hand is the high electricity bills incurred by school for the past many years.

Where?

Now that they know who is associated with the problem and what the problem actually is; they need to focus on the context/situation/location of the problem. This block will help them look into the situation in which the problem arises, the context of it, and the locations where it is prominent. Proper survey of the electrical appliances used in the school to have an answer to this question.

Why?

They have finally listed down all the major elements that affect the problem directly. Now it is convenient to understand who the people that would be benefitted by the solution are; what is to be solved; and where will the solution be deployed. The financials of the school will be improved to a great extent through implementation of the findings of this analysis.

Data Acquisition: Data acquisition refers to acquiring authentic data crucial for the AI model from reliable sources. The data in our case will be collected through the monthly bills and various surveys in the school.

Data Exploration: After acquiring data there comes the need to analyze the data. For this, they need to visualize the acquired data in a user-friendly format so that they can:

Quickly get a sense of the trends, relationships and patterns contained within the data through bar chart and line graph.

Define strategy for which model to use it at a later stage.

Communicate the same to others effectively.

Semantris

A Google experiment, Semantris is a word association game powered by machine learning. Each time you enter a word that is associated with the target word, the AI looks at all the words in play and chooses the ones it thinks are most related

https://research.google.com/semantris/

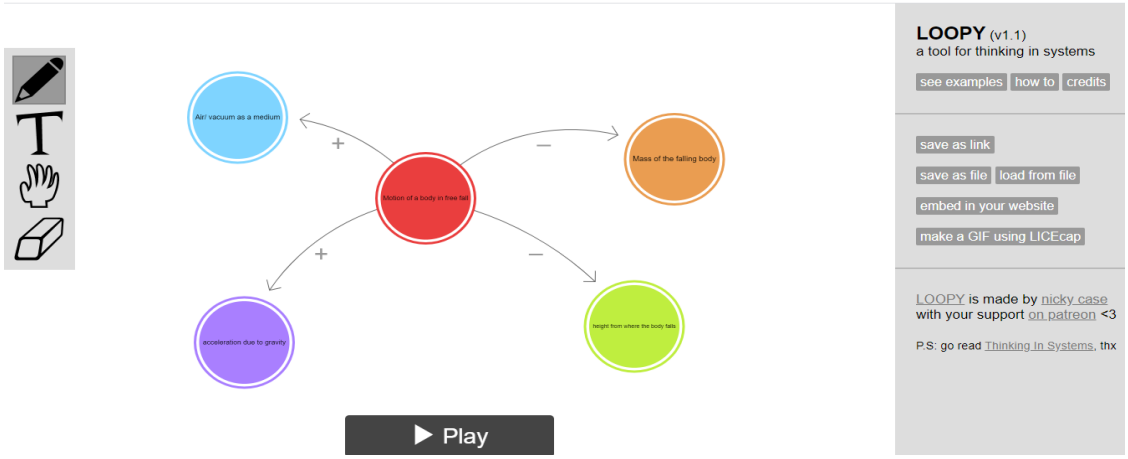
SCIENCE

Class 9

3.39 Gravitation

PARAMETERS	DESCRIPTION	AI CONCEPTS INTEGRATED
Chapter Covered	**Chapter 10: Gravitation**	
Name of the Book	**Science, Class 9, NCERT**	
Subject and Artificial Intelligence Integrated	Free fall Acceleration due to gravityintegrated with data visualization and inklewriter	Datavizcatalogue Inklewriter/ my story on chatbot
Learning Objectives	Students will be able to: ● Understand the concept of free fall ● Analyze that while falling there is no change in the direction of motion of the objects. ● Explain that when objects fall towards the earth, it accelerates. ● List the factors on which acceleration due to gravity depends. ● Calculate the value of acceleration due to gravity on Earth ● Explain why acceleration of a freely falling body is independent of its mass	
Time Required	2-3 classes of 40 minutes each	
Classroom Arrangement	Regular classroom setup, Science Laboratory, Computers with internet connection for each group of students	
Material Required	Textbooks, laptop/desktop with internet connection with the AI tools installed in it.	
Pre – Preparation Activities	● Students should observe the objects falling vertically downwards to see if they fall uniformly or not. ● Some understanding of bar graphs/ histogram/ line graphs (from newspapers/ comparative charts)	
Previous Knowledge	● Students know the types of forces studied in class 8th. ● Understand the terms- velocity, acceleration ● Objects fall towards the Earth because it pulls them	
Methodology	Activity 1: Teacher to perform the activity and ask the students to observe. Dropping any two objects (a heavy and a light body) from a certain height simultaneously. For example - a hollow and a solid body, a paper and a pen, a paper and a piece of stone. ● Students are asked to observe, which of the two bodies reach the ground faster? ● What if we increase the height from where the two bodies are released? ● Do the bodies fall with uniform speed?	

	● What difference will you observe if the activity is performed in the presence or absence of air? ● What are the forces acting on a freely falling body? ● After discussing the answers to all the above questions, the teacher explains the concept of free fall and acceleration due to gravity ● Derive the factors on which acceleration due to gravity depends on. https://ncase.me/loopy/v1.1/ Task to be performed by students: After discussing the activity 1, students will be asked to open the above mentioned url on their desktop. The teacher will write all the factors which may or may not affect the motion of a freely falling body. Using the Loopy tool, students will categorize the given factors as dependent and independent factors. The dependent factors to be shown with a + sign and independent factors to be shown with a - sign.	
Learning Outcomes	Students will be able to: ● Apply the concept of free fall in daily life ● Explain why velocity of a freely falling body increases ● Conclude that all objects hollow or solid, big or small, should fall at the same rate. ● State the factors on which acceleration due to gravity depends.	
Follow up Activities	● In the last 5- 10 minutes, the teacher recaps the topics covered in each class. ● Students are asked to read the story of Galileo, how he dropped different objects from the top of the Leaning Tower of Pisa in Italy to prove that all objects fall at the same rate. Ask them to use the AI tool My story on chatbot or https://www.inklewriter.com/ to present their understanding in own words. After understanding the factors on which acceleration due to gravity depends on, students will be asked to collect data(from internet) for different values of acceleration due to gravity on all the planets and hence chose “comparison chart” from https://datavizcatalogue.com/search.html to show the difference in the value of g at different planets.	https://datavizcatalogue.com/search.html
Reflections	Discussion with Students on the role of AI application- dataviz catalogue.	



GLOSSARY:

AI Related Terminologies

1. **Data Acquisition**: Data acquisition refers to acquiring authentic data crucial for the AI model from reliable sources. There can be various ways in which students can collect data. Some of them are: • Surveys • Web Scraping • Sensors • Cameras • Observations • Application Program Interface.
   Data Exploration: After acquiring data there comes the need to analyze the data. For this, they need to visualize the acquired data in some user-friendly format so that they can: ● Quickly get a sense of the trends, relationships and patterns contained within the data. ● Define strategy for which model to use at a later stage. ● Communicate the same to others effectively. To visualize data, various types of visual representations could be used by the students like diagrams, charts, graphs, flows, etc.

2. **Story Speaker**: It is an AI experiment which is available as an add-on to Google Docs. Story Speaker lets anyone create an interactive story with no coding required. It is an easy to install and easy to use tool and comes in handy when the user wants to create a story which changes according to the user's input. Link to install Story Speaker extension for Story Speaker: https://chrome.google.com/webstore/detail/story-speaker/ohfibfhhfbhknfdkipjdopbnegkbkjpj 84
   Introduction to Story Speaker: https://www.youtube.com/watch?v=wsrzvYYvhH8&feature=youtu.be

   Link to read more about Story Speaker:

   https://docs.google.com/document/d/1hFrBtsBbF2LoZ1FFpXEH7L6fWH1lj24W1-itXnKSXK8/edit

   Basic Template of Story Speaker:

   https://docs.google.com/document/d/1rXPSayQVVQT5cWlhxPbOCc2UJEZTbVWkxqOnC_RnDE/edit?usp=sharing

SCIENCE

Class 9

3.40 Force and Laws of Motion (Introduction to Concept of Force)

PARAMETERS	DESCRIPTION	AI CONCEPTS INTEGRATED
Chapter Covered	**Chapter 9: Force and Laws of Motion**	
Name of the Book	**Science, Class 9, NCERT**	
Subject and Artificial Intelligence Integrated	● Soft Buddy game to understand impact of force: ● Introduction to the concept of push/pull through Pakku Pakia Game (by Rishabh) (Google Search) ● Application of force to be understood through sculpting game: ● Recap of the concept- Frictional Force through Hoverborad Game (AI Google Experiment) ● Concept of motion can be introduced through visualisation of following tool: ● Demo of gravitational force through simulation: https://youtu.be/ZTwrQSOHdX0	https://github.com/joshshadik/voxsculpt.git https://github.com/harkle/roadtrip.git
Learning Objectives	Students will be able to: ● understand force and its effects ● understand meaning of balanced and unbalanced forces ● Explain relationship between force and motion. ● Understand the role of friction in inhibiting motion.	
Time Required	2-3 periods (40 min each)	
Classroom Arrangement	Flexible	
Material Required	Ball, Clay, Sponge, Wooden Block, Book Projector and Screen Computer Lab	
Pre – Preparation Activities	Materials through which different impacts of force can be discussed. · Situations to be developed for role play	
Previous Knowledge	Teacher will show demo with different materials and students will have to identify what impact is caused by force in each case.	
Methodology	With the help of role play and videos concept of friction alongwith Balanced/Unbalanced Forces will be discussed. https://youtu.be/DK81n-Fw9x0 https://youtu.be/d3QRNH_jNOI https://youtu.be/ZTwrQSOHdX0 Concept of Static, Sliding and Rolling Friction would be taken up with relevant examples. As an integrated approach, students will be made to play Tug of War in their sports class. Thereafter they will be made to discuss about muscular force, friction, unbalanced forces with a list of follow-up questions:	https://github.com/joshshadik/voxsculpt.git https://github.com/harkle/roadtrip.git

	What will happen if: • Team A is given smoother end of rope and Team B rough end. • Team A is provided with powder to rub their hands and Team B with sand, • Team A members are with shoes and Team B members are without shoes.	
Learning Outcomes	• With the help of so many real life examples the concept of Net Force/ Resultant Force will be clear to students and the students will be able to find logical answers to most of routine life incidents. • Students will be able to identify force as a vector quantity and interpret the direction of motion in case of unbalanced forces.	
Follow up Activities	Picture based questions to check on the understanding about Types of Force and impact caused by force. Quiz on Quizizz.com (Let's Reinforce the concept of Force) Assessment of chapter	
Reflections	Simple life activities would be interpreted by students in terms of physics.	

GLOSSARY:

AI Related Terminologies

1. **Soft Buddy Game** (https://youtu.be/DK81n-Fw9x0) to be played unsupervised by learners which can later be discussed by teacher based on magnitude and direction from where force was applied. Learners will be able to visualise the impact caused and the variations when the above mentioned parameters changed.

2. Introduction to the concept of push/pull through **Pakku Pakia Game** (by Rishabh) (Google Search)
(as per the description offered, there are specific points for push/pull/missed action. Playing this game would give fair idea to students about various actions leading to application of force.)

3. Application of force to be understood through sculpting game: (https://github.com/joshshadik/voxsculpt.git) Students can play this 3D based game and understand how increasing the force will lead to deeper impact on cube.
4. Recap of the concept- Frictional Force through **Hoverborad Game** (AI Google Experiment) https://youtu.be/d3QRNH_jNOI
Simulation to observe low friction mode

5. Concept of motion can be introduced through visualisation of following tool: (https://github.com/harkle/roadtrip.git) Just a video can be shown through which teacher can introduce terms like speed/velocity, acceleration, overtaking, etc

SCIENCE

Class 9

3.41 Why Do We Fall Ill?

PARAMETERS	DESCRIPTION	AI CONCEPTS INTEGRATED
Chapter Covered	**Chapter 13: Why Do We Fall Ill?**	
Name of the Book	**Science, Class 9, NCERT**	
Subject and Artificial Intelligence Integrated	Acquiring data, data exploration and mapping highest occurring human diseases as well as immunization (provided data is available) on google world maps	Supervised Natural Language Processing
Learning Objectives	Learners will be • realizing the magnitude of top 5 causes of death in the world (communicable diseases only) • identifying the top 5 countries manifesting such high death rates respectively. • deciphering any correlation between deaths (events) and income levels • offering solutions to control the spread of such diseases	
Time Required	3 sessions (35 minutes each)	
Classroom Arrangement	Learners will sit in a group of two in the computer lab (all the three days)	
Material Required	Computer, notebook, pen, pencil.	
Pre – Preparation Activities	Learners will asked to visit this link, and learn about data acquisition: https://www.youtube.com/watch?v=NE6pudadmJY&ab_channel=instyneducation	
Previous Knowledge	The learners: • understand the difference between in diseases, conditions and disorders • have identified the causative microorganism behind various disease	
Methodology	(Day 1) The learners will be • guided to obtain latest data on top 5 causes of deaths in the world • acquiring various relatable parameters to define income levels of a country, such GDP, healthy life expectancy etc. • The data will be mapped on the google world maps (Day 2 (2 sessions) The learners will • plot the data of 5 top causes of deaths due to communicable diseases • -identify the trend based on the country identified and try to find a correlation between the country's	Data acquisition-https://apps.who.int/gho/data/node.home Data exploration:https://datavizcatalogue.com/ Customizing Google World maps:https://www.google.com/earth/outreach/learn/visualize-your-data-on-a-

	happiness index and/or income level and disease manifestation. • suggest a remedy that can be applied by the government and personnel to curb it. (Day 3): Homework Learners will be asked to read about an AI tool, used as an information platform by various governments and companies to predict disease outbreaks, assess risks etc. Information platform for disease outbreaks:https://bluedot.global/work/	custom-map-using-google-my-maps/#import-your-data-1
Learning Outcomes	The learners will be • able to identify the most contagious/communicable diseases around the world based on income levels. • finding a relation between financial/ economic well-being of a country and the diseases (courtesy: happiness index) • recalling/identifying the causative of the disease spread. • deducing the efforts by the country (such as conducting immunization campaigns) to help in disease control and generating immunity among masses.	
Follow up Activities	Learners will be asked to explore COVA mobile application	
Reflections	Learners will be provided a questionnaire on the COVA app, to ensure that the learner can look up for important information, such as hospital beds availability, hotspots of Covid- positive patients etc.	COVA app:- https://play.google.com/store/apps/details?id=in.gov.punjab.cova&hl=en_IN

GLOSSARY:

1. AI Related Terminologies:

Unsupervised Learning: While there are many machine learning models, they can be broadly

classified into 3 families. They are supervised learning, unsupervised learning and enforcement

learning. Unsupervised learning focuses on finding patterns or trends out of the data fed to the machine. Every machine learning algorithm requires training data as a base to work upon. Talking about unsupervised learning, the training data fed into this machine is un-labelled i.e. the data fed into the machine is unknown or random. It has not been supervised and hence is given to the machine to get processed in such a way that some meaningful information can be extracted out of it. For example, if in a locality, there are 1000 stray dogs and they are all random bred, if the pictures of all these dogs is fed into an unsupervised learning algorithm, it would automatically cluster these images according to the features observed and would give clusters of images as output. These clusters could be based on any trend or pattern observed in the data fed. This helps in understanding the dataset better.

Natural Language Processing: Artificially Intelligent machines could be broadly classified on the basis of the type of data fed to them. One of the domains of Artificial Intelligence is Natural Language Processing. NLP refers to the algorithms which processes natural language data and makes some sense out of it. Natural language data consists of textual data, speech data, etc. and artificially intelligent machines are used to interpret this data and make several decisions/ predictions. Some of the examples can be speech recognition, chatbots, auto-captioning, etc.

Data Acquisition: Data acquisition refers to acquiring authentic data crucial for the AI model from reliable sources. The data acquired can then be divided into two categories: Training Data and Testing Data. The AI model gets trained on the basis of training data and is evaluated on the basis of testing data There can be various ways in which students can collect data. Some of them are:

- Surveys
- Web Scraping
- Sensors
- Cameras
- Observations
- Application Program Interface

Data Exploration: After acquiring data comes the need to analyze the data. For this, they need to visualize the acquired data in some user-friendly format so that they can:
- Quickly get a sense of the trends, relationships and patterns contained within the data.
- Define strategy for which model to use at a later stage.
- Communicate the same to others effectively.

To visualize data, various types of visual representations can be used by the students like diagrams, charts, graphs, flows, etc. An online open-source website is available at

https://datavizcatalogue.com where the students can observe various types of representations that can be used in data visualization. On this platform, the students will be able to get the description of any graph they select and the website will also guide them to various software/online tools which can be used to generate the same.

2. AI Activity Description:

Data Acquisition: In this activity, the learners shall search for data regarding top death causing communicable diseases around the globe, on the basis of income bands. The learners will also gather more information on the status of the country the respect to GDP, immunization campaigns etc. Post data collection from reliable sources, learners can begin organising the data set on an excel sheet.

Data Exploration: The learners shall explore the data through visual representations. The learners will be prompted to prepare graphical/pictorial representations using online data visualization tool:- https://datavizcatalogue.com. The learners will use hit and trial method to test various representations types, until they achieve the most appropriate for visualizing their data. Once they finalize their graph, ask them to draw the same on a chart paper using the data which they acquired. Now that the students have drawn the graph, they need to present it to the whole class in such a way that they are able to analyze some meaningful pattern out of it. The pattern or the trend recognized out of the representation should lead them to identify any correlation between various factors such as income, immunization rates, diseases, GDP etc.

Customizing Google Maps: To customize google map,log in to your Google account. Go to Google My Maps: https://www.google.com/mymaps. In the welcome pop-up, select Create a new map:

1. Click the text Untitled map to edit the map title and description.
2. Now put information into the Description dialog box.
3. In the menu, select Import:
4. Select the ‘filename.csv’ (your file) from your desktop. This will be the first data layer to upload. Tip: You can also import a XLSX file or a Google Sheet. You may upload a table containing up to 2,000 rows.
5. After uploading your data, you’ll be asked to select the column(s) with location information, so that your data will be correctly placed on the map (e.g. columns with latitude and longitude information). For this example, select the Lat and _ Long columns_, and hit Continue. You can hover over the question marks to see sample data from that column.
   Tip: If you don’t have latitude and longitude information, you can use addresses in your columns instead.

6. Now pick the column you'd like to use to title your markers. For this example, select the Date column and hit Finish:
7. You should now see your data as a layer in the menu, and your points plotted on the map. If you'd like to change the name of this layer in the menu, just select the text of the layer name (the default will be the file name). For this example, change the layer name to
8. Now to upload the second data layer. Click Add layer.
9. Repeat steps 6 through 9 using the filename.csv from your desktop. Select the Lat and Long columns for your location column, and select the Beach Name column to title your markers.
10. You should now see both layers visible in your menu and plotted on your map.

(Courtesy: https://www.google.com/earth/outreach/learn/visualize-your-data-on-a-custom-map-using-google-my-maps/#import-your-data-1)

SCIENCE

Class 9

3.42 Is Matter Around Us Pure?

PARAMETERS	DESCRIPTION	AI CONCEPTS INTEGRATED
Chapter Covered	**Chapter 2: Is Matter Around Us Pure?**	
Name of the Book	**Science, Class 9, NCERT**	
Subject and Artificial Intelligence Integrated	Classification of mixtures: True solutions, Colloidal solutions and suspensions integrated with data exploration and data visualisation tool (to show flow chart, mind map)	Data exploration and data visualization
Learning Objectives	Students will be able to understand: Types of homogeneous and heterogeneous mixtures, Properties of true solutions, colloidal solutions and suspension, Identification of type of mixture on the basis of its properties. How AI tools help to understand the concept	
Time Required	2 periods of 40 minutes each	
Classroom Arrangement	In 1st period : Lab In 2nd period: Regular classroom setup having projector, computer/laptop and internet.	
Material Required	Copper sulphate crystals, milk, chalk powder, glass rod, beaker, pen and paper	
Pre – Preparation Activities	Divide the class into three groups- A, B and C. Distribute the following samples to them. Few crystals of $CuSO_4$ to group A, Chalk powder to group B and few drops of milk to group C. Ask them to add the given sample in water and stir properly using a glass rod. Now each group is ready with their mixture.	
Previous Knowledge	What is the mixture? Preparation of mixture Revision of homogeneous and heterogeneous mixture with a quick recap.	
Methodology	Continuing with the same groups, teacher demonstrates some other activities- Pass a beam of light through all the mixtures and observe and filter. After collecting all the observations from these activities, students will be asked to make a table with 3 columns and ask them to write the properties of three different types of mixtures on the basis of their observations. On the day 2, the teacher will discusssome other properties of three types of mixtures and also bring out differences between them. Ask students to make note of it. https://youtu.be/8Xcpq6e8pBY For more visualisation, related videos are shown to them.	https://datavizcatalogue.com/ Data visualisation tool

	They are introduced on how artificial intelligence is playing a major role in analyzing the data to predict types of mixture. Help students to make flow charts of mixtures. https://ncase.me/loopy/v1.1/ With the help of a loopy tool, they can understand the concept of dilute and concentrated solution with regard to solute concentration.	
Learning Outcomes	Learners will be able to understand the components of mixture. They will be able to understand the properties of true solutions, colloidal solutions and suspension. They will be able to compare dilute and concentrated solutions.	
Follow up Activities	Ask them to classify the mixtures which they come across day to day life.	
Reflections	Ask them to explore some artificial intelligence tools to understand the same concept.	

GLOSSARY:

AI Related Terminologies

Data Exploration refers to visualising the data to determine the pattern, relationships between elements and trends in the dataset that gives a clear meaning and understanding of the dataset. Data exploration is important as it helps the user to select an AI model in the next stage of the AI project cycle. To visualise the data, various types of visual representations can be used such as diagrams, charts, graphs, flows and so on. The representation of concept mapping can be specified for the particular chapter.

https://datavizcatalogue.com/

SCIENCE

Class 9

3.43 Structure of the Atom

PARAMETERS	DESCRIPTION	AI CONCEPTS INTEGRATED
Chapter Covered	**Chapter 4: Structure of the Atom**	
Name of the Book	**Science, Class 9, NCERT**	
Subject and Artificial Intelligence Integrated	Atomic structure integrated with interactive simulations.	https://phet.colorado.edu/sims/html/build-an-atom/latest/build-an-atom_en.html
Learning Objectives	To familiarize students with the concept of electronic configuration so that they are able to place the subatomic particles correctly in an atom and distribute electrons in shells.	
Time Required	40 min	
Classroom Arrangement	Flexible	
Material Required	Computer, Projector, laptop, markers Chart papers, Coloured Post-its sketch pens etc Paper cutouts with name of elements and the number of protons neutrons and electrons in it. One computer per pair of student (Class can be taken in Computer lab)	
Pre – Preparation Activities	Divide the class in small groups and assigning them places in the computer lab. Providing them list of elements	
Previous Knowledge	Students know about the scientific theory of atoms (also known as atomic theory) by describing changes in the atomic model over time and why those changes were necessitated by experimental evidence. Students know that the max number of electrons in a shell is equal to 2n2 where n= shell number 1,2,3,..	
Methodology	Students will be seated in the computer lab in pairs with one computer per pair (ideally) The teacher revises the pre knowledge using a small video after which the game can start Video link for revising the pre knowledge is given. **(10 min)** https://www.youtube.com/watch?v=Q3htqdKrHOk&t=260s Teacher (after the end of the video) can ask some probing questions to the students. ● What is the total charge of an atom? ● What is the function of neutrons in an atom? ● Can you name some conditions under which we can say that an atom is stable? ● What is your understanding of the term Electronic Configuration?	https://phet.colorado.edu/sims/html/build-an-atom/latest/build-an-atom_en.html

	• Each pair writes their responses on a coloured post its and pastes it on a chart placed at the corner of the class. (Discussion about responses) (10MIN) Teacher then hands over the sheet of paper to each pair (on which the name of elements with their number of protons, neutrons and electrons are printed) Teacher asks each pair to make atoms using simulation (15 MIN) Teacher sums up the session announcing the follow up activity and HW (5 min)	
Learning Outcomes	Students will be able to understand the meaning of electronic configuration and distribute electrons in various shells. Students would be able to virtually construct their own atom using simulation	
Follow up Activities	Students would draw the structure of at least 2 atoms in their notebooks. (encourage them to use coloured pens/coding for representing protons, neutrons and electrons) Research Question: According to $2n^2$ rule the third shell should have 18 electrons but it actually has 8. What might be the reason for that?	
Reflections	Feedback of simulation tool from students and where it can be used further?	

GLOSSARY:

AI Related Terminologies

Students will open this link and they will make a model of an atom using any element, by picking electrons, protons and neutrons. It will be automatically tell whether it is a cation, anion or neutral atom.

It will identify if it is stable or unstable and it is informative for understanding electronic configuration also.

https://phet.colorado.edu/sims/html/build-an-atom/latest/build-an-atom_en.html

SCIENCE

Class 9

3.44 Atoms and Molecules

PARAMETERS	DESCRIPTION	AI CONCEPTS INTEGRATED
Chapter Covered	**Chapter 3: Atoms and Molecules**	
Name of the Book	**Science, Class 9, NCERT**	
Subject and Artificial Intelligence Integrated	Atom, Subatomic particles, atomic mass, molecule and its types integrated with Semantris https://research.google.com/semantris/	Natural Language Processing
Learning Objectives	Students will be able to: Define 'atom'. Enlist various sub- atomic particles. Calculate atomic mass. Understand how atoms combine to form molecules. Enlist types of molecules.	
Time Required	2 periods of 35-40 mins each.	
Classroom Arrangement	Normal seating arrangement.	
Material Required	Laptop/ desktop or smart mobile phone with internet connection, notebook, pens, white board etc.	
Pre – Preparation Activities	Students will be shown different objects and they have to pick 3 objects and write the components from which the objects are made.	
Previous Knowledge	Students must be aware about the states of matter and particle arrangement.	
Methodology	Students will be asked about various states of matter. They will take 2-3 examples from various states and tell the class form which components are these made? Students will be introduced to AI basics with the help of word block game through Semantris wherein they'll write components of the items given. Students will have a discussion about whether the components can be further broken up into parts or not? Collating their answers, they will be introduced to the concept of 'Atoms'. Students will watch a video based on atoms, subatomic particles etc. https://youtu.be/jMW_0Ro6b5c Students will work on creating atoms to have better clarity of subatomic particles, ions etc with the help of PhET simulations. On day 2, Students will be shown a picture of a mason who is constructing a wall.They will be asked how the wall is made.	Natural Language Processing https://research.google.com/semantris/ https://phet.colorado.edu/sims/html/build-an-atom/latest/build-an-atom_en.html

	They will be derived to the concept of 'Molecule' from there. Students will watch a video showing formation of molecules, types of molecules etc. https://www.youtube.com/watch?v=IOXxFaHbIXg They will be asked to write examples of molecules of elements and compounds.	
Learning Outcomes	By the end of the class, students will be able to: Define 'atom'. Enlist various sub- atomic particles. Calculate atomic mass. Understand how atoms combine to form molecules. Enlist types of molecules.	
Follow up Activities	Students will be assessed on the basis of their learning with the help of AI based app KAHOOT. *https://create.kahoot.it/details/03e94c97-38ce-4e8a-8e1a-0be5fc1f3d80*	
Reflections	Students will learn the basics of AI with the help of apps. They will be asked to find out about the apps that can be used as an alternative to today's apps.	

GLOSSARY:

AI Related Terminologies

Natural Language Processing: Artificially Intelligent machines could be broadly classified on the basis of the type of data fed to them. One of the domains of Artificial Intelligence is Natural Language Processing. NLP refers to the algorithms which processes natural language data and makes some sense out of it. Natural language data consists of textual data, speech data, etc. and artificially intelligent machines are used to interpret this data and make several decisions/predictions. Some of the examples can be speech recognition, chatbots, auto-captioning, etc.

Semantris: Semantris is a set of word association games powered by machine-learned, natural language understanding technology. Each time you enter a clue, the AI looks at all the words in play and chooses the ones it thinks are most related. Because the AI was trained on billions of examples of conversational text that span a large variety of topics, it's able to make many types of associations.

SCIENCE

Class 9

3.45 Tissues

PARAMETERS	DESCRIPTION	AI CONCEPTS INTEGRATED
Chapter Covered	**Chapter 6: Tissues**	
Name of the Book	**Science, Class 9, NCERT**	
Subject and Artificial Intelligence Integrated	Tissue - Plant Tissue and its types	Unsupervised learning Natural Language processing
Learning Objectives	● Identify the various types of plant tissues. ● To understand structural, functional and locational differences between various types of Simple permanent tissues -Parenchyma, Collenchyma and Sclerenchyma ● Explain structural and functional differences of various types of complex permanent tissues- Xylem and Phloem	
Time Required	2 to 3 periods (35 mins each)	
Classroom Arrangement	● Regular Classroom setup having laptop/ computer and internet	
Material Required	● Textbook ● Computer, projector, smart board and internet connectivity ● Pen, paper	
Pre – Preparation Activities	● Make four groups and give students salient features of different types of plant tissues and ask them to guess the location of these in a plant.	
Previous Knowledge	● Students to know the difference between cell and tissue. ● Students to know the parts of a plant.	
Methodology	● Students continue in the same groups and conduct an online search for various kinds of plant tissues and classify them ● Students will be able to define the term tissue and differentiate it from cell. ● Students to be guided to identify location of the same. ● Student groups are asked to prepare a presentation on plant tissues and their functions. For better understanding: https://youtu.be/lLnjo4Pf2JM	AI tool for showing cell and tissue Cell Cycle **https://n-e-r-v-o-u-s.com/cellCycle/?t=0**

	Growth of a plant **http://platane.github.io/Procedural-Flower/examples/RampantFlower.html**	
Learning Outcomes	● Students will be able to define the term tissue and differentiate it from cell. ● Classify and compare different types of plant tissues as meristematic and permanent tissues. ● Classify meristematic tissue on the basis of its location.	
Follow up Activities	● Make students solve a quiz on google form. ● Peer assessment- Let the students work in pairs, draw diagrams of different plant tissues and have it assessed by their partner. ● Observe and assess how much students have understood ● Also assess if the lesson is better learnt by using AI tool	
Reflections	● Know from students the role of AI application.	

GLOSSARY:

AI Related Terminology

This AI tool – Cell Cycle helps students to design the structure of cells and tissues with different dimensions and shapes. With the help of this students can generate 3-D structures of cells and tissues.

They have different product type- sculpture, ring , bangle and cuff. Edge style can be selected on the basis of type of cell, horizontal and vertical cellular structure can be designed to understanding the concept. Different colours are available to show a particular part of cell or tissue. Students can design different structures and concept can be understood better when they do it on their own.

https://n-e-r-v-o-u-s.com/cellCycle/?t=0

SCIENCE

Class 9

3.46 Tissues (Epithelial Tissues)

PARAMETERS	DESCRIPTION	AI CONCEPTS INTEGRATED
Chapter Covered	**Chapter 6: Tissues**	
Name of the Book	**Science, Class 9, NCERT**	
Subject and Artificial Intelligence Integrated	Epithelial Tissues : Types and Functions	Supervised learning, Data exploration https://datavizcatalogue.com/
Learning Objectives	• To enable the students understand the body organisation and how tissues are formed • To enable the students define tissues • To familiarise the students with the four types of tissues found in animals • To enable the students describe the general characteristics and functions of epithelial tissues • To enable the students name the types of epithelial tissues found in our body and help the students identify an organ in which each is found . • To enable the students explain how glands are formed from epithelium and classify the glands	
Time Required	4-5 periods of 35 minutes each	
Classroom Arrangement	Regular classroom setup with projector or any other visual aid available to show the diagrams different kinds of epithelial tissues	
Material Required	• Computers to display the powerpoint presentation • Permanent slides of epithelial tissues • Common classroom materials required for teaching • Computers with internet connection to search more about the epithelial tissue and make their own mind maps	
Pre – Preparation Activities	• Materials needed for self-guided learning of tissues • Preset microscope with permanent slides • Power point slides for supervised learning	
Previous Knowledge	The students have the knowledge of cells which are the basic unit of life and how they are organised to form tissues	

Methodology	• The teacher introduces the concept of tissues and the four basic types of tissues found in the animals • The teacher divides the students into group of 4 students each and each group are then instructed to study on their own a group of tissues within a specified period of time through a microscope to promote hands on learning with microscopes • The students are then instructed to observe the slides preset in the microscope each showing a good field of view • The teacher then shows the histological images in the form of power point slides on a projector screen in the classroom and explains the primary and distinguishing anatomical features of each tissue , the etymologies of the names of tissues, the locations in the body and the roles each tissue plays in bodily functions • In the last the teacher instructs the students of each group to draw the tissues and label them correctly on the basis of their observation of the slides in microscope and images seen • The students are introduced with a link to make their own tree diagrams	Supervised learning Data visualisation and exploration https://datavizcatalogue.com/
Learning Outcomes	• The students will be able to understand the body organisation of animals • The students will be able to familiarise themselves with the four types of tissues found in animals • The students will be able to describe the general characteristics and functions of epithelial tissues • The students will be able to name the types of epithelial tissues found in our body and help the students identify an organ in which each is found • The students will be able to explain how glands are formed from epithelium and classify the glands.	
Follow up Activities	• Assessment worksheets • Report on the use of the AI in the field of Histopathology using google search engine	

GLOSSARY:

AI Related Terminologies

1. **Supervised learning:** Supervised learning as the name indicates the presence of a supervisor as a teacher. Basically supervised learning is a learning in which we teach or train the machine using data which is well labeled that means some data is already tagged with the correct answer. After that, the machine is provided with a new set of examples(data) so that supervised learning algorithm analyses the training data(set of training examples) and produces a correct outcome from labeled data.

2. **Data Exploration:** After acquiring data there comes the need to analyze the data. For this, they need to visualize the acquired data in some user-friendly format so that they can:
   - Quickly get a sense of the trends, relationships and patterns contained within the data.
   - Define strategy for which model to use at a later stage.
   - Communicate the same to others effectively.

To visualize data, various types of visual representations could be used by the students l like diagrams, charts, graphs, flows, etc

SCIENCE

Class 10

3.47 Metals and Non-Metals

PARAMETERS	DESCRIPTION	AI Concepts Integrated
Chapter Covered	**Chapter 3: Metals and Non-Metals**	
Name of the book	**Science, Class 10, NCERT**	
Subject & Artificial Intelligence integrated	Occurrence & Extraction of Metals through Story Speaker	
Subject Integrated	Occurrence & Extraction of metals through Interactive Story speaker and Interactive Quiz (Kahoot) 3.4.3- 3.4.5 Extracting Metals Low, Middle High in the Activity Series	Introduction to AI Awareness through Google story Speaker
Objectives	● to understand the occurrence of metals ● to learn about extraction of metals.	
Time required	2 periods of 40 minutes each	
Classroom Arrangement	Laptops/ desktops with internet connection for each group	
Introduction/ Previous Knowledge	● Students have learnt about various elements, their classification as metals and non-metals on the basis of their properties ● Ask the students to recall: Names of some metals and non-metals used in their daily life? ● Name the properties that help them to categorize the above mentioned metals and non-metals ● emphasize that metals are also classified on the basis of their reactivity	
Materials Required	Chart Paper pen, pencils, sketch pens, scale Laptops/ desktops, Internet connection	
Methodology – Activity Based	In groups of 4-5 ask students to study the flow chart to show steps involved in the extraction of metals from their ores (pg 50 Fig 3.10) ● Ask them to make a note of - different metals on the basis of reactivity - different processes for different categories of metals to extract them from their ores ● Ask them to build a story about extraction of any one metal (of high, medium or low reactivity) on the Story Speaker. ● Ask groups to showcase their story to at least one other group.	Story Speaker https://docs.google.com/document/d/1rXPSayQVVQ-T5cWlhxPbOCc2UJEZTbVWkxqOnC_RnDE/edit?usp=sharing
Learning Outcomes	● Learners will be able to develop an understanding of the occurrence, classification of metals on the basis of their reactivity ● Learners will be able to explain the different processes in the extraction of metal ores according to their reactivity series	

Self Evaluation & Follow up Activity	● Make students answer Question 2 & 3 on page 53 ● The students work in groups and do peer assessment Assess their understanding on the concept of extraction of metals ● Observe to assess how much have they understood the concept of extraction of metals ● also assess if they learn better using AI based apps like Story Speaker or Kahoot	

GLOSSARY:

1. AI Related Terminologies

Story Speaker: It is an AI experiment which is available as an add-on to Google Docs. Story Speaker lets anyone create an interactive story with no coding required. It is an easy to install and easy to use tool and comes in handy when the user wants to create a story which changes according to the user's input.

Link to install Story Speaker extension for Story Speaker: https://chrome.google.com/webstore/detail/story-speaker/ohfibfhhfbhknfdkipjdopbnegkbkjpj

Introduction to Story Speaker: https://www.youtube.com/watch?v=wsrzvYYvhH8&feature=youtu.be

Link to read more about Story Speaker:
https://docs.google.com/document/d/1hFrBtsBbF2LoZ1FFpXEH7L6fWH1lj24W1-itXnKSXK8/edit

Basic Template of Story Speaker: https://docs.google.com/document/d/1rXPSayQVVQ-T5cWlhxPbOCc2UJEZTbVWkxqOnC_RnDE/edit?usp=sharing

Steps to install Story Speaker:

- Login in to your Google account
- Go to google.com
- Search for story speaker addon download
- Go to the first link of experiments.google.com
- Click on Launch Experiment
- To install this addon, click on free.
- Give the required permissions to get the addon.
- Once it is installed, go to docs.google.com → Add-ons → Story Speaker → Open Story Speaker

Ask the students to first load the basic template and play it. To play the story, go to Add-ons → Story Speaker → Open Story Speaker, as soon as the story speaker window opens at the right, click on Play your Story → scroll down to Play story in chat preview. The basic template will start playing where once the story pauses, the user needs to give input according to the question asked. According to the response fed either by typing or by speaking, the story will change.

Basic Template of Story Speaker:

Title: The Tale of The Pig Monster ← Title of the story (can be changed)
By: Your name ← Author's Name (can be changed)

START HERE ← Depicts the Start of the story to the machine (CANNOT be changed)

Intro ← Start of the story (CANNOT be changed)
You're standing in a forest. There are two roads in front of you. Do you go to the left or the right? ←Introduction to the story. Students can make it their own way

[1] **If you say "left"** ← Conditional Statement. Can only change the text in " " according to what input do they expect from the user to diverge their story.

You hear a fearsome growling. A pig monster approaches. It eats you. I'm sorry. [[END]] ← The story diverges as the user gives appropriate input. The text here can be changed according to the story. [[END]] depicts that the story would end at this point.

[2] **If you say "right"**
You walk down a darkened path. You come to a house. There's a light on inside. Do you go inside? ← The statement where you want the user to respond should end with a question like this.
If you say "yes" or "go inside"
You knock on the door. It opens, revealing the pig monster. This is the pig monster's house. It eats you. I'm sorry. [[END]]
If you say "no" or "keep going" or "don't go inside"
You keep walking. The story would keep going. But you'll have to write it. [[END]]
Otherwise ← If user enters any input other than the expected ones, the story lands at this point. This is for the [2] if condition. (CANNOT be changed)
Do you want to go in the house? Say "yes" or "no." It's getting cold out here. ← (can be changed)
Otherwise ← The story would land at this point if the user gives an unexpected response to the Intro question. (CANNOT be changed)
You've got to go to the left or the right. The pig monster isn't going to wait all day. ← (Can be changed)

Anytime you say "where is the pig monster" ← Optional Statement. Text in " " can be changed I don't know. It could be anywhere. ← (can be changed)

Fallback← This statement gets executed for any erroneous response which does not get covered in any Otherwise statements. (CANNOT be changed)

Sorry, I didn't get that. Try asking again. ← (can be changed)

NOTE:

- The statements written in **BOLD** are interpreted by the machine for specific purposes. Thus, in most cases, they cannot be changed as they describe a specific function to the machine.
- Wherever one wants the story to diverge, the statement should end with a question which the user can answer so that according to his/her response, choices can be made. There can be more than one choice for the user to make but it is advisable that whichever choice the user has should be mentioned in the question itself to bring more clarity.
- Indentation is very important in writing an interactive story using story speaker. It lets the machine understand the flow of the story. Indentations are given with the help of TAB key. As you can see, the If statement [1] in the template has been tabbed after the intro part as it shows that this If statement comes under intro. While the other If statement [2], has been tabbed again to show that it comes inside the **If you say "right"** statement.

2. AI Activity Description

Ask the students to explore the basic template and try playing it before they start working on their story. After they understand how to use the tool, ask them to build a story about extraction of any one metal (of high, medium or low reactivity) in which the story talks about each and every step of metal extraction with the help of the knowledge they acquired from the chapter.

SCIENCE

Class 10

3.48 Magnetic Effects of Electric Current

PARAMETERS	DESCRIPTION	AI CONCEPTS INTEGRATED
Chapter Covered	**Chapter 13: Magnetic Effects of Electric Current**	
Name of the Book	**Science, Class 10, NCERT**	
Subject and Artificial Intelligence Integrated	Understanding Concept of Magnetic field around straight current carrying conductor AI Applications and Data Acquisition and Data exploration	
Learning Objectives	● To understand the shape of magnetic field around produced around straight current carrying conductor ● To identify steps of data handling - Sources of data - Collection of data - Organization, representation and analysis of data ● To identify the factors affecting the strength of magnetic field produced around a straight current carrying conductor ● To establish a relationship between current flowing in the conductor and strength of magnetic field produced by it ● To establish a relationship between distance from the conductor and strength of magnetic field produced by it ● To understand application of Data Acquisition and Data exploration in real life situations	Data Acquisition Data exploration Data Visualisation
Time Required	2 periods of 40 minutes each	
Classroom Arrangement	Flexible	
Material Required	Graph Paper, Colored Pen, paper, Black Board chalk, Battery - 12V, Rheostat, Ammeter (0- 5) A, Long straight conductor (copper wire), Iron fillings , cardboard, key, Laptops/ desktops and Internet connections	
Pre – Preparation Activities	● The students will be divided into 2 groups for a discussion of properties of magnetic field lines around a bar magnet ● They will be asked to guess the shape of magnetic field produced around a straight current carrying conductor ● Students will be performing activity using given material ● They will make a circuit using a straight conductor normal to the plane of cardboard, rheostat, battery and key, ask them to sprinkle iron filings around the conductor. ● Ask students to close the key and gently tap the keyboard. They will observe iron filings will align themselves in concentric circles around conductor ● Some questions will be given to them to think upon as task of the day - What do these concentric circles represent? - Why do these circles are more concentrated near the conductor?	

	- What happens to these concentric circles on increasing and decreasing the magnitude of the current flowing in the circuit? All these questions will be answered in the next class	
Previous Knowledge	● Students must possess the knowledge of concept the magnetic field. ● They should be aware of the direction of magnetic field lines around a bar magnet	
Methodology	● Now students will discuss their answers first given to them during pre-preparation activity ● Teacher will tell them concentric circles represent field produced around a straight current carrying conductor ● Now they will be informed about Right Hand Thumb rule to find the direction of magnetic field produced around a straight current carrying conductor ● Students will explore www.olabs.edu.in and through simulator they will collect following readings/data- ● how increase in current changing the strength of magnetic field ● how increase in the distance from current changing the strength of magnetic field at that point ● After collecting data students will analyzeand represent data with the help of some graphical representation. ● Students will explore data and establish relationship between magnetic field (B) and current (I). ● Students will explore data and establish relationship between magnetic field (B) and distance from current carrying conductor (d). ● Ask the students to go on https://datavizcatalogue.com and explore various types of graphs and the way to use these. Ask them to select a representation which will suit their data best (line graph) Students will be able to recognize various patterns/trends out of their representations which can be used to represent this problem. Ask the students to explore the possibilities/applications of using AI in solvingthis problem. ● Students will explore data and establish relationship between magnetic field (B) and current (I). B is directly proportional to I ● Students will explore data and establish relationship between magnetic field (B) and distance from current carrying conductor (d). B is inversely proportional to d ● Students can also draw magnetic field around straight current carrying conductor using autodraw for clockwise and anticlockwise direction to practise Right Hand thumb rule	https://datavizcatalogue.com/search.html https://experiments.withgoogle.com/autodraw
Learning Outcomes	• Students will be able to understand shape of magnetic field line around straight current carrying conductor • Students will be able to understand the dependence of strength of magnetic field on current	
Follow up Activities	• They will explore similar AI tools to deepen the learning of this concept • Students can use similar AI tools for representation and collection of data for current carrying circular loop	
Reflections	● Discussion with Students on the role of AI application	

GLOSSARY:

Data Acquisition and Data Exploration

AI Activity Description

For this activity ask the students to go to www.olabs.edu.in to collect data/readings through simulator for this given activity. For this keeping one of the factor constant other readings can be noted down

Data Exploration:

Now that the data has been acquired, ask the students to explore it through visual representations. Guide the students to visit https://datavizcatalogue.com and observe various types of graphical/ pictorial representations. As soon as they land upon the website, they need to go to some of the graphs and read their descriptions and how to create them. After exploring the resource, ask the students to select the type of representation that according to them would be most appropriate for visualizing their data. Once they finalize their graph, ask them to draw the same on a chart paper using the data which they acquired. Now that the students have drawn the graph, they need to present it to the whole class in such a way that they are able to analyze some meaningful pattern out of it. The pattern or the trend recognized out of the representation should lead them towards the relationship between current and magnetic field produced around a straight conductor. Finally, ask the students to discuss how AI can be leveraged in this situation.

Autodraw.com: Autodraw.com is an AI enabled tool which is based on the domain of Computer Vision in which the machine identifies the pattern of your drawing and accordingly maps it with the most similar image. This tool shows various options trying to predict what the user is trying to draw.

AI Activity description for this activity, ask the students to go to https://autodraw.com. Once they land on this website, ask the students to select the first icon from the left side toolbar. This icon activates the AI element of the tool. Now, ask the students to draw any shape and let the AI algorithm detect and predict the possible drawings similar to it. The predictions will appear in the top row. After looking at the predictions and analyzing how accurate the machine is, ask them to keep an image in mind (say of a monument or a vehicle or thing etc.) and then start drawing it roughly and see at what step the machine is able to predict the image.

SCIENCE

Class 10

3.49 Heredity and Evolution

PARAMETERS	DESCRIPTION	AI CONCEPTS INTEGRATED
Chapter Covered	**Chapter 9: Heredity and Evolution**	
Name of the Book	**Science, Class 10, NCERT**	
Subject and Artificial Intelligence Integrated	Mendelian experiments on pea plants. Reasons for success of Mendel. Laws of Inheritance integrated with supervised learning	https://experiments.withgoogle.com/tiny-sorter https://teachablemachine.withgoogle.com/train/image
Learning Objectives	Students will be able to: ● Understand gametes contain the chromosomes that get transferred to the next generation. ● Identify that DNA is the substance that leads to the variation in organisms. ● Differentiate between Dominant and Recessive traits. ● Justify the use of Pea plants as the experimental material by Mendel. ● Construct a monohybrid & dihybrid cross and calculate the ratio of offspring. ● Analyse the appearance and suppression of specific traits during the crosses.	
Time Required	3-4 periods, 40 mins each.	
Classroom Arrangement	Flexible sitting arrangement	
Material Required	Desktops with internet connection for each group, Pen, pencil, paper, projector.	
Pre – Preparation Activities	Students will be provided with samples of pea seeds, and asked to sort them according to their shapes. They will also be asked to observe and note down following characters in their classmates: The eye color, hair color, hair texture, dimples on cheeks and note the number as their observation.	
Previous Knowledge	Students must be familiar with terms like variations and that sexual reproduction leads to variations. The DNA plays an important role in determination of characters.	

Methodology	The students will share their observations with the class. Teacher now explains that there are some traits which are dominant over others, and explains the first law of Mendel through a Monohybrid Cross. Dominant traits are the ones which are found in most of the population and recessive ones are found less frequently in the population. Students will be divided into groups of 5 students each and asked to work out on any 3 dominant/ recessive traits they are able to find in a population and then make a report of the same. Later share it with the class. Further the teacher explains the work of Mendel and the other two laws of Mendel and law of independent assortment.i.e. law of segregation. Students now will be asked to practice the mono and dihybrid cross using different examples.	https://experiments.withgoogle.com/tiny-sorter https://teachablemachine.withgoogle.com/train/image
Learning Outcomes	Students should be able to: ● Understand that gametes contain the chromosomes that get transferred to the next generation. ● Appreciate the efforts of Mendel for studying contrasting traits located on different chromosomes in the pea plant. ● Differentiate between Dominant and Recessive traits. ● Justify the use of Pea plants as the experimental material by Mendel. ● Illustrate the Monohybrid cross as performed by Mendel. ● Construct a monohybrid & dihybrid cross and calculate the ratio of offspring using (Punnett square). ● Analyse the appearance and suppression of specific traits during the crosses.	
Follow up Activities	● Hold a brief class discussion on the topic of inheritance and observe what the students say and which concepts are still not clear to them. ● Ask them to award a score to themselves based on how much they could contribute to the discussion ● Take a mind map making activity on paddlet.com	https://teachablemachine.withgoogle.com/train/image
Reflections	Students can feed in different samples and calculate the dominant trait in different characters like dominant coat colour in dogs; black or brown hair.	

GLOSSARY:

Machine Learning algorithms can be broadly classified into tree families: Supervised learning, Unsupervised learning and Reinforcement learning.

Classification is a part of the Supervised learning model. Classification models work on labelled datasets and are used to predict the label of the test dataset. For example, 100 images of apples and 100 images of bananas have been taken as a training dataset for the AI model. These 200 images have been labelled as apples or bananas respectively. This labelled data is then fed to the machine which trains itself by extracting common features from the dataset and understands which features come under the apple label and which ones come under the banana label. At the time of testing, the machine takes an input image and extracts features from it which are then compared with the features marked under both the labels. On the basis of the degree of similarity, the machine will label the testing image as either an apple or a banana. This process is known as Classification.

Tiny Sorter

For heredity experiment, a sample of pea seeds can be put into a sorter and then the sorter separates them and we can calculate the ratio.

Getting started with physical computing and machine learning can be pretty intimidating. But it doesn't have to be! Meet Tiny Sorter, a DIY experiment that teaches you how to build a sorter by connecting Arduino and Teachable Machine.

It's a little machine that you can easily make with a piece of paper — just cut, fold, assemble the motor and put in right on top of your laptop's webcam. Then use Teachable Machine to create a machine learning model (no coding required) to sort little objects – cereal, candy, paper clips, whatever you've got laying around. And just like that you have your own machine learning sorter.

It's a super simple and fun project for just about everyone - students, coders, non-coders, even if this is your first time using arduino. Build your own Tiny Sorter and get a feeling for what machine learning and physical computing is all about.

BUILT WITH: tensorflow.js, Teachable Machine, Arduino, Javascript

Teachable Machine is a web tool that makes it fast and easy to create machine learning models for your projects, no coding required. Train a computer to recognize your images, sounds, & poses, then export your model for your sites, apps, and more.

BUILT WITH: Javascript, tensorflow.js, Teachable Machine

For this heredity experiments, we can feed in sample of dark and light hair color in the teachable machine, and observe a population to quickly check which one is dominant character.

SCIENCE

Class 10

3.50 Chemical Reactions and Equations

PARAMETERS	DESCRIPTION	AI CONCEPTS INTEGRATED
Chapter Covered	**Chapter 1: Chemical Reactions and Equations**	
Name of the Book	**Science, Class 10, NCERT**	
Subject and Artificial Intelligence Integrated	Types of Chemical Reactions	My storytime tool on AI chatbot Supervised learning AI voice over generator- Clipchamp
Learning Objectives	Students will be able to ● Understand different types of reactions. ● Explain decomposition reactions as opposite to combination reactions. ● List examples of combination and decomposition reactions. ● Describe displacement and double displacement reactions with examples. ● Explain redox reactions.	
Time Required	3-4 periods of 40 minutes each	
Classroom Arrangement	Regular classroom setup, Chemistry Laboratory, Computers with internet connection for each group of students (with AI tools installed)	
Material Required	NCERT textbook, NCERT exemplar book, Science lab manual, Google story speaker installed in computers.	
Pre – Preparation Activities	● Ask children to think of various chemical reactions that they see around them. ● Ask them to classify them into different categories of reactions. Students would be able to see some similarities in the reactions while classifying them.	
Previous Knowledge	● Different sets of conditions are required for different types of reactions to take place. ● The observational changes are different in various reactions. ● Students know that upon heating, substances break down to form new simpler substances. Example: Bacteria decompose organic matter in nature to form manure. ● Food gets spoilt when it gets oxidized. E.g cut apples turn brown, cooked food spoils after one or two days.	

Methodology	● The teacher will take the class to the Science Laboratory and demonstrate different types of reactions to invoke curiosity and interest in students. ● Then the students will be divided into groups of four each. ● Experiential Learning: Each group of students will be assigned a reaction to perform and note down the observations. ● On the next day, the students will be taken to the Computer laboratory and each group will be asked to build a story explaining the observations and the process involved in the reaction. ● Then, each group may tell the story to others by using an AI tool which converts their stories into speech. ● The teacher will show a video to sum up the chapter: https://www.youtube.com/watch?v=HmNsQKLRgh8	Natural Language Processing My storytime tool on AI chatbot- AI voice over generator- Clipchamp https://clipchamp.com/en/features/ai-voice-over-generator/
Learning Outcomes	Students would be able to ● Explain combination and decomposition reactions by taking various examples from our daily life. ● Give examples of redox reactions from our daily life. ● Analyze the differences between displacement and double displacement reactions. ● Draw conclusions on the basis of observations made in chemical reactions.	
Follow up Activities	● Students in a group will be asked to make a flow-chart indicating the types and sub-types of reactions with their examples. (collaborative learning while working in groups together). ● Playing cards game: Students will shuffle the cards and place them face down, in a stack, on the desk. The players take turns to reveal the top card in the stack and identify the type of reaction shown on the card. The students who correctly identify the type of reaction gets points. ● Google form test to be conducted to know whether they have achieved the desired learning outcomes.	
Reflections	● Discussion with the students on the role of AI applications- My storytime on AI chatbot tool,, supervised learning ● Any other AI application that can be used as an alternative- Inklewriter	

GLOSSARY:

AI Related Terminologies

1. Mystorytime tool on AI chatbot: It is an AI experiment which is available as an add-on to Google Docs. It lets anyone create an interactive story with no coding required. It is an easy to install and easy to use tool and comes in handy when the user wants to create a story which changes according to the user's input.

2. Natural Language Processing: It is the ability of a program to understand human language. Human language data can be fed to the machine in the form of text or speech. Natural Language Processing is one of the subfields of Artificial Intelligence wherein the machine interprets human language and produces intelligent output.

3. Supervised Learning: Supervised learning is an approach to creating artificial intelligence (AI), where the program is given labeled input data and the expected output results. Classification is a part of the Supervised learning model. Classification models work on labelled datasets and are used to predict the label of the testing dataset. For example, 100 images of apples and 100 images of bananas have been taken as a training dataset for the AI model. These 200 images have been labelled as apples or bananas respectively. This labelled data is then fed to the machine which trains itself by extracting common features from the dataset and understanding which features come under the apple label and which ones come under the banana label. At the time of testing, the machine takes an input image and extracts features from it which are then compared with the features marked under both the labels. On the basis of the degree of similarity, the machine will label the testing image as either apple or banana. This process is known as Classification.

4. AI Voice Over Generator- Clipchamp: Voice overs are pretty much the modern day version of the narrator in a story book. In most cases a voice over (aka off-camera commentary) describes a production technique where a voice is used to narrate a story – they are heard but not seen. An AI voice over is created by AI technology in a computer. It works by turning your text to voice in a voice over generator.

Depending on the AI voice over generator you use, you can usually choose from a range of voices to meet your needs – male, female, formal or emotive, the choice is up to you. While you might associate AI with robotic sounds, modern AI (like what we've used to create our generator) is capable of producing realistic text to speech transformations.

SCIENCE

Class 10

3.51 The Human Eye and the Colourful World

PARAMETERS	DESCRIPTION	AI CONCEPTS INTEGRATED
Chapter Covered	**Chapter 11: The Human Eye and the Colourful World**	
Name of the Book	**Science, Class 10, NCERT**	
Subject and Artificial Intelligence Integrated	• Human Eye • Defects of vision and their correction • Loopy for power of accommodation integrated with Teachable machines and Application of AI in ophthalmology	
Learning Objectives	• Students will be able to explain and draw the internal structure of the human eye. • They will be able to understand how the image is formed in the eye. • They will be able to know the cause of various eye defects and their correction	
Time Required	4 periods of 40 minutes each	
Classroom Arrangement	Regular	
Material Required	Computer, Projector Computer Lab	
Pre – Preparation Activities	Quick recap of last topic	
Previous Knowledge	Refraction of light	
Methodology	• Discussion of the internal structure of the human eye by drawing an analogy with a camera. • Students will play this game in the computer lab in groups of 2-3 depending upon the resources available. • (HW) Students will prepare a 2D model of an eye with the help of different coloured clay. CW - In the class they will be asked to flag label it. • Explanation of power of accommodation with loopy. • Link for loopy: https://ncase.me/loopy/v1.1/?data=[[[1,800,201,1,%22distance%2520of%2520object%2520from%2520eye%22,4],[2,720,492,1,%22ciliary%2520muscles%2520of%2520eye%2520(relaxation)%22,5],[3,312,296,0.5,%22curvature%2520of%2520lens%22,0],[4,383,142,0.5,%22thickness%2520of%2520llens%22,0],[5,559,75,0.5,%22focal%2520legth%2520%22,0]],[[1,2,89,1,0],[2,3,124,-1,0],[3,4,32,1,0],[4,5,53,-1,0]],[],5%5D • Discussion of various eye defects and their correction with the help of videos. • Students will be provided the experience of teachable machines to create awareness that just like eyes help us	https://www.helpfulgames.com/subjects/biology/303-human-eye-anatomy.html https://teachablemachine.withgoogle.com/train/image

	to identify objects similarly AI cam also help in recognising things. • Students will be shown videos to tell how AI is helping in correcting human eye defects. • https://www.youtube.com/watch?v=fFpOeIi7j8Y • Students will play the online Quizizz game to self assess themselves.	
Learning Outcomes	• Students will be able to draw a well labelled diagram of the human eye. • Students will be able to explain how the image is formed in the human eye. • Students will explain the various eye defects with the reason and also mention their correction.	
Follow up Activities	• Snowball activity- Teacher will prepare chits (f increases, f decreases, image before retina, myopia, etc,) containing words related to various eye defects. Each student will pick up one chit and find other students who have chit related with the same defect. The group which find its all members first is the winner. • Students will self assess themselves with the Online Quizizz game on the human eye.	
Reflections	Discussion on role of AI on ophthalmology	

GLOSSARY:

AI Related Terminologies

AI Identifies Whether a Patient is a Good Candidate for Laser Eye Surgery
by **Jack Carfagno** -July 2, 2019

Machine learning AI has recently been used to distinguish between patients who are fit for corneal refractive surgery and those who are likely to experience post-operative complications. The referral for this procedure often goes misdiagnosed, but by using AI, these researchers have potentially created an accurate screening tool for the surgery. Their work was published on June 20 in the journal npj Digital Medicine.

Refractive surgery, such as LASIK, utilize lasers to reshape the cornea in treating conditions such as near and farsightedness, and astigmatism. It is essential to screen candidates for these operations to prevent adverse outcomes, but there are no existing screening methods that address the possibility of improper diagnosis.

To address this, senior author Tyler Hyungtaek Rim of the Singapore Eye Research Institute and colleagues trained five algorithms to identify appropriate surgery candidates. Along with these five algorithms was an ensemble classifier that was developed to improve the system's performance.

The team analyzed data from healthy Korean subjects with intention to undergo refractive surgeries between 2016 and 2018. 10,561 subjects were used in the algorithm training set that constructed the prediction models. An internal validation set of 2,640 participants was used to test this prediction model's ability to predict candidacy for the operation. External validation was conducted using 5,279 subjects as well.

READ MORE: How IDx is Paving the Way for Artificial Intelligence Use in Medicine

The team found that the ensemble classifier was able to differentiate between good and bad candidates for corneal refractive surgery with 93.4% accuracy. Authors note that the large collection of cohort data allowed the machine learning algorithms to precisely detect the clinical signs associated with eye conditions. This AI platform combines multi-instrument data and clinical decisions from trained professionals to yield impressive results.

Tyler Hyungtaek Rim and colleagues note that this machine learning model matched the performance of experts, with consistency in the high-risk groups with nearsightedness, astigmatism, and thin central corneal thickness.

“Our proposed machine learning model is expected to perform reliably because it was trained by a large population,” the authors concluded. “An automated analysis of preoperative data can provide a safe and reliable clinical decision for refractive surgery. In the future, this approach will facilitate standardized and automated selections of surgical choices.”

SCIENCE

Class 10

3.52 Periodic Classification of Elements

PARAMETERS	DESCRIPTION	AI CONCEPTS INTEGRATED
Chapter Covered	**Chapter 5: Periodic Classification of Elements**	
Name of the Book	**Science, Class 10, NCERT**	
Subject and Artificial Intelligence Integrated	Trends in the Modern Periodic table Natural language processing integrated with inklewriter.	Natural language processing: Inklewriter
Learning Objectives	Learners will be ● able to understand what is group and period in a periodic table ● able to recognize the patterns in different properties like valence electron , valence shell , electronegativity ● able to identify different family grouping in the periodic table	
Time Required	2 Periods of 35 minute	
Classroom Arrangement	Flexible classroom	
Material Required	Chart Paper pen, pencils, sketch pens, scale; laptops/desktops; screen; projector; Internet connection 17 drawing of Periodic People	
Pre – Preparation Activities	● Students will be divided into group of four and each group will be provided with 17 drawings of ‘Periodic People’ and ask them to arrange into a table that considers patterns. ● These patterns include the number of antennae (1 to 8), the number of fingers (1 to 18), the number of arms (1 to 3), the facial expression (really sad to super happy), and the body design pattern (9 different ones) ● Arranged pattern should be going up and down and across from left to right.	
Previous Knowledge	Students: ● have comprehended the concept of atoms and atomic structure ● can deduce the electronic configuration of the first 20 atoms in the modern periodic table. ● Knows about valence electrons, valence shell, electronegativity and atomic number	

Methodology	After the students have arranged the drawings the facilitator will explain ● These patterns are synonymous with the major patterns on the Periodic Table itself ● Horizontal row in the table is a period and vertical column is a group ● The number of arms represents the number of electron shells ● The number of antennae represents the number of valence electrons ● The number of fingers represents the atomic number. ● the number of electron shells increases moving down a column ● The number of valence electrons increases moving from left to right across a row ● The electronegativity increases moving from left to right across the main group elements ● After they have understood the trends in the periodic table they will identify different families present in the periodic table like noble gases, alkali metals , halogens transition metals etc. ● For more exploration about each element google experiment 3D Periodic Table will be used https://experiments.withgoogle.com/3d-periodic-table ● Discussion will be done on can AI recreate the periodic table and a link will be provided to explore more https://news.stanford.edu/2018/06/25/ai-recreates-chemistrys-periodic-table-elements/#:~:text=Stanford%20AI%20recreates%20chemistry's%20periodic%20table%20of%20elements&text=Called%20Atom2Vec%2C%20the%20program%20successfully,names%20from%20an%20online%20database.	
Learning Outcomes	Students will ● Understand what a group and period is in a periodic tale ● Identify trends in the periodic table ● Be able to identify different families in the periodic table and the similar properties present in them	
Follow up Activities	● Assign each member of your class one of the elements in the periodic table. Ask them to imagine that one day one element (one assigned to them) disappears. ● Ask them to write a fictional story using AI tool about the day their element disappeared ● In order to accomplish this end students need to research some of the basic uses of elements. Where do they appear in nature? Where is their presence crucial? How will their life be different without them	https://www.inklewriter.com/
Reflections	Scavenger hunt based on the periodic table will be given to students in the form of questionnaires.	

GLOSSARY:

AI Related Terminologies

Inklewriter is a free tool designed to allow anyone to write and publish interactive stories. It's perfect for writers who want to try out interactivity, but also for teachers and students looking to mix computer skills and creative writing.

https://www.inklewriter.com/

Activity Description

Students will be assigned an element and will be asked to write a fictional story about the day their element disappeared. Hence, he/she will understand the importance and use of that particular element and how lives will be affected with its disappearance.

SCIENCE

Class 10

3.53 Acids, Bases & Salts

PARAMETERS	DESCRIPTION	AI CONCEPTS INTEGRATED
Chapter Covered	**Chapter 2: Acids, Bases and Salts**	
Name of the Book	**Science, Class 10, NCERT**	
Subject and Artificial Intelligence Integrated	pH of Acids, Bases and Salts Integrated with Supervised learning, Data exploration and data visualization.	Supervised learning Data exploration and data visualization
Learning Objectives	Students will be able to understand: • What is pH and a pH scale? • How strong a given acid or base is? • Variation of pH with the change in concentration of hydrogen ions. • They will be able to understand the nature of substance on the basis of its pH value.	
Time Required	Two periods of 40 minutes each.	
Classroom Arrangement	In 1st period- Lab and in 2nd period- Regular classroom setup having projector, computer/laptop and internet.	
Material Required	HCl solution, Acetic acid solution, NaCl solution, NaOH solution, Ammonium hydroxide solution, pH paper, dropper, pH colour chart, test tubes	
Pre – Preparation Activities	Divide the class into three groups- A, B and C. Distribute the following samples to each group HCl solution, Acetic acid solution, NaCl solution, NaOH solution, Ammonium hydroxide solution. Provide 5 pH paper strips and a pH colour chart to each group. Ask them to put 1-2 drops of each solution on separate pH paper strips and try to match the observed colour with the pH colour chart.	
Previous Knowledge	Students know the concept of Acids, bases and their properties, they know about the indicators used for the test of acids and bases.	
Methodology	Teacher explains the concept of pH scale and about the pH range of acids, bases and neutral solutions. Help them in labeling the given solutions as acid, base or neutral on the basis of their observation (pH value) from the pre- preparation activity. On day 2, Explain them about the pH variation with Hydrogen ion concentration. They are introduced to loopy tools to understand the connection of pH with Hydrogen ion concentration. https://ncase.me/loopy/v1.1/	Supervised learning https://teachablemachine.withgoogle.com/ Data visualisation tool https://datavizcatalogue.com/

	Videos will be shown to them related to pH of acids,bases and salts and colours obtained with universal indicator for more concept clarity. https://youtu.be/988dvJWjycU https://youtu.be/-lbh5_1xxtI They are introduced that how Artificial intelligence helps in understanding the concept through supervised learning using- teachable machine tool They are asked to find pH values of different solutions given to them and to make a graph according to increasing order of pH.	
Learning Outcomes	Students will be able to : Differentiate between weak and strong acids, weak and strong bases based on their pH values. Understand the pH range for acids,bases and neutral solutions. Understand the variation of pH with hydrogen ion concentration.	
Follow up Activities	Ask them to test pH values of the following solutions and write the nature of each substance on the basis of their observations: Lemon juice, cold drinks, carrot juice, tomato juice, saliva, baking soda. Ask them to make a pH colour chart on their own for different pH values from 0 to 14.	
Reflections	Ask them to explore some artificial intelligence tools to understand the same concept.	

GLOSSARY:

AI Related Terminologies

1 Teachable Machine

It is a web tool that makes it fast and easy to create machine learning models for projects. A computer to recognize your images, coloured pH paper. Teacher will create a file by showing pictures of different cloured pH paper. Students will show different coloured pH paper and the machine will identify them as acid, bases and neutral salt.

https://teachablemachine.withgoogle.com/

2. Data Exploration and Visualisation

https://datavizcatalogue.com/

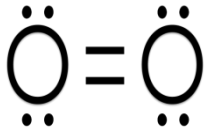
Data Exploration refers to visualize the data to determine the pattern, relationships between elements and trends in the dataset that gives a clear meaning and understanding of the dataset. Data exploration is important as it helps the user to select an AI model in the next stage of the AI project cycle. To Visualize the data, various types of visual representations can be used such as diagrams, charts, graphs, flows and so on. The representation of concept mapping can be specified for the particular chapter.

SCIENCE

Class 10

3.54 Carbon and its Compounds

PARAMETERS	DESCRIPTION	AI CONCEPTS INTEGRATED
Chapter Covered	**Chapter 4: Carbon and its Compounds**	
Name of the Book	**Science, Class 10, NCERT**	
Subject and Artificial Intelligence Integrated	Bonding in Carbon- The covalent bond, Properties of carbon compounds, Electron dot structure, Allotropes of carbon.	Data Acquisition Data Exploration Auto draw
Learning Objectives	Students will be able to: • Understand the nature of bonding in carbon. • Explain why carbon forms covalent bond. • Draw electron dot structure of various molecules. • Enlist various allotropes of carbon, their structure and uses.	
Time Required	2 periods of 35-40 mins each.	
Classroom Arrangement	Flexible seating arrangement.	
Material Required	Laptop/ desktop or smart mobile phone with internet connection, notebook, pens, white board etc.	
Pre – Preparation Activities	Students will be asked to make a list of ten items that they have used/consumed since morning. They will group the items as follows: Items made up of metals- Items made up of glass- Others- After they divide the items, they will write which item may contain carbon in some form.	
Previous Knowledge	Students must be aware about atomic number and atomic mass, concept of valence electron and valency.	

Methodology	• Students will be divided into groups of 4-5. • They will be asked to collect the data of melting and boiling points of at least 10 carbon compounds.Arrange the data in ascending order. • Students will plot a line graph for melting point as well as boiling point. • Students will be able to explain the forces of attraction among different carbon compounds based on the plotted graph. • Next, Students will watch a video to understand bonding nature of bonding in carbon. • https://www.youtube.com/watch?v=gZkJY4NvaOs • They will be introduced to electron - dot structure with the help of one example.  • Students will be asked to draw electron dot structures of various compounds. **Day 2** Students will recall the concepts taught on day 1. They will be asked about the various forms in which they find carbon around them.Taking their answers, they will be introduced to the concept of allotropes. A video will be shown for the same. https://www.youtube.com/watch?v=j0suPpZAjwM Based on the video, they'll draw a tree diagram highlighting various allotropes of carbon.	Data acquisition Data Exploration https://datavizcatalogue.com/ Autodraw https://experiments.withgoogle.com/autodraw Data Exploration https://datavizcatalogue.com/methods/tree_diagram.html
Learning Outcomes	By the end of the class, students will be able to: • Enlist properties of carbon compounds. • Explain why carbon forms covalent bond. • iii) Diagrammatically depict the properties of various allotropes of carbon.	
Follow up Activities	Students will be assessed on the basis of their learning with the help of AI based app KAHOOT.	
Reflections	Students will learn the basics of AI with the help of apps. They will be asked to find out about the apps that can be used as an alternative to today's apps.	

GLOSSARY:

AI Related Terminologies

Autodraw.com: Autodraw.com is an AI enabled tool which is based on the domain of Computer Vision in which the machine identifies the pattern of your drawing and accordingly maps it with the most similar image. This tool shows various options trying to predict what the user is trying to draw. For example, if a user is trying to draw a tent and he starts with drawing a basic triangle, the machine would compare his drawing and would show the possible outcomes for the same. The user can then select out of them which one is the most appropriate form for him/her.

Data Acquisition: Data acquisition refers to acquiring authentic data crucial for the AI model from reliable sources. The data acquired could then be divided into two categories: Training Data and Testing Data. The AI model gets trained on the basis of training data and is evaluated on the basis of testing data. There can be various ways in which you can collect data.

Some of them are:

• Surveys • Web Scraping • Sensors • Cameras • Observations • Application Program Interface

Data Exploration: After acquiring data there comes the need to analyze the data. For this, they need to visualize the acquired data in some user-friendly format so that they can: ● Quickly get a sense of the trends, relationships and patterns contained within the data. ● Define strategy for which model to use at a later stage. ● Communicate the same to others effectively. To visualize data, various types of visual representations can be used by the students like diagrams, charts, graphs, flows, etc.

SCIENCE

Class 10

3.55 Sources of Energy

PARAMETERS	DESCRIPTION	AI CONCEPTS INTEGRATED
Chapter Covered	**Chapter 14: Sources of Energy**	
Name of the Book	**Science, Class 10, NCERT**	
Subject and Artificial Intelligence Integrated	Learning Sources of Energy integrated with Google Earth.	Google Earth https://earth.google.com/web/
Learning Objectives	Students will be made to understand: • Conventional sources of energy • Non-conventional sources of energy. • Difference between renewable and non-renewable sources of energy. • Sun is the ultimate source of energy.	
Time Required	3-4 periods of 40 minutes each	
Classroom Arrangement	Flexible	
Material Required	Textbook Projector, smart board, laptop/desktop, internet connection Model of solar cooker.	
Pre – Preparation Activities	Students will be divided in four groups and would be asked to take biogas in the classroom, without any danger. ● Fill a glass bottle with moist plant matter from the garden. Seal the bottle. Place the bottle close to a gentle source of heat (the sun, a radiator) and allow it to ferment for a few days. ● Make an observation of the bottle each day ● After a week or so, open the bottle. You will hear a slight hissing sound and a foul smell will be released: the organic matter in the bottle has fermented and pressurized biogas has formed. ● Carry out the experiment again using other types of organic matter, such as leftovers from the school canteen.	
Previous Knowledge	To trigger the previous knowledge of the students they will be asked the following questions: • Why the Sun is known as ultimate source of energy? • What do you mean by fossil fuels? • What do you mean by greenhouse effect?	

Methodology	● Students will be asked to differentiate between renewable and non-renewable sources of energy. ● They will be asked to find the temperature on different surfaces. ● Students will be asked to maintain a record of: - Monthly electrical energy consumption (electricity bill-for units, per unit charges etc.) - 2.Nearby hydroelectric plant. For explaining Tidal Energy: http://www.spacegoo.com/beach/	AI tool: https://scied.ucar.edu/interactive/earths-energy-balance AI tools: https://earth.google.com/web/
Learning Outcomes	● Students will be able to understand about the Sun. ● They will be able to think of different sources of energy. ● Students will learn about conservation of energy. They will learn how they can save energy in their day to day life.	
Follow up Activities	The students will work in groups and find answers to the following: • How can we conserve energy? • What was the impact of global lockdown on our environment?	

GLOSSARY:

AI Related Terminology

Google Earth

Google Earth is a computer program that renders a 3D representation of Earth based primarily on satellite imagery. The program maps the Earth by superimposing satellite images, aerial photography, and GIS data onto a 3D globe, allowing users to see cities and landscapes from various angles.

AI Thermometer

AI Thermometer is an open-source project for automatically measuring the temperature of people using a thermal camera. The software can be freely used for any non-commercial applications and it is useful for the automatic early-screening of fever symptoms. The software first detects people with an off-the-shelf body pose detector and then finds the extract location of the face where the temperature is measured.

SCIENCE

Class 10

3.56 Life Processes

PARAMETERS	DESCRIPTION	AI CONCEPTS INTEGRATED
Chapter Covered	**Chapter 6: Life Processes**	
Name of the Book	**Science, Class 10, NCERT**	
Subject and Artificial Intelligence Integrated	Digestive system and its explanation by the students using "My story Time " and assessment through a quiz on " Quillionz"	Introduction of AI awareness with the help of : My storytime Quillionz (An AI based quiz maker) Drawalong AR
Learning Objectives	• To enable the students understand the structure and function of human digestive organs • To enable the students understand the process of digestion and the role of enzymes and juices in this process • To enable the students identify the various parts of the digestive system as per their location and function in the body	
Time Required	4-5 periods of 35 minutes each	
Classroom Arrangement	a)Regular classroom setup for content explanation b)Computers for story making and answering quiz	
Material Required	• Necessary classroom materials • Desktops with stable internet connection • Powerpoint presentation to explain the content	
Pre – Preparation Activities	• Setting up of the visual learning material to display the slides • Computer setup to use story speaker and quillionz	
Previous Knowledge	The students have knowledge of the following- • Why do we eat food? • How food is processed in the body? • Which organs are involved in the digestion of food?	
Methodology	• At first the teacher introduces the lesson by asking a set of questions • The teacher then discusses the role of food in our body and why it is needed? • The teacher explains the structure and function of the various parts of the digestive system • The teacher then shows an animated video of the process of digestion for better understanding of the topic	https://mystorytime.com/

	AI activity • The teacher divides the students in group of 3-4 students each depending upon the strength of the class and introduces them to an AI based tool named My story time .For example : An adventurous journey of Mr. pizza or chewy Mrs. jelly bean OR the adventurous journey of a monster 'stomach' with his enemy pizza • The teacher then instructs them to build their own story on the basis of what they have learnt and present it before class discussing the functions of various parts of the digestive system	
Learning Outcomes	• The students will be able to understand the structure and function of human digestive organs • The students will be able to explain the process of digestion and the role of enzymes and juices in this process • The students will be able to identify the various parts of the digestive system as per their location and function in the body	
Follow up Activities	• The students are assessed on the basis of the quiz generated on quillionz by themselves (peer learning) • They are also asked to practice the different parts of the digestive system using the google 's Draw along AR https://experiments.withgoogle.com/drawalong-ar	https://www.quillionz.com/
Reflections	Discussions on the tools used and how it made science learning fun	

GLOSSARY:

AI Related Terminologies

1. **My storytime:** AI Story Time helps develop LOVE for the language through stories. - Treasure and listen to your child's reading voice! We created a story universe where kids can watch and read the animated stories that excite them. AND, they can do short quizzes to re-enforce what they just read.
   Link :https://mystorytime.com/

2. **Quillionz:** Quillionz is the world's first AI based question generator and is perfect if you are looking for questions that ask your learners to identify and recall specific entities, key words, and phrases, define key terms, and describe key ideas encountered in the content. Quillionz also creates questions that evaluate your learners' ability to explain causal relationships based on explicitly stated reasoning and cite examples of general ideas expressed in the content.
   Link :https://www.quillionz.com/

3. **DrawalongAR:** Drawalong AR is an experiment,that shows developers how they can use AR to transform educational YouTube art tutorials into virtual tracing paper. For the millions of people who head to YouTube to learn drawing skills, it's frustrating to glance between the screen and paper to match their drawing up to what's happening on screen -- a process that loses a lot in translation. To provide inspiration to developers, the video and blog tutorial explores how ARCore can overlay YouTube videos on a sketchpad.

SCIENCE

Class 10

3.57 Electricity

PARAMETERS	DESCRIPTION	AI CONCEPTS INTEGRATED
Chapter Covered	**Chapter 12: Electricity**	
Name of the Book	**Science, Class 10, NCERT**	
Subject and Artificial Intelligence Integrated	● Introduction of potential and potential difference,SI unit of potential, voltmeter,and the way it is connected in a circuit. ● Current and its formula, Units of current, Ammeter and the way it is connected in a circuit. ● Electric circuit and symbols ● Ohm's law ● Resistance	https://play.aidungeon.io/ Data visualization: **https://datavizcatalogue.com/**
Learning Objectives	Students will be able to: ● Understand the terminology related to potential, current and resistor ● State Ohm's law(a relation between current and electric potential) ● Learn S.I units of physical quantities ● Solve numerical problems related to the topic ● Draw circuit of Ohm's law	
Time Required	5 periods of 40 min. each	
Classroom Arrangement	Normal class arrangement	
Material Required	● Smart board with net connection ● Electric devices like Ammeter, Voltmeter, Electric cell, battery, wires, plugkey, Ohm's law set up box etc. ● Text book NCERT Class 10	
Pre – Preparation Activities	● All the electrical devices should be there for giving demonstration to the students. ● The working of Ohm's law set up box should be visualized by the students.	
Previous Knowledge	Electric charge, Static electricity, electric circuit-open or closed,	
Methodology	● Fussing with definitions ● Lecture cum demonstration method ● Hands-on activities using data acquisition and data visualization. ● Students will be asked to practice the symbols of the electric components and electric circuits using Autodraw.com	data visualization https://datavizcatalogue.com/

Learning Outcomes	Students will be able to ● Define electric charge, electric current, electric circuit, one ampere etc. ● Recall S.I units of physical quantities used ● Learn formulae used ● Draw different electric symbols and electric circuits ● Solve numerical problems based on these concepts	
Follow up Activities	A brief discussion will be held on the same topic for recapitulation and quiz will be conducted on smart board in google form. https://www.youtube.com/watch?v=VnnpLaKsqGU https://www.youtube.com/watch?v=iLzfe_HxrWI	
Reflections	The students will be asked to verify Ohm's law for different values of V and I.	

GLOSSARY:

AI Related Terminologies

Data Exploration refers to visualising the data to determine the pattern, relationships between elements and trends in the dataset that gives a clear meaning and understanding of the dataset. Data exploration is important as it helps the user to select an AI model in the next stage of the AI project cycle. To visualise the data, various types of visual representations can be used such as diagrams, charts, graphs, flows and so on. The representation of concept mapping can be specified for the particular chapter.

https://datavizcatalogue.com/

AI Dungeon is a free-to-play single-player and multiplayer text adventure game which uses artificial intelligence to generate unlimited content. It also allows players to create and share their own custom story. In this topic, we can make a story of Electric circuits and its components with the help of students so that the concept of electricity and its terminology can be made clear to the students.

https://play.aidungeon.io/

CHAPTER 4

Appendix 1

AI Curriculum

ARTIFICIAL INTELLIGENCE CURRICULUM
(Class 8 & 9)

OBJECTIVE

The objective of this unit is to develop a readiness for understanding and appreciating Artificial Intelligence and its application in our lives. This unit focuses on:

1. Helping learners understand the world of Artificial Intelligence and its applications through games, activities, and multisensorial learning to become AI-Ready.
2. Introducing the learners to three domains of AI in an age appropriate manner.
3. Allowing the learners to construct meaning of AI through interactive participation and engaging hands-on activities.
4. Introducing the learners to AI Project Cycle.
5. Introducing the learners to programming skills - Basic python coding language.

LEARNING OUTCOMES

Learners will be able to:

- Identify and appreciate Artificial Intelligence and describe its applications in daily life.
- Relate, apply and reflect on the Human-Machine Interactions to identify and interact with the three domains of AI: Data, Computer Vision and Natural Language Processing and Undergo assessment for analyzing their progress towards acquired AI-Readiness skills.
- Imagine, examine and reflect on the skills required for futuristic job opportunities.
- Unleash their imagination towards smart homes and build an interactive story around it.
- Understand the impact of Artificial Intelligence on Sustainable Development Goals to develop responsible citizenship.
- Gain awareness about AI bias and AI access and describe the potential ethical considerations of AI.
- Develop effective communication and collaborative work skills.
- Get familiar and motivated towards Artificial Intelligence and Identify the AI Project framework. Learn problem scoping and ways to set goals for an AI project and understand the iterative nature of problem scoping in the AI project cycle.
- Brainstorm on the ethical issues involved around the selected problem
- Foresee the kind of data required and the kind of analysis to be done, identify data requirements and find reliable sources to obtain relevant data.
- Use various types of graphs to visualize acquired data.
- Understand, create, and implement the concept of Decision Trees.
- Understand and visualize computer’s ability to identify alphabets and handwritings.
- Understand and appreciate the concept of Neural Network through gamification and learn basic programing skills
- Acquire introductory Python programming skills in a very user-friendly format.

UNIT WISE DISTRIBUTION

No.	UNIT	SUB-UNIT	DURATION	MARKS	
				Theory	Practical
1	Introduction to AI	Excite	2.4 Hours (4 Periods)	10	10
		Relate	02 Hours (3 Periods)		
		Purpose	02 Hours (3 Periods)		
		Possibilities	02 Hours (3 Periods)		
		AI Ethics	3.6 Hours (6 Periods)		
2	AI Project Cycle	Problem Scoping	14 Hours (21 Periods)	10	10
		Data Acquisition	02 Hours (3 Periods)		
		Data Exploration	04 Hours (6 Periods)		
		Modelling	06 Hours (9 Periods)		
3	Neural Network		04 Hours (6 Periods)	10	10
4	Introduction to Python		70 Hours (105 Periods)	20	10
5	Co-curricular Skills				10
TOTAL			**112 Hours (168 Periods)**	**50**	**50**

Total: **100** Marks

COURSE OUTLINE

UNIT	SUB-UNIT	SESSION/ACTIVITY/PRACTICAL	LEARNING OUTCOMES
Introduction to AI	Excite	**Session**: Introduction to AI and setting up the context of the curriculum	To identify and appreciate Artificial Intelligence and describe its applications in daily life.
		Ice Breaker Activity: Dream Smart Home idea Learners to design a rough layout of floor plan of their dream smart home.	
		Recommended Activity: The AI Game Learners to participate in three games based on different AI domains. ● **Game 1: Rock, Paper and Scissors** (based on data) ● **Game 2: Mystery Animal** (based on Natural Language Processing - NLP)	To relate, apply and reflect on the Human-Machine Interactions. To identify and interact with the three domains of AI: Data, Computer

		● **Game 3: Emoji Scavenger Hunt** (based on Computer Vision - CV)	Vision and Natural Language Processing.
		Recommended Activity: AI Quiz (Paper Pen/Online Quiz)	To undergo an assessment for analyzing progress towards acquired AI-Readiness skills.
		Recommended Activity: To write a letter Writing a Letter to one's future self ● Learners to write a letter to self keeping the future in context. They will describe what they have learnt so far or what they would like to learn someday	To imagine, examine and reflect on the skills required for futuristic job opportunities.
	Relate	**Video Session: To watch a video** **I**ntroducing the concept of Smart Cities, Smart Schools and Smart Homes	Learners to relate to application of Artificial Intelligence in their daily lives.
		Recommended Activity: W**rite an Interactive Story** Learners to draw a floor plan of a Home/School/City and write an interactive story around it using **Story Speaker** extension in Google docs.	To unleash their imagination towards smart homes and build an interactive story around it. To relate, apply and reflect on the Human-Machine Interactions.
	Purpose	**Session:** Introduction to **sustainable development goals**	To understand the impact of Artificial Intelligence on Sustainable Development Goals to develop responsible citizenship.
		Recommended Activity: Go Goals Board Game ● Learners to answer questions on Sustainable Development Goals	
	Possibilities	**Session: Theme-based research and Case Studies** ● Learners will listen to various case-studies of inspiring start-ups, companies or communities, where AI has been involved in real-life. ● Learners will be allotted a theme around which they need to search for present AI trends and have to visualize the future of AI in and around their respective theme.	To research and develop awareness of skills required for jobs of the future. To imagine, examine and reflect on the skills required for the futuristic opportunities.
		Recommended Activity: Job Ad Creating activity ● Learners to create a job advertisement for a firm describing the nature of job available and the skillset required for it 10 years down the line. They need to figure out how AI is going to transform the nature of jobs and create the Ad accordingly.	To develop effective communication and collaborative work skills.

	AI Ethics	**Video Session: Discussing about AI Ethics**	
		Recommended Activity: Ethics Awareness ● Students play the role of major stakeholders and they have to decide what is ethical and what is not for a given scenario.	To understand and reflect on the ethical issues around AI.
		Session: AI Bias and AI Access ● Discussing about the possible bias in data collection ● Discussing about the implications of AI technology	To gain awareness around AI bias and AI access.
		Recommended Activity: Balloon Debate ● Students divide in teams of 3 and 2 teams are given same theme. One team goes in affirmation to AI for their section while the other one goes against it. ● They have to come up with their points as to why AI is beneficial/harmful for the society.	To let the students analyze the advantages and disadvantages of Artificial Intelligence.

AI Project Cycle	Problem Scoping	**Session: Introduction to AI Project Cycle** ● Problem Scoping ● Data Acquisition ● Data Exploration ● Modelling ● Evaluation	Identify the AI Project Cycle framework.
		Activity: Brainstorm around the theme provided and set a goal for the AI project. ● Discuss various topics within the given theme and select one. ● List down/ Draw a mind map of problems related to the selected topic and choose one problem to be the goal for the project.	Learn problem scoping and ways to set goals for an AI project.
		Activity: To set actions around the goal. ● List down the stakeholders involved in the problem. ● Search on the current actions taken to solve this problem. ● Think around the ethics involved in the goal of your project.	Identify stakeholders involved in the problem scoped. Brainstorm on the ethical issues involved around the problem selected.
		Activity: Data and Analysis ● What are the data features needed? ● Where can you get the data? ● How frequent do you have to collect the data? ● What happens if you don't have enough data? ● What kind of analysis needs to be done? ● How will it be validated? ● How does the analysis inform the action?	Understand the iterative nature of problem scoping for in the AI project cycle. Foresee the kind of data required and the

			kind of analysis to be done.
		Presentation: Presenting the goal, actions and data.	Share what have the students discussed so far.
	Data Acquisition	**Activity: Introduction to data and its types.** ● Students work around the scenarios given to them and think of ways to acquire data.	Identify data requirements and find reliable sources to obtain relevant data.
	Data Exploration	**Session: Data Visualization** ● Need of visualizing data ● Ways to visualize data using various types of graphical tools.	To understand the purpose of Data Visualization
		Recommended Activity: Let's use Graphical Tools ● To decide what kind of data is required for a given scenario and acquire the same. ● To select an appropriate graphical format to represent the data acquired. ● Presenting the graph sketched.	Use various types of graphs to visualize acquired data.
	Modelling	**Session: Decision Tree** ● To introduce basic structure of Decision Trees to students.	Understand, create and implement the concept of Decision Trees.
		Recommended Activity: Decision Tree ● To design a Decision Tree based on the data given.	
		Recommended Activity: Pixel It ● To create an "AI Model" to classify handwritten letters. ● Students develop a model to classify handwritten letters by diving the alphabets into pixels. ● Pixels are then joined together to analyze a pattern amongst same alphabets and to differentiate the different ones.	Understand and visualize computer's ability to identify alphabets and handwritings.
Neural Network		**Session: Introduction to neural network** ● Relation between the neural network and nervous system in human body ● Describing the function of neural network.	Understand and appreciate the concept of Neural Network through gamification.
		Recommended Activity: Creating a Human Neural Network ● Students split in four teams each representing input layer (X students), hidden layer 1 (Y students), hidden layer 2 (Z students) and output layer (1 student) respectively. ● Input layer gets data which is passed on to hidden layers after some processing. The output layer	

		finally gets all information and gives meaningful information as output.	
Introduction to Python		**Recommended Activity: Introduction to programming** using Online Gaming portals like Code Combat.	Learn basic programming skills through gamified platforms.
		Session: Introduction to Python language ● Introducing python programming and its applications	Acquire introductory Python programming skills in a very user-friendly format.
		Practical: Python Basics ● Students go through lessons on Python Basics (Variables, Arithmetic Operators, Expressions, Data Types - integer, float, strings, using print () and input () functions) ● Students will try some simple problem-solving exercises on Python Compiler.	
		Practical: Python Lists ● Students go through lessons on Python Lists (Simple operations using list) ● Students will try some basic problem-solving exercises using lists on Python Compiler.	

ASSESSMENT

After completion of each unit, the students can be evaluated on the basis of the following skills:

Conceptual Skills	Technical Skills	Life Skills
Conceptual understanding of AI AI applications and three domains of AI Knowledge Enhancement in 3 AI Domains: Data, Computer Vision & Natural Language Processing Mind mapping Problem Identification Data Acquisition Data Exploration Graphical Representation Neural Network	Ability to use AI Powered Tools Troubleshooting Skill Basic programming skills Basic Python	Thinking Skills Problem Solving Creative thinking Critical Thinking Decision Making Skills Social Skills - Teamwork Team Building Skills Leadership Self-Awareness Empathy Effective Communication Skills Oral & Written Presentation

Appendix 2

Artificial Intelligence Curriculum

(Class 10)

UNIT	SUB-UNIT	SESSION/ ACTIVITY/ PRACTICAL
INTRODUCTION TO AI	Foundational concepts of AI	**Session**: What is Intelligence?
		Session: Decision Making. ● How do you make decisions? ● Make your choices!
		Session: what is Artificial Intelligence and what is not?
	Basics of AI: Let's Get Started	**Session**: Introduction to AI and related terminologies. ● Introducing AI, ML & DL. ● Introduction to AI Domains (Data, CV & NLP)
		Session: Applications of AI – A look at Real-life AI implementations
		Session: AI Ethics
AI PROJECT CYCLE	Introduction	**Session:** Introduction to AI Project Cycle
	Problem Scoping	**Session:** Understanding Problem Scoping & Sustainable Development Goals
	Data Acquisition	**Session:** Simplifying Data Acquisition
	Data Exploration	**Session:** Visualizing Data
	Modelling	**Session:** Introduction to modelling ● Introduction to Rule Based & Learning Based AI Approaches ● Introduction to Supervised Unsupervised & Reinforcement Learning Models ● Neural Networks
	Evaluation	**Session:** Evaluating the idea!
ADVANCE PYTHON	Recap	**Session:** Jupyter Notebook
		Session: Introduction to Python
		Session: Python Basics
DATA SCIENCES	Introduction	**Session:** Introduction to Data Science
		Session: Applications of Data Science
		Session: Revisiting AI Project Cycle
	Concepts of Data Sciences	**Session**: Python for Data Sciences
		Session: Statistical Learning & Data Visualization
		Activity: Personality Prediction

UNIT	SUB-UNIT	SESSION/ ACTIVITY/ PRACTICAL
	K-nearest neighbour model	**Session:** Understanding K-nearest neighbour model
COMPUTER VISION	Introduction	**Session:** Introduction to Computer Vision
		Session: Applications of CV
	Concepts of Computer Vision	**Session & Activity:** Understanding CV Concepts ● Pixels ● How do computers see images? ● Image Features
	OpenCV	**Session:** Introduction to OpenCV
		Hands-on: Image Processing
	Convolution Operator	**Session:** Understanding Convolution operator
		Activity: Convolution Operator
	Convolution Neural Network	**Session:** Introduction to CNN
		Session: Understanding CNN ● Kernel ● Layers of CNN
		Activity: Testing CNN
NATURAL LANGUAGE PROCESSING	Introduction	**Session:** Introduction to Natural Language Processing
		Session: NLP Applications
		Session: Revisiting AI Project Cycle
	Chatbots	**Activity:** Introduction to Chatbots
	Language Differences	**Session:** Human Language VS Computer Language
	Concepts of Natural Language Processing	**Hands-on:** Text processing ● Data Processing ● Bag of Words ● TFIDF ● NLTK
EVALUATION	Introduction	**Session:** Introduction to Model Evaluation
	Confusion Matrix	**Session & Activity:** Confusion Matrix
	Evaluation Score Calculation	**Session:** Understanding Accuracy, Precision, Recall & F1 Score
		Activity: Practice Evaluation

Appendix 3

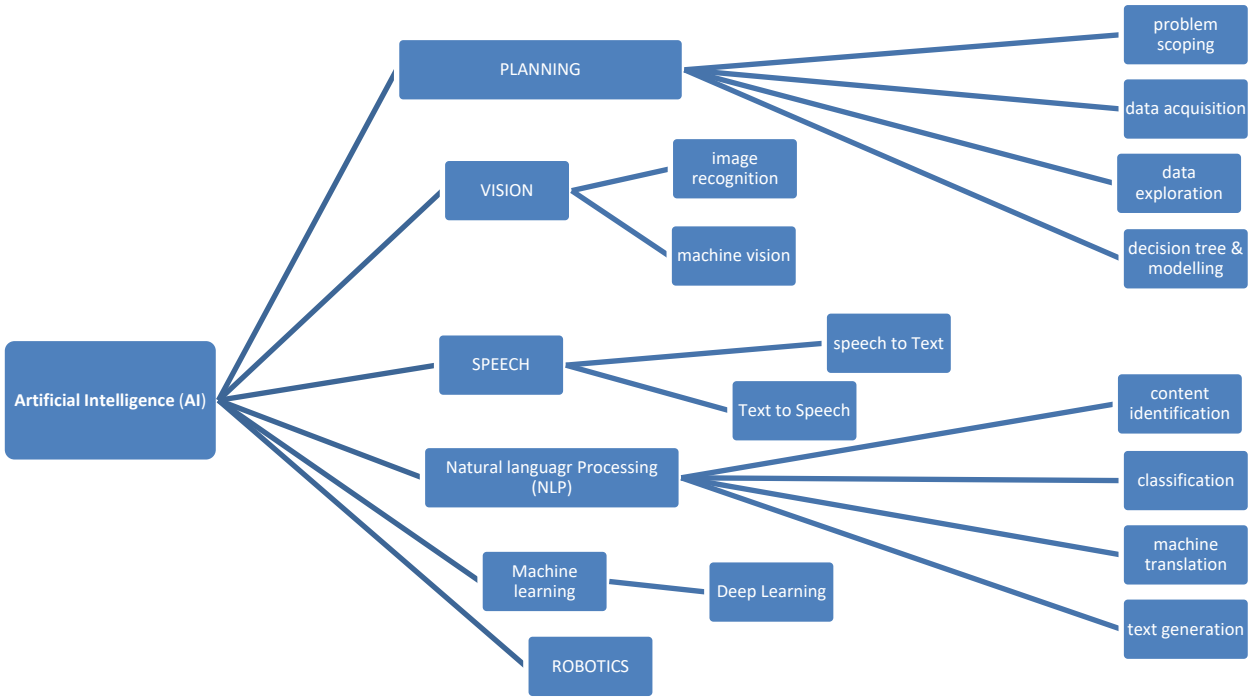
AI Learning Indicators

Areas	Class 8	Class 9/10
Knowledge Understanding AI	What is AI? Why? Pedagogy- Brainstorming/Concept maps, Venn Diagrams	Why AI /Why not AI? What other possibilities? Pedagogy- Discussion/Debate Questioning, NLR- Comparison Matrix
Skills Prerequisite skills Skills to be acquired/developed	Inquiry / Questioning Skills Generating Ideas – Critical & Computer skills	Inquiry / Questioning Skills Communicating Creative thinking Critical Thinking
Technical Competencies for Artificial Intelligence (AI) Data Computer Vision (CV) Natural Language Processing (NLP)	Through Creative games /Skills based problem solving challenges /Designing Introduction to all three domains Data CV NLP Using all three domains in different challenging games to identify AI in different context	Through Creative games /Skills based problem solving challenges /Designing Building conceptual understanding and skill development in one domain of AI - Data CV NLP- Gaining competency in NLP. Learning basics of Python
Attitude	Initiative Positive Thinking	Initiative Success Vs failure Positive Thinking
Life Skills to be developed	Thinking Skills Social Skills	Thinking Skills /Social Skills Emotional Skills
Program course to be covered	In one academic session	In one academic session
Mentoring & feedback Suggestive Activities	Face to face Online Online Newsletter for all levels on the work in AI all across participating schools	Face to face Online Online Newsletter for all levels on the work in AI all across participating schools

Appendix 4

AI Capabilities

AI has been an academic area of study for many years with lots of dips on the way to its progress; in recent times it is increasingly becoming an enabler for a variety of technologies and appliances that impact our daily lives. Also, with the ever-*increasing computing power, lesser cost of data storage* and *immense data available,* there is a boom of technological innovations, which should make us believe that '**AI Spring'** has arrived. So, AI is marching ahead to be the mainstream of the mainstream disciplines of study that it connects.



Appendix 5

AI Integrated Lesson - Assessment Rubric

Given below are the indicators that can be used if teacher needs to assess students' performance for their AI Integrated lesson plan activity. They may modify it suited to the needs of the lesson and student needs.

Content	**30–19** **Clearly** shows understanding of topic content. Provides **suffi cient** supporting evidence when needed. Understands applications of AI in subject learning.	**18–7** **Somewhat** shows understanding of topic content. Provides **some** supporti ng evidence when needed.	**6–0** **Minimally** shows understanding of course content. Provides **little** supporting evidence though needed.
Application	**5–4** **Clearly** makes connections to other relevant ideas, concepts, texts, and/or real-world examples of AI as appropriate.	**3–2** **Somewhat** makes connections to other relevant ideas, concepts, texts, and/or real-world examples of AI as appropriate.	**1–0** **Minimally** makes connections to other relevant ideas, concepts, texts, and/or real-world examples of AI though needed.
Practice	**5-4** **Clearly** demonstrates preparation & practice of AI based applications	**3-2** **Somewhat** demonstrate s preparation & practice of AI based applications	**1-0** **Minimally** demonstrates preparation & practice of AI based applications
Participation	**5-4** **Fully** participates in AI integrated lesson.	**3-2** **Somewhat** participates in AI integrated lesson.	**1-0** **Minimally** participates in AI integrated lesson.
Commitmen t	**5-4** **Initiates and experiments** with AI tools.	**3-2** **Completes** the AI based research in a timely manner.	**1-0** **Does not complete** the AI research in a timely manner.
Total Points	**/50**		

Appendix 6

AI versus Virtual Reality (VR); AI versus Internet of Things (IOT);

Artificial Intelligence VS Virtual Reality

Artificial intelligence is using an artificial obsolete intelligence to function the same way as we humans want it to work. We program it the way we want to, we specify the limits, we specify the loops; it's like giving a machine an artificial human brain so it can function on those areas where human interception is difficult. AI is directly related to machine learning, it's like the things we teach to them is what we will get in return as feedback.

Virtual Reality, on the other hand is to make virtual environment a form of reality for human needs - may be for an entertainment point of view. VR is a gadget technology which focuses on 3d visualization of graphics and generating a view which tops the graphic user interface. It's like creating an environment which we've always wanted in true reality.

Artificial Intelligence VS Internet of Things

Artificial Intelligence is a field of computer science in which a machine is equipped with the ability to mimic cognitive functions of a human (or any being that is capable of cognitive thinking) that can make decisions based on its past experiences or responding to an action that it was completely unaware of until that time. It is given a goal and it continuously tries to improve its performance from its past actions to the best reach of the goal. An AI machine will be equipped with a learning mechanism and a neural network -something similar to a brain- which enables a cognitive ability, where the machine will learn by understanding and adapting to the environment that it is surrounded with and making rational decisions. You can never know what an AI machine is capable of until it actually does that.

Internet of Things is the internetworking of physical devices like vehicles, buildings, electronic devices, sensors, actuators etc. that are capable of communicating among themselves (sensor1 to sensor2, sensor2 to sensor3 and so on) or with the external environment (sensor to vehicles, vehicles to humans) that are equipped with devices capable of communicating over a network. In IoT, the devices are given a fixed set of commands like:

Switch off the lights when a person leaves the room. (let's say communication between a light and a wearable device on the person based on GPS)

Open the garage door when a car approaches (communication between a sensor 1 on garage door and a sensor 2 on the car)
In IoT, the capabilities of a machine already exist and you use it according to your feasibility.

Appendix 7

Translating AI on Ground

Creating the Mindset

The aim is to familiarize students into understanding the AI Program. The foundation on which AI is built upon is Patterning; Data Interpretation; Sorting; Comparing; Classifying; Identifying. The AI Applications that surround us are proof of innovation; we need to prepare ourselves to unlearn, learn and relearn!

Preparatory Groundwork

Reading and gathering all the information one can get about ‘what is AI and what is not’ - is imperative for a better understanding of the subject. We need to be prepared to connect to new learning on the basis of our previous knowledge. – Read, Research, Inquire, Ask Questions, Watch Videos, Discuss, walk through Malls, Airports, Hospitals and try to figure out where do you find AI in operation.

To be a Good Facilitator

Learning to facilitate is learning to know the difference between when to guide/suggest and when to allow students to figure out and understand for themselves, question, hypothesize and take the challenge.

Being a Facilitator is mostly about how to motivate, encourage and simplify.

Learning to use appropriate vocabulary while giving feedback, is the skill set, most required by a Facilitator. Give feedback in a positive manner to inspire students to explore and persevere in their learning.

Mentoring & Monitoring

Ensure that continuity is maintained in mentorship and monitoring the students’ learning. Online feedback, Interactive discussions on problems and challenges are some of the effective ways to assist this.

Appendix 8

Artificial Intelligence Tools – a ready reference

S, No.	AI Tool	Explanation	Link
1	Autodraw	Autodraw is an AI enabled tool which is based on the domain of Computer Vision in which the machine identifies the pattern of your drawing and accordingly maps it with the most similar image. This tool shows various options trying to predict what the user is trying to draw. For example, if a user is trying to draw a tent and he starts with drawing a basic triangle, the machine will compare his/her drawing and show the possible outcomes for the same. The user can then select out of them which one is the most appropriate for him/her.	https://autodraw.com
2	Quickdraw	Quickdraw is a google experiment, an AI tool based on neural network in which the machine learns to recognize doodles/objects from the user's drawings. By playing this game, you will be adding your drawings to the world's largest doodling data set. After clicking on let's draw! the player will see the name of the object on the screen. While drawing the object within a timer of 20 seconds, the machine analyses the pattern and the shape of the drawing and simultaneously tries to guess the object that the player is trying to draw.	https://quickdraw.withgoogle.com/
3	Rock, Paper & Scissors	In this game, an artificially intelligent system learns to identify patterns of a person's behaviour by analyzing their decision strategies in order to predict future behaviour. This game is based on the AI domain "**Data**" where the machine collects and analyses data to predict future outcomes. Click on play the game to get started!	https://www.afiniti.com/corporate/rock-paper-scissors
4	Cosine Similarity	Words are considered to be n-dimensional entities in the AI domain of "NLP" which can have more information than we can visualize. The statements which are to be processed in an AI algorithm are considered as vectors that have an amplitude and a direction by definition of a vector. In order to compare two statements to identify how similar they are, the cosine angle between the two statements is calculated. According to the cosine similarity model, the statements whose cosine angle is the smallest are closest to each other in terms of the words used in them.	

5	Data Acquisition	Data acquisition refers to acquiring authentic data crucial for the AI model from reliable sources. The data acquired can then be divided into two categories: Training Data and Testing Data. The AI model gets trained on the basis of training data and is evaluated on the basis of testing data. There can be various ways in which students can collect data. Some of them are: • Surveys • Web Scraping – data.gov.in, kaggle.com • Sensors • Cameras • Observations • Application Program Interface	
6	Data Exploration	After acquiring data comes the need to analyze the data. For this, they need to visualize the acquired data in some user-friendly format so that they can: ● Quickly get a sense of the trends, relationships and patterns contained within the data. ● Define strategy for which model to use at a later stage. ● Communicate the same to others effectively. Data Exploration refers to visualizing the data to determine the pattern, relationships between elements and trends in the dataset that gives a clear meaning and understanding of the dataset. Data exploration is important as it helps the user to select an AI model in the next stage of the AI project cycle. To visualize the data, various types of visual representations can be used such as diagrams, charts, graphs, flows and so on.	https://datavizcatalogue.com
7	Inkle Writer	Inkle writer is a free tool designed to allow anyone to write and publish interactive stories. It's perfect for writers who want to try out interactivity, but also for teachers and students looking to mix computer skills and creative writing.	www.inklewriter.com
8	Kuki Chatbot	Mitsuku, or Kuki the world's best conversational chat bot (according to folks like Google AI Research). It can be used to chat on any topic and see the visualized form of the subject.	https://www.pandorabots.com/mitsuku/
9	GoArt AI Photo Effects	It uses an algorithm inspired by the human brain. It uses the stylistic elements of one image to draw the content of another.	https://goart.fotor.com/

10	Mystery Animal	An AI experiment developed by Google based on the AI domain **"NLP"** In this game, the computer pretends to bean animal and the player needs to guess the animal by asking 20 yes/no questions. The player asks questions to the machine via microphone to which the machine will respond either in Yes or No and according to the answers, the player needs to modify his/her questions to guess the animal. Upon opening the website, click on preview it now! to start.	https://mysteryanimal.withgoogle.com/
11	Semantris	A Google experiment, Semantris is a word association game powered by machine learning. Each time you enter a word that is associated with the target word, the AI looks at all the words in play and chooses the ones it thinks are most related.	https://research.google.com/semantris/
12	Ethics in AI	Artificial intelligence is a field that is boundless in today's time. There are a lot of scenarios that tell us that ethical issues exist around AI. Hence, it is important to have an understanding of ethics in AI and to have ethical guidelines which can guide us in such conditions where there is no clear definition of what is right or wrong.	https://www.moralmachine.net/
13	AI Project Cycle	AI Project cycle is a framework which is used to design an AI project. The project cycle consists of 5 stages namely: Problem scoping, Data acquisition, Data Exploration, Modelling and Evaluation.	
14	Problem Scoping	Problem scoping refers to understanding a problem and finding out various factors that affect the problem. In this stage of the AI project cycle, 4W problem canvas method is used that helps the user answer questions related to the problem thereby arriving at a definite problem statement. The 4Ws are Who, What , When/Where and Why. The answers to these questions lead to a problem statement.	
15	AI Modelling	Data is the fuel of artificial intelligence. A machine is said to be artificially intelligent if it gets trained and can make decisions/ predictions on its own and learns from its own experience and mistakes. In the modelling stage, data is split to training set and testing set. The model is trained on the training set from which it makes its own rules that helps the machine to give an output and the model is then evaluated on the testing set.	https://teachablemachine.withgoogle.com/

16	Classification	Classification is a part of supervised learning model. Classification models work on labelled dataset and are used to predict the label/class of the testing dataset which is unknown to the machine. For example, an AI model is trained on a labelled dataset of 100 images of apples and 100 images of bananas. The machine gets trained on the dataset by extracting features from the dataset and understands what features will classify an image as an apple or a banana. To test the machine, random images of an apple/banana are fed to the AI model and the output will be classification of apples and bananas.	https://teachablemachine.withgoogle.com/
17	Possibilities in AI	To understand the possibilities that AI has to offer to us, an activity to research about various companies or organizations who are working towards incorporating AI into their respective fields.	Research Template
18	Google Map	Google Maps is a web mapping service developed by Google. It offers satellite imagery, aerial photography, street maps, 360° interactive panoramic views of streets (Street View), real-time traffic conditions, and route planning for traveling by foot, car, bicycle and air (in beta), or public transportation.	
19	My Story Time:	My Story time is a new Google Experiment web application which allows users to record stories to play back on Google assistant devices. Record stories from anywhere and play them back at home with Google assistant	https://experiments.withgoogle.com/my-storytime
20	Google Lens	Google Lens is an image recognition technology developed by Google, designed to bring up relevant information related to objects it identifies using visual analysis based on a neural network.	https://lens.google.com/
21	Emoji Scavenger Hunt	Emoji Scavenger Hunt is a browser-based game built with machine learning that uses your phone's camera and a neural network to try and guess what it's seeing. ... js, the game is built to run efficiently on your phone's web browser without needing to access backend servers.	https://emojiscavengerhunt.withgoogle.com/

22	Akinator	Akinator is a computer game and mobile app. During gameplay, it attempts to determine what fictional or real-life "character" the player is thinking of by asking a series of questions. It uses an artificial intelligence program that learns the best questions to ask through its experience with players. To begin the questionnaire, the user must press the play button and think of a popular character, object or other things that frequently come to mind (musician, athlete, political personality, video game, mother or father, actor, fictional film/TV character, Internet personality, etc.). Akinator, a cartoon genie, begins asking a series of questions (as many as required), with "Yes", "No", "Probably", "Probably not" and "Don't know" as possible answers, to hack down the potential character. If the answer is narrowed down to a single likely option before 25 questions are asked, the program will automatically ask whether the character it chose is correct. If the character is guessed wrong three times in a row (or more, usually in intervals of 25, 50, and 80), then the program will prompt the user to input the character's name, to expand its database of choices	https://en.akinator.com/
23	Google Earth	**Google Earth**, formerly Keyhole Earth, is a computer program that renders a 3D representation of Earth based primarily on satellite imagery. The program maps the Earth by superimposing satellite images, aerial photography, and GIS data onto a 3D globe, allowing users to see cities and landscapes from various angles. Users can explore the globe by entering addresses and coordinates, or by using a keyboard or mouse	https://www.google.com/earth/
24	Photo Creator	Photo Creator is AI enabled tool that lets creators make custom photos for their specific stories instead of searching for the ready-made images that suit their goals more or less.	https://photos.icons8.com/creator
25	Neural Network	Neural networks are loosely modelled after how the human nervous system works. A neural network is essentially a system of organising machine learning algorithms to solve problems for which the dataset is very large. Simply put, a neural network is divided into multiple layers and each layer is further divided into several blocks called nodes. The first layer is the input layer where no processing occur. The whole processing operation occur at the hidden layers. Each node of the hidden layer is a machine learning algorithm. the output from each node is then passed to the subsequent nodes	Human Neural Network activity

		in the hidden layer. Lastly, an output layer that gives a result based on the analysis conducted from the hidden layer.	
26	Loopy	Loopy is an opensource tool to understand the concept of system maps. A system map shows the components and boundaries of a system and the components of the environment at a specific point in time. With the help of system maps, one can easily define a relationship amongst different elements which come under a system. The map shows the cause & effect relationships of elements with each other with the help of arrows. The arrow-had depicts the direction of the effect and a sign (+ or -) shows their relationship. A + sign indicated positive relationship and a - sign indicates negative relationship between the elements. Considering the data features of any problem to be solved, a system map can be drawn.	http://ncase.me/loopy/
27	Evaluation	Evaluation is a stage in the AI project cycle where the performance of the model is evaluated based on certain metrics such as accuracy, precision and so on. This gives a clear idea to the user to compare the expectations with the actual results.	
28	Decision Tree	Decision Tree is a rule based AI model to solve classification or regression problems which helps the machine in predicting the element with the help of various rules fed to it. A decision tree looks like an inverted tree where root is at the top and the tree further divides into branches, nodes and leaves. Root is the starting point of a decision tree. Depending on the rules, the tree splits further into various branches that lead to an end point known as a leaf. Each leaf of the tree is labelled with a class.	
29	Infinite Drum Machine	Infinite Drum Machine is an AI experiment developed by Google to understand how unsupervised learning works. In this experiment, thousands of known sounds are fed to the machine. The sounds are not labelled and the machine does not have any information on the sounds in the dataset. The AI system analyses the data fed to it and clusters similar sounds together. These clusters are visible on the screen as different colours. The dots appearing on the screen are the sound clips and they have been clustered together on the basis of factors such as frequency, amplitude, pitch.	https://experiments.withgoogle.com/ai/drum-machine/view/

30	Quillionz	For assessing and improving the efficiency of question generation (except HOTS), this software can be used to generate questions efficiently.	https://www.quillionz.com/
31	swiggy.com	Swiggy is India's largest and most valuable online food ordering and delivery platform. Once you enter your preferences, you will get delivery of food at your doorstep. This is one of the AI tools as it takes the data from the user according to his liking and deliver the food items.	https://www.swiggy.com/
32	VOKI	Voki is an AI based educational tool for teachers and students, that can be used to enhance instruction, engagement, and lesson comprehension. Voki can be used in class (for student work), as an animated presentation tool, for student assignments, and as a virtual supervised discussion forum (Voki Hangouts).Voki characters can look like historical figures, cartoons, animals, and more	https://www..voki.com/
33	AI Dungeon	The learner should enter the link, start a new game, as a single player, with custom settings. They may not begin conversing with the AI. The facilitator prompts certain keywords that can be used by the learners, to initiate a conversation with the AI. The response from AI is noted by the learner, and discussed with the facilitator	https://play.aidungeon.io/
34	Virtual Mirror	Virtual mirror/Virtual trial room: Globally, the fashion industry is a huge industry so it's no surprise that AI technologies are being used across a wide range of applications from helping design clothes, optimizing manufacturing, and hyper personalized marketing.	https://www.veromoda.in/upto-50-vm?gclid=CjwKCAjwkdL6BRAREiwA-kiczPCPI0wIaRgEZEsk1Wvl4r6jq6vPVCuKEf0Pl1GNOB7ruNTUr0e5KhoCcXEQAvD_BwE
35	AI Thing Translator	This experiment lets you take a picture of something to hear how to say it in a different language. It's just one example of what you can make using Google's machine learning API's, without needing to dive into the details of machine learning.	https://thing-translator.appspot.com/
36	Google Assistant	It is an AI powered virtual assistant which can engage in two-way conversation. Users can interact with this tool through natural voice. It offers voice commands,	

		voice searching letting you complete a number of tasks by saying “OK Google” or “Hey. Google” wake words.	
37	Quizlet	It can be used to display hints about a pet animal and the children have to guess it and then the correct option may be viewed by them to check.	https://quizlet.com/en-gb/features/live
38	Poem Portraits	POEMPORTRAITS is an experimental, collective artwork, woven at the intersection of AI and human creativity - combining poetry, design and machine learning - conceived by artist and designer Es Devlin in collaboration with Google Arts & Culture Lab and creative technologist Ross Goodwin. In this, the user is required to feed in a word to begin the interaction after which the tool gives out two lines which can be used by the users to continue writing a poem.	https://artsexperiments.withgoogle.com/poemportraits
39	Imaginary Soundscape	“Imaginary Soundscape” is a web-based sound installation, focusing on this unconscious behavior, where viewers can freely walk around Google Street View and immerse themselves into imaginary soundscapes generated with deep learning models. The soundscapes generated by the AI sometimes amaze us by meeting our expectation, but occasionally ignore the cultural and geographical context (the sound of waves on an icy field of Greenland for instance). These differences and mistakes lead us to contemplate how the imagination works and how fertile the sound environments surrounding us are. By externalizing our synesthetic thinkings, we tried to shed lights on the power of imagination we all share.	http://www.imaginarysoundscape.net/
40	Scribbling Speech	Language and images are closely intertwined: We think in pictures and we explain facts as spatial constellations. What if the spoken word could be transformed into dynamic visual worlds in real time? Speech input, machine learning and recurrent neural networks for image generation allow computers to generate complex imaginary worlds that follow the narrator and thus create complex animations controlled by linguistic structures.	https://experiments.withgoogle.com/scribbling-speech