ARTIFICIAL INTELLIGENCE
INTEGRATION IN MATHEMATICS

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ARTIFICIAL INTELLIGENCE INTEGRATION IN MATHEMATICS

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ACKNOWLEDGEMENTS

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.
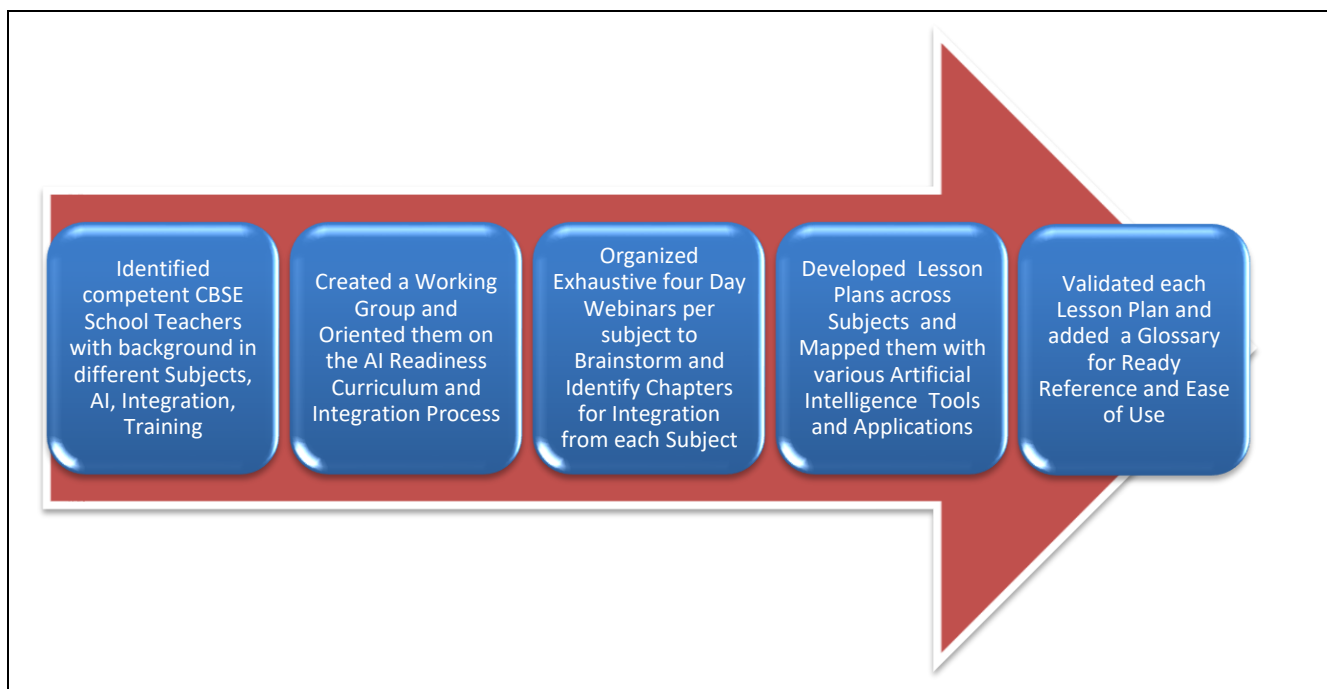
Figure 1: How this Integration Document was created

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**

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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/
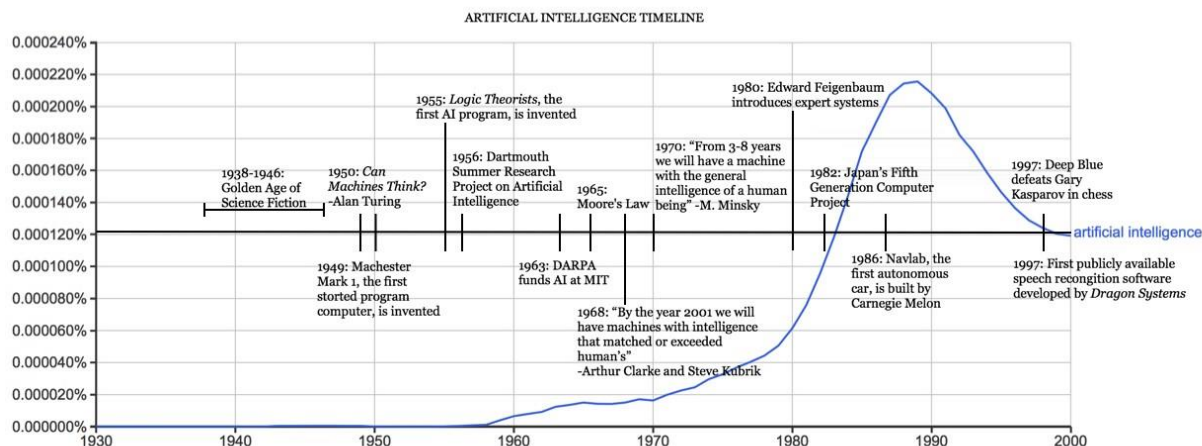
1.2 What do we understand by AI in EDUCATION?

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.
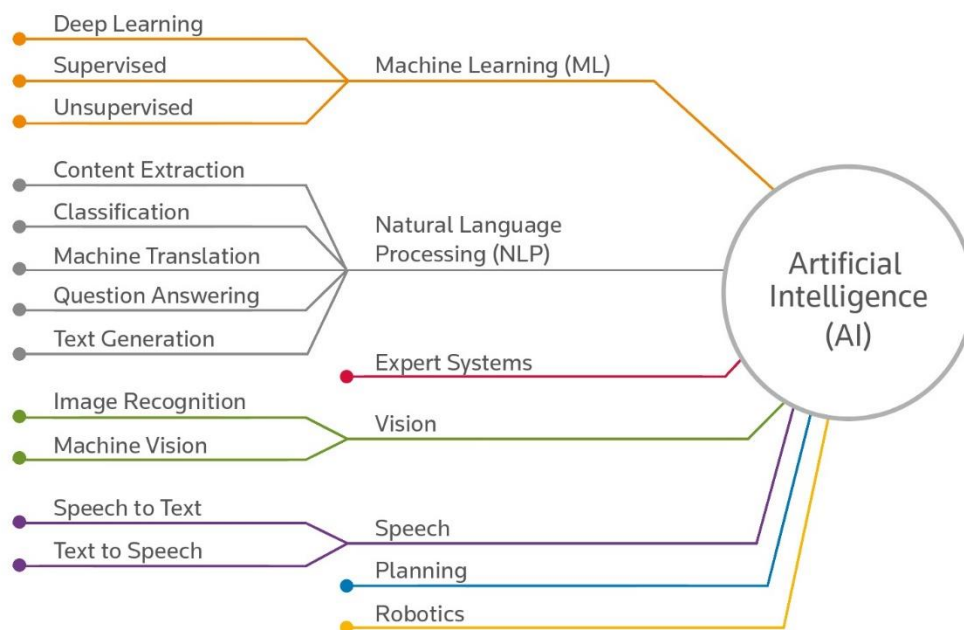
A careful study of the above graph would lead us to believe that many of the technologies and the underlying principles that each of these follows, have a strong correlation with the teaching learning processes at school as well as college levels. Hence it is necessary that AI should not only be introduced 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

AI Integration using Google Story Speaker

AI Integration using Computer Vision

English

Write a newspaper article suggesting strategies to improve the food production in the country.

A discussion - "With the population rise in India more farmland areas is needed, while India is already intensively cultivated "Do you think Aritificial Intelligence is the way to solve this problem?"

Science

Higher yields of food

What do we do to get higher yields in our farms?

Case study - Why can we not make do with the current levels of agriculture production?

Theme Class 9

Science

Chapter 15

Improvement in Food Resources

Geography

Does climate inpact grain production? How can you suggest ways to predict the climate and protect crops? What are the ideas you suggest for improving the natural irrigation system?

Mathematics

Problem Solving - Considering the population of India is more than 1 billion people and we need a quarter of a billion tonnes every year, what data will you collect to present your research report?

AI Integration using Natural Language Processing

AI Integration using Data Exploration

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:
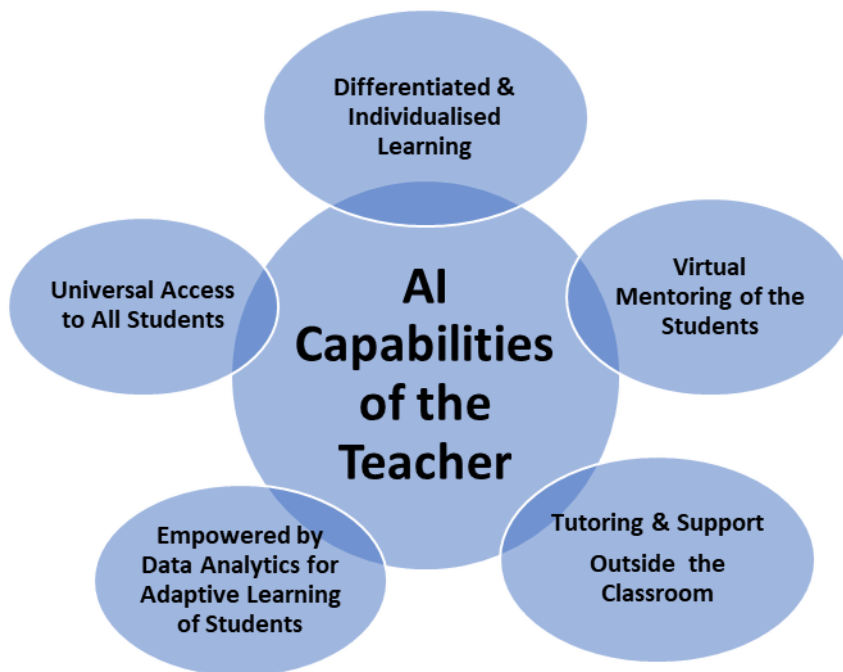
Once AI tools are in operation, the teacher will be facilitated, to have more spare time in the classroom. So, she/he can now focus on unique learning styles of her students. Having assumed the AI capabilities, she/he can also in turn, focus suitably on the challenge of developing the skills of language 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
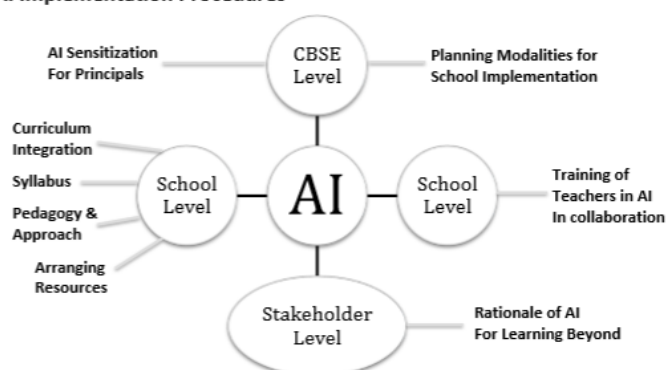
1.10 How would this AI integrated Learning help meet the national goals-NCF/ NCERT/ NA

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.

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*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

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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**
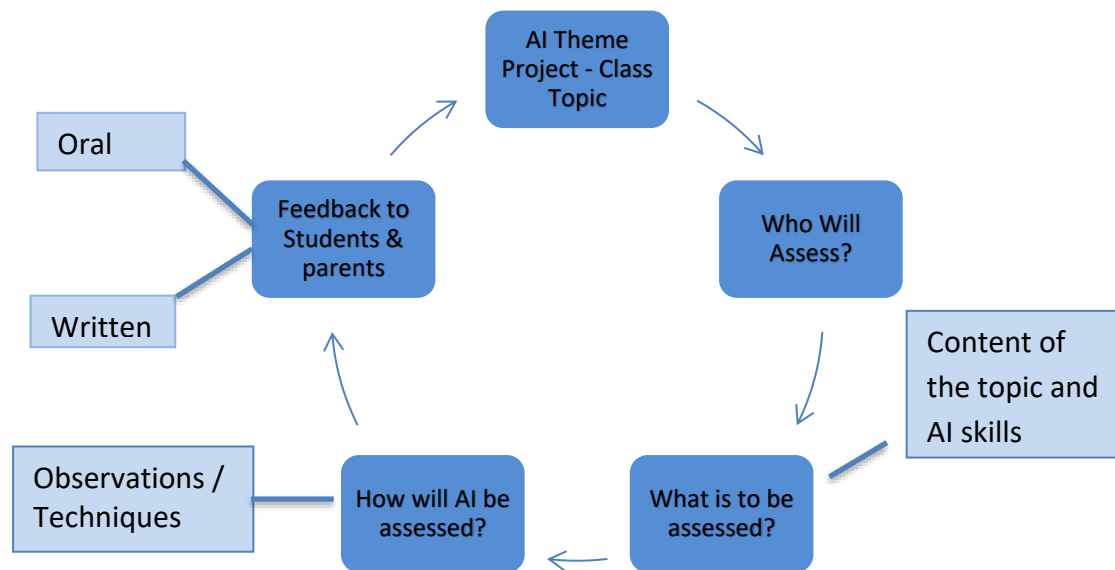
2.5.3 Assessment Rubrics

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

MATHEMATICS
CLASS 6

3.1 Symmetry

PARAMETERS	DESCRIPTION	AI CONCEPTS INTEGRATED
Chapter Covered	**Chapter 13: Symmetry**	
Name of the book	**Mathematics, Class 6, NCERT**	
Subject and Artificial Intelligence Integrated	Understanding the concept of Symmetry using AI Experiential Applications	
Objectives	- To understand concept of Symmetry. - To understand difference between symmetrical and unsymmetrical articles/ Objects using AI game. - To identify the number of lines of symmetry in any object. (one line, two lines and more than two lines)	Autodraw.com
Time Required	2 periods of 40 minutes each	
Classroom Arrangement	Flexible	
Material Required	Pen, paper, Black Board chalk, Laptops/ desktops and Internet connections.	
Pre- Preparation Activity	The Students will be asked to collect some objects and observe their pattern of symmetry.	
Previous Knowledge	The students are asked to collect any four or five objects whose halves can be mirror images and to draw the line of symmetry on the object.	
Introduction	The teacher will introduce the concept of symmetry with the help of objects brought by students.	
Methodology	**Divide the class into two teams.** **Activity I: Draw the line of symmetry.** Ask students to draw one or more lines of symmetry depending upon the nature of the object. The students will be able to identify symmetrical and unsymmetrical articles. **Activity II: Reflection and symmetry** Ask students to look at a set of symmetrical objects in the mirror and observe that though the image shown in the mirror is inverse but the symmetry does not get affected. **Activity III: Practice Activity** ask students to apply their understanding of Symmetry to attempt questions of 13.1 and 13.2 **Activity IV: Autodraw!** 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 would	Computer Vision enabled AI application Autodraw.

	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. Once the original drawing comes into picture form, ask the students to observe the line of symmetry in it and describe it to the whole class.	
Discussion on the Text	Open discussion and presentation on: • Symmetry and its application in real life like Road signs, patterns on Board games like Ludo, Chess etc. More examples of Reflection and Symmetry.	
Learning Outcomes	• The students will understand the concept of Symmetry. • The students will understand the lines of Symmetry. The students will understand relationship between Reflection and Symmetry.	
Self-Evaluation and Follow-Up	Ask students to make a chart with different figures showing symmetrical patterns and lines on symmetry. Ask them to present to small groups. • Let them assess how correct they are in their presentations	

GLOSSARY:
1. 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 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.

2. 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. Once the original drawing comes into picture, ask the students to observe the line of symmetry in it and describe it to the whole class.

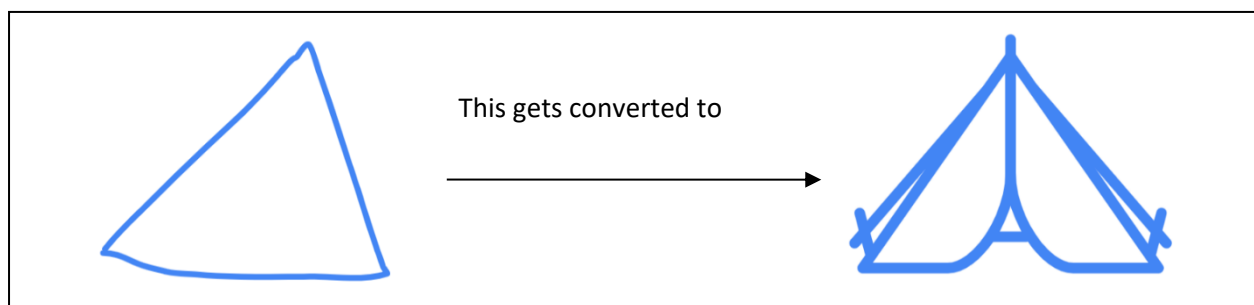# MATHEMATICS
CLASS 6

3.2 Integers

PARAMETERS	DESCRIPTION	AI CONCEPTS INTEGRATED
Chapter Covered	Chapter 6: Integers	
Name of the book	**Mathematics, Class 6, NCERT**	
Subject and Artificial Intelligence Integrated	• Concept of Integers https://ncase.me/loopy/v1/?data=[[[1,312,239,0.5,%22Positive%22,4],[3,646,241,0.5,%22Negative%22,4],[4,800,241,0.5,%22Positive%22,5],[5,466,241,0.5,%22Positive%22,5]],[[4,3,86,1,0],[3,4,82,1,0],[5,1,88,1,0],[1,5,106,1,0]],[[310,160,%22click%2520here%250A%25E2%2586%2593%22],[644,161,%22and%2520here%250A%25E2%2586%2593%22]],5%5D • Integers, Ordering of integers, representing and addition of integers on number lines.	
Learning Objectives	By the end of this lesson, learner should be able to: Define the set of integers, positive numbers, negative numbers, and signs. Compare two integers, using the proper inequality symbol. Order a set of integers from least to greatest. Order a set of integers from greatest to least.	
Time Required	6 Periods, 40 minutes each	
Classroom Arrangement	Flexible	
Material Required	Textbooks, White boards /Smart Board, String, Scrapbook, Scissors, crayons/Sketch pens, Glue, geometry box. Smart Board, Internet, Laptop/Desktop	
Pre – Preparation Activities	Activity to represent integers on a number line in desktop or Laptop. Activity to add or subtract integers on number line by drawing arcs or arrows on number line. Develop an algorithm for addition, subtraction, multiplication and divisions of integers.	
Previous Knowledge	Prior knowledge and experience of handling addition, subtraction, multiplication and division of natural numbers Addition and subtraction of natural numbers from primary school Representing positive numbers on a number line. Addition and subtraction of simple positive numbers with the aid of a number line.	

Methodology	Interactive method- Understandability of students can be assessed quickly when they interact verbally. Learning by doing-addition and subtraction using flash cards or on number line (Ordering of integers using knots on a string) gives the concept of equal spacing between the integers mutually and quick (reflexive) action for operation on integers.	
Learning Outcomes	As a result of studying this topic, students will be able to: Investigate the properties of arithmetic, commutative, associative and distributive properties and the relationships between operations including inverse operations Appreciate the order of operations, including brackets Investigate models such as the number line to illustrate the operations of addition, subtraction, multiplication and division in Integers. Explore some of the laws that govern these operations and use mathematical models to reinforce the algorithms they commonly use.	
Follow up Activities	Preparing Quizzes (Develop confidence in operation of integers.) Situational analysis citing examples from daily life(Example-passbook page of parents showing one month transaction, transaction details of 1-2 hours obtained from a shopping mall/Restaurant etc.) Develop the concept of positive or negative integers in practical use. (Game of Business in daily life.)	
Reflections	Preparing videos on representation on integers and operations of Integers. **https://youtu.be/5oHJcmYbHvA** Display the videos in the class and discuss the positive aspects taken consideration of (Correction to be given personally) **https://youtu.be/o3kli8g3mwl**	

GLOSSARY:

AI Related Terminology

Loopy: Loopy is an open source 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/

MATHEMATICS

CLASS 6

3.3 Mensuration - Perimeter of Polygons

PARAMETERS	DESCRIPTION	AI CONCEPTS INTEGRATED
Chapter Covered	**Chapter 10: Mensuration - Perimeter of Polygons**	
Name of the book	**Mathematics, Class 6, NCERT**	
Subject and Artificial Intelligence Integration	Understanding the concept of perimeter of different polygons like square, rectangle, triangle, etc. Use of AI tools to understand different shapes and figures.	
Objectives	Define polygon, triangle, rectangle, square, equilateral triangle, regular polygon, regular pentagon, regular hexagon. Describe the procedure for finding the perimeter of a polygon. Recognize that perimeter is measured in linear units. Restate the formula for the perimeter of a rectangle. Compute the perimeter for various polygons and regular polygons. Apply perimeter concepts and formulas to complete interactive exercises	
Time Required	3 periods of 40 minutes each	
Classroom Management	Flexible	
Material Required	Pen, Paper, White Board, Markers, Laptop, Internet Connection, Jodo straws, threads	
Pre-preparation Activity	Students will be asked to recall all basic concepts like Point, Line, Line segment and Ray Students will be introduced to AI tools, Auto Draw and Quick Draw.	
Previous knowledge	Questioning will be used to check students' previous knowledge in the form of Quiz. Quick Draw will be used in the class to familiarize students with different shapes. Students will draw different figures and try to identify shapes used in the figure.	Quick Draw https://quickdraw.withgoogle.com/
Introduction	Students will be asked to prepare 2D shapes using JODO straws/paper folding and deduce formula of Perimeter of it.	
Methodology	**Thread Activity**: Students will be divided into groups of 4 or 5 and each group will make polygons using paper folding and cutting. They will then use the thread to cover the boundary of the polygon and hence find its length of the boundary and derive the formula under the guidance of the teacher. **Design Making Activity:** Students will be divided into groups of 4 or 5 and using Auto Draw tool they will have to create a geometrical figure which includes all 2D shapes. It can be an animal, flower, geometrical	Autodraw.com https://autodraw.com

	design, etc. Then, they need to calculate the perimeter for the figure obtained. **Quiz Activity:** Students will be asked to search quiz in which they can see the maximum use of 2D shapes. Students will be motivated to create their own quiz which involves identification shapes and computing its perimeter using quizzes, mentimeter, padlet, etc. **Problem Solving Activity:** Students will be using the formula derived for the perimeter of polygons to find the perimeter of perimeter in the real life problems of NCERT exercises. **Geoboards:** In this follow-up activity, students use rubber bands on geoboards to create shapes with different perimeters that I have written on the board. For example, I'll ask them to make a square with a perimeter of 16, a triangle with a perimeter of 12, etc. To wrap up this activity, I ask students to create four different polygons and record the perimeter of each on their small dry erase boards. As I walk around, it is easy to see who has grasped the idea and who needs more time and practice.	
Discussion on the Text	Open discussion for all new terms related to Perimeter of Polygons: Regular polygons, Irregular polygons, square, Rectangle, Triangle, Open curve, Closed Curve, Polygons	
Learning Outcomes	Students will be able to Calculate the perimeter of polygons To solve real life word problems involving perimeter of Polygons done. Estimate length of the boundary of given shape. To identify the regular and irregular shapes	
Self-Evaluation and Follow up	Peer assessment: Asking questions to each other in pairs and using peer tutoring. Flip teaching Use of Google form to create assessment sheet for students	

GLOSSARY:

AI Related Terminology

Autodraw: 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 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

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/

MATHEMATICS

CLASS 6

3.4 Fractions

PARAMETERS	DESCRIPTION	AI CONCEPTS INTEGRATED
Chapter Covered	**Chapter 7: Fractions**	
Name of the Book	**Mathematics, Class 6, NCERT**	
Subject and Artificial Intelligence Integrated	Fractions • Fractions • Fractions on a number line • Proper fractions • Improper and Mixed Fractions. Understanding the concept of fractions using AI experiential applications.	
Learning Objectives	• To determine a part and a whole in order to label the numerator and denominator of a fraction. • To draw equal parts between whole numbers in order to represent fractions on a number line. • To understand the difference between Proper and Improper fractions using AI tool. • To compare fractions.	
Time Required	2 periods of 40 minutes each	
Classroom Arrangement	Flexible	
Material Required	Newspaper, Pen, Paper, White Board, Marker, Laptops/ desktops and Internet connections, 4 Chapattis/Fruits.	
Pre – Preparation Activities	Students will be asked to draw a number line in their notebook and label 0-10. Auto Draw AI tool will be introduced to the students and they will practice by drawing different shapes on it.	https://autodraw.com
Previous Knowledge	Students will be asked, What number comes between 1 and 2? Discuss answers and show using a number line.	

Methodology	Divide the class into groups. (Learning by doing) Activity 1: Fraction Boogie- Each student will need one piece of newspaper. Students place the piece of newspaper out as a "whole piece". The teacher plays some fun dancing music so that the student can dance along on their newspaper. When the music stops, the students must pick up their piece of paper and fold it in half. Then they start dancing on half of the newspaper. Again, the music stops and they fold the piece of paper so that they are only dancing on eighth of the paper. They can then unfold their piece of paper to see the folds in the paper. A great discussion can take place after this game about the different fractions they created during the activity.(this activity helps students understanding proper fraction) Activity: 2 Students will be asked to record a recipe in which they are using different ingredients using concept of fractions to get the best recipe. They will be asked to use My Story Time to record their recipe story. https://youtu.be/rxkbIw3VlGE Activity 2: Each student will need 2 full chapatti and 1 half chapatti. Students place the chapatti on a table. Now teacher ask them how to write the chapattis and help students to count 2 whole chapattis as a whole number and one half chapatti as a fraction (i.e. ½).(this will help students in understanding the concept of mixed fraction) . After that students will cut the 2 chapatti in two halves and then count these half parts now total 5 halves (4 halves of 2 chapatti and 1 half)then they will count and write these halves as 5/2. A great discussion can take place after this game about the different fractions they created during the activity.(this activity helps students understand improper fraction and mixed fraction). https://youtu.be/iniVZ8L0BUI Activity 3: Practice Activity Ask students to apply their understanding of Fraction to attempt questions of 7.1 and 7.2 in the exercise given in the NCERT Math book. Activity 4: Autodraw! 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 and make shapes to show fractions. 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.	My Story Time https://experiments.withgoogle.com/my-storytime Auto Draw https://autodraw.com

Learning Outcomes	The students will: • Understand and apply the concept of fraction in solving the problems. • Understand the concept of proper, improper and mixed fraction. • Know the relationship between improper and mixed fraction. • Apply their understanding to draw images according to fraction on autodraw.com. • Know and reason out that the machines can predict.	
Follow up Activities	• Ask students to make a chart with different figures showing fraction patterns. • Ask them to present to small groups. • Let them assess how accurate they are in their presentations.	
Reflections	Discuss with students: • How do you like the site – autodraw.com? • Do you know of any other tool/ app that can predict & draw? • Would you be able to try this activity at home also?	

GLOSSARY:

AI Related Terminology

Auto Draw: 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 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

My Storytime: 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

MATHEMATICS

CLASS 6

3.5 Mensuration - Area of Polygons

PARAMETERS	DESCRIPTION	AI CONCEPTS INTEGRATED
Chapter Covered	**Chapter 10: Mensuration - Area of Polygons**	
Name of the Book	**Mathematics, Class 6, NCERT**	
Subject and Artificial Intelligence Integrated	Understanding the concept of Area using AI experiential applications.	
Learning Objectives	Students will able to ● Define Area ● List the formulae for finding Area using AI tool. ● Apply the formulae.	Microsoft math (using Faststart technology)
Time Required	2 periods of 40 minutes each	
Classroom Arrangement	Seating arrangement - ● Theory Sessions- pairs of 2 for peer discussions ● Activities Sessions- groups of 4	
Material Required	Pen, paper, geoboards, Black Board chalk, Laptops/ desktops/ Tabs and Internet connections.	
Pre – Preparation Activities	● Students will be asked to measure the sides of their table tops, math books etc. ● Students will be asked to draw different simple polygons on AutoDraw. ● Students will be asked to use their measurements which they will find in activity 1 to be used in AI tool to check their results.	Autodraw : https://autodraw.com
Previous Knowledge	Students are asked to cut a smaller square and a bigger square and are asked to think which is having more perimeter or area.	
Methodology	The teacher will introduce the concept of area with the help of cuttings brought by the students Activity1: Divide the class into pairs of two and tell students to make a table and note down the measurements of different objects like table top, math book, rug, etc. Activity2: Divide the class into groups of 4 each, and tell them to draw different polygons of the given dimensions on the AutoDraw.(teacher will ask to draw different polygons as per	

	their choice and find their perimeters, to check their knowledge) Activiy3: For this activity ask students to open Microsoft math solver and tell them to use camera to find solution of their measurements noted in activity 1or enter measurements noted in activity 1 and select shape type and let AI detect related formula to find its perimeter or area. After which they can themselves will come to know about different formulae and related solutions. Students will than solve exercise questions based on the formulae. After this Open discussion and presentation on: • Perimeter and area and its application in real life like in fencing, in planning of construction of house, etc	Autodraw : https://autodraw.com Geometry calculator Rectangle · Perimeter · $p = 2(l+w)$ Perimeter 120 Width (w) 20 Length (l) 40
Learning Outcomes	• Students will be able to solve real world and mathematical problems involving perimeters of polygons. • To find the area of the given side dimension, finding an unknown dimension, and exhibiting polygons with the same • Students will also learn how to frame problem questions.	
Follow up Activities	Ask students to make a presentation on area and tell them to present in groups of 4 to the whole class and also tell them to prepare a formula table on A-4 size sheet. (Teacher will assess students on the basis of their presentation; how much they understood.)	

GLOSSARY:

AI Related Terminology

Auto Draw: 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 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

Microsoft Math Solver (camera based AI app) — available on both IOS and Android — can solve various **Math** problems including quadratic equations, calculus, and statistics. ... The app can also show graphs for the equation to enhance understanding of the subject.

MATHEMATICS

CLASS 6

3.6 Playing with Numbers

PARAMETERS	DESCRIPTION	AI CONCEPTS INTEGRATED
Chapter Covered	**Chapter 3 - Playing with Numbers**	
Name of the Book	**Mathematics, Class 6, NCERT**	
Subject and Artificial Intelligence Integrated	Understanding the concept of Prime factorization, HCF & LCM using AI tool	
Learning Objectives	• To understand the concept of Factor of a number using AI tool • To understand the concept of prime & composite numbers • To understand the concept of Common factor & Highest Common Factor • To solve real life word problems	
Time Required	3 classes of 40 min each	
Classroom Arrangement	Seating arrangement - • Startup activity: group activity • Concept building: pair of two • Follow up activity: Group activity all in a circle	
Material Required	NCERT Class 6 Textbooks, Notebook, Pen, paper, Desktop/ laptop with good internet connection https://www.nctm.org/Classroom-Resources/Illuminations/Interactives/Factor-Game/	https://www.nctm.org/Classroom-Resources/Illuminations/Interactives/Factor-Game/
Pre – Preparation Activities	Students will be asked to revise their multiplication tables	
Previous Knowledge	Student should have previous knowledge of multiplication	

Methodology	**Introduction:** Previous knowledge of multiplication will be checked by dodging tables **Activity 1:** As a startup activity, students will play kabaddi in a group of two teams each having 20 members. (**Physical Education integration)** • Each member of the team will represent numbers from 1 to 20. • Now raider from team A(suppose no 12) will go in the opposite teams court and will try to out all the numbers except the numbers by which it get divided exactly and the numbers by which it gets divided exactly will be left out in the court(In case of number 12 , the numbers left out in the court will be 1,2,3,4,6,12) . • After this activity the teacher will explain that **all the numbers which divide a given number exactly are called factors of the given number.** Students will develop their understanding of factors using given AI tool *https://www.nctm.org/Classroom-Resources/Illuminations/Interactives/Factor-Game/* (How to play the game is given in the glossary below) **Activity2:** Now as the students are aware about factors of a given numbers ,they will be introduced with the concept of prime & composite numbers using sieve of Eratosthenes . **Activity 3:** Students will be explained the method to find Common Factors & Highest Common Factor(HCF) of 2 or more numbers using factors. Step 1) Students will find out factors of given numbers Step2) They will write the factors which are common factors of all the given numbers Step3) Out of these factors , the factor which is the greatest is HCF **Activity 4 :** Based on their understanding of factors, prime & composite numbers common factors & HCF students will solve problems in Ex 3.1, 3.2, 3.4, 3.6 & 3.7	
Learning Outcomes	• Students will understand the concept of Factors using AI tools • Students will understand the concept of prime & composite numbers • Students will understand the concept of common factors & HCF • Students will analyse the situation where HCF and LCM will be useful in real life situation. • Students will understand the importance of Artificial Intelligence to develop their concept of Prime factors.	
Follow up Activities	• Students will conduct a quiz on factors, prime & composite numbers & HCF (group activity : group of 20) • Students will develop a game for HCF on scratch in Computer science (Subject Integration) • Ask the students to analyze the real-life situations in their daily life and apply the concept of factors & HCF	Scratch

| Reflections | Discussion about how AI tool has been helpful in concept building of factors
https://www.nctm.org/Classroom-Resources/Illuminations/Interactives/Factor-Game/
Ask the students to explore what other available AI applications can be used as alternative | |

GLOSSARY:

AI Related Terminology

The National Council of Teachers of Mathematics (NCTM) is Mathematics education organization in the world.

https://www.nctm.org/Classroom-Resources/Illuminations/Interactives/Factor-Game/

AI Activity Description

● Player 1 chooses a number on the game board by clicking on it. The square will be colored blue, as shown for 12. Player 1 receives 12 points for this choice.
● Player 2 then clicks on all the proper factors of Player 1's number. The *proper factors* of a number are all the factors of that number, except the number itself. For example, the proper factors of 12 are 1, 2, 3, 4, and 6. Although 12 is also a factor of 12, it is not considered a *proper* factor. All of the proper factors that Player 2 selects will be colored red. Player 2 will receive 1 + 2 + 3 + 4 + 6 = 16 points for selecting all of the proper factors.

Player 2: Choose a number
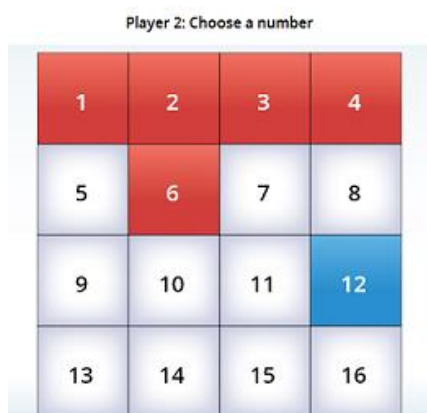
● Players reverse roles. On the next turn, Player 2 colors a new number and gets that many points, and Player 1 colors all the factors of the number that are not already colored and receives the sum of those numbers in points.
● The players take turns choosing numbers and coloring factors.
● If a player chooses a number with no uncolored factors remaining, that player loses a turn and does not get the points for the number selected.
● The game ends when there are no numbers remaining with uncolored factors.
● The player with the greater total when the game ends is the winner.

Scratch: scratch.mit.edu

Scratch is a block-based visual programming language and website targeted primarily at children to help learn code. Users of the site can create online projects using a block-like interface.

MATHEMATICS

CLASS 6

3.7 Data Handling

PARAMETERS	DESCRIPTION	AI CONCEPTS INTEGRATED
Chapter Covered	**Chapter 9: Data Handling**	
Name of the Book	**Mathematics, Class 6, NCERT**	
Subject and Artificial Intelligence Integrated	To understand the concept of Data Handling AI Tools of Data Acquisition and Data Exploration.	

Learning Objectives	● To understand the concept of Data.
	● To understand the process of Data.
	  - Data and source of Data.
	  - Organization of Data.
	  - Pictograph.
	  - Bar graph.
	● To understand the process of Data Handling in real - life situations using AI Tools of Data Acquisition, Data visualization and Data Exploration.
		Data Acquisition
		Data visualization

Time Required	2 periods of 40 minutes each.	
Classroom Arrangement	Flexible	
Material Required	● Textbook, Graph Paper, Coloured Pen or Sketches, White Board. ● Laptops/ desktops and Internet connections.	
Pre – Preparation Activities	The students will be asked to collect the weekly test marks of all subjects and represent the data in tabular form and draw a bar graph.	
Previous Knowledge	The students are asked to recall the knowledge about collection of data, bar graph and pictograph. Some questions would be given to them to solve.	
Methodology	**Divide the students into four groups.** ● The students will be asked to collect the weekly test marks of math of all students and arrange these marks in a table using tally marks. ● Ask the students to go on http://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. ● Ask students to apply their understanding of data to do questions of exercise 9.1, 9.2 and 9.3 from NCERT Math Book.	Data Acquisition Data Visualization http://datavizcatalogue.com

Learning Outcomes	- The Students will understand the concept of Data Handling. - The Students will understand the process of Data Handling. - Sources of Data. - Collection of Data - Data Acquisition - Organization & representation of Data - Data Exploration. - The Students will understand the process of Data Handling in real - life situations using AI Project cycle process of Data Acquisition and Data Exploration.	http://datavizcatalogue.com
Follow up Activities	Make a group of 4 or 5 students and ask them to collect data about the number of men and women in their village and present the data with the help of AI project cycle process of Data Acquisition and Data Visualization. Let them assess how accurate they are in their presentation.	

GLOSSARY:

AI Activity Description

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

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

MATHEMATICS
CLASS 6

3.8 Practical Geometry - Constructing Angles

PARAMETERS	DESCRIPTION	AI CONCEPTS INTEGRATED
Chapter Covered	**Chapter 14: Practical Geometry**	
Name of the Book	**Mathematics, Class 6, NCERT**	
Subject and Artificial Intelligence Integrated	Understanding the concept of constructing angles using AI Experiential Applications	
Learning Objectives	- To understand the concept of construction - To understand the construction of line segments - To understand the construction of angles - To understand the construction of perpendicular bisectors and angle bisectors	
Time Required	2 Periods of 40 minutes each	
Classroom Arrangement	Flexible	
Material Required	Pen, paper, Black board chalk, Laptop/desktops and Internet connections	
Pre – Preparation Activities	The students will be asked to recall how to draw the circles and arc using compass	
Previous Knowledge	A video can be shown to the students to introduce angles. https://youtu.be/aGejx2fRCHU The students are made to recall the various types of angles and how to draw and measure by using protractor	
Methodology	**Activity 1: Clock Activity** Students are shown the analog clock and set the clock to different times. Ask the students some questions regarding the angles made by the hands of the clock and its degree measure. The team members will discuss themselves and answer the questions. **Activity II: Auto Draw** Students are asked to draw different shapes and figures involving angles using Auto Draw **Activity III-** A video will be shared to make the students understand the construction of various angles. https://youtu.be/wYeDgQShXq4 **Activity IV- Practice Activity** Ask students to apply their understanding of constructing angles to attempt questions of 14.5 and 14.6 given in the exercise of NCERY Book.	Auto Draw

Learning Outcomes	The students will be able to ● Construct line segments using compass ● Construct and measure angles ● Construction of perpendicular bisectors ● Construction of angles using ruler and compass ● Construction of angle bisectors	
Follow up Activities	The students will be asked to explore the angles created in their body parts while making different movements and using google experiment using AI tool. The students will be asked to observe different types of angles in their surroundings and how they play an important role in architecture.	https://experiments. withgoogle.com/billt jonesai

GLOSSARY

3.9 Data Handling

AI Generated Movement/Dance

The experiment allows user to use a web-browser and a simple camera, the experiments invite users everywhere to explore the creative possibilities of their own bodies and make new connections with Bill's iconic solo, 21. With different posture angles one can hear different music.

Use of this tool with class 6 graders can be a fun activity in which students can explore different angles created by their body parts when various postures are created.

https://experiments.withgoogle.com/billtjonesai

Auto Draw

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 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

MATHEMATICS

CLASS 7

3.9 Data Handling

PARAMETERS	DESCRIPTION	AI CONCEPTS INTEGRATED
Chapter Covered	**Chapter 3: Data Handling**	
Name of the book	**Mathematics, Class 7, NCERT**	
Subject and Artificial Intelligence Integrated	Understanding the concept of Data Handling using AI Tools of Data Acquisition and Data Exploration.	
Objectives	• To understand concept of Data Handling. • To understand process of Data Handing: - Sources of Data - Collection of Data – Data Acquisition - Organization & Representation of Data – Data Exploration. • To understand process of Data Handing in real-life situations using AI Tools of Data Acquisition and Data Exploration.	
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 Activity	The Students will be asked to collect some Newspaper articles related to Air Pollution. A picture of a Graph showing the Air quality of India over the past 10 years will also be displayed	
Previous Knowledge	The students are asked to recall what they have already done with regard to collection of Data, Tabulations and Bar Graphs. Some questions would be given to them to solve.	
Introduction	The teacher will introduce the concept of Double Bar Graph in order to understand how to make comparative Analysis of two or more Data Sets.	
Methodology	Divide the class into two teams. Activity I: Air Pollution in Delhi – A Case Study. Ask students to read articles on Air Pollution in Delhi from different Sources: Newspaper, Internet etc. Ask them to collect data on changing Air Pollution Levels in Delhi and represent it with the help of some graphical/pictorial representation. 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 representation which will suit their data best. 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 of using AI in addressing this problem. Activity II: Practice Activity Ask students to apply their understanding of Data Handling to attempt questions of 3.1 &3.2 given in the exercise of the book.	Data Acquisition Data exploration https://datavizcatalogue.com

Discussion on the Text	Open discussion and presentation on: ● Observation made by each group on the changing levels of air pollution in Delhi. ● What are the causes? How can the existing problem of deterioration of air quality be solved?	

Learning Outcomes	• The students will understand the concept of Data Handling.
	• The students will understand the process of Data Handing:
	   - Sources of Data
	   - Collection of Data – Data Acquisition
	   - Organization & Representation of Data – Data Exploration.
	The students will understand the process of Data Handing in real-life situations using AI Project cycle process of Data Acquisition and Data Exploration.	

Self-Evaluation and Follow-Up Activity	Ask students to choose some issues in their surrounding and make a presentation with the help of AI Project Cycle of Data Acquisition and Data Exploration Ask them to present to small groups. • Let them assess how accurate they are in their presentations.	

GLOSSARY:

AI Related Terminology

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

Data Exploration: https://datavizcatalogue.com

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.

AI Activity Description

Data Acquisition: In this activity, ask the students to search for data regarding Air Pollution in Delhi through various sources. Ask them to identify authentic sources which can provide reliable information. They can go for either online or offline sources of acquiring data. After identifying reliable data sources, ask the students to get data and store it for the next activity.

Data Exploration: Now that the data has been acquired, ask the students to explore it through visual representations. Ask students about various visual representations that could be used to present their data in a meaningful manner. 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 solving the problem of Air pollution in Delhi. Finally, ask the students to discuss how AI can be leveraged in this situation.

MATHEMATICS
CLASS 7

3.10 The Triangle and its Properties

PARAMETERS	DESCRIPTION	AI CONCEPTS INTEGRATED
Chapter Covered	**Chapter 6: The Triangles and Its properties**	
Name of the book	**Mathematics, Class 7, NCERT**	
Subject and Artificial Intelligence Integrated	- To understand the concept of Triangles. - Classify Different types of triangles on the basis of Angles. - To understand properties of Equilateral Triangles, Isosceles Triangles, Scalene Triangles. - To Explain Exterior angles of Triangles, Angle sum property of Triangles, The sum of length of two sides is greater than third side (Triangle inequality).	
Learning Objectives	- Students will be able to identify and classify the types of triangle by length of the sides. - Students will be able to identify and classify the types of triangle by the size of the angle. - Students will be apply their knowledge about triangle in solving problem related to characteristics of triangle - Extension of triangle types to create or describes Solids. Example Triangular prism, Pyramids and Triangular models. - Congruency	
Time Required	06 Periods of 40 minutes	
Classroom Arrangement	Flexible	
Material Required	Textbooks, White boards /Smart Board, String, Scrapbook, Scissors, crayons/Sketch pens, Glue, geometry box and Internet connections.	
Pre – Preparation Activities	Different types of triangles (unnamed or classified figures to be given to the students and tell to measure the sides and angles as an exercise. https://youtu.be/_xl-j29V9x4 Students will be asked to use Autodraw and design different triangles on the basis of sides and angles. Verified Triangle inequality. https://youtu.be/APX7sh7_PcU Verify angle sum property of triangles. https://youtu.be/Fy3OkZHX7LE	https://www.autodraw.com/
Previous Knowledge	- It is assumed that the students know about the point, straight line, line segment, angles, equal angles, acute angles, obtuse angles and right angle. - Angle sum property of triangle is 180. - Classification of triangles on the basis of sides and angles.	

Methodology	Interactive method-Understandability of students can be assessed quickly when they interact verbally. Learning by Doing-measuring the sides and angles of triangles and naming them in general and classifying as whole. Comparison of the sides to affirm triangle inequality.	
Learning Outcomes	As a result of studying this topic, students will be able to: ● Name and classify the triangles on the basis of sides and angles. ● Verify angle sum property of triangle and triangle inequality. ● Handle sums related to the properties of equilateral, isosceles and right angled triangle. ● Know that a triangle can have only one obtuse angle or right angle. ● Handle sums related to exterior angle property of triangle. ● Identify the triangular faces of a solids.	
Follow up Activities	Preparing Quizzes (Develop confidence in identifying and co relation of properties of triangle in doing problems.) Situational analysis –Correlating the triangular shapes from the environment (Examples-The roof top of a temple, Pyramids of Egypt ,Shapes of sweets ,half folded Kites, Diagonals of any quadrilateral divided it into two triangles.	
Reflections	Preparing videos on the representation of different types of triangles and their properties Provide reference of links related to the topics.	

GLOSSARY

AI Related Terminology

Autodraw: 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 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

MATHEMATICS

CLASS 7

3.11 Perimeter and Area - Area of Polygons

PARAMETERS	DESCRIPTION	AI CONCEPTS INTEGRATED
Chapter Covered	**Chapter 11: Perimeter and Area - Area of Polygons**	
Name of the book	**Mathematics, Class 7, NCERT**	
Subject and Artificial Intelligence Integration	Understanding the concept of Area different polygons like parallelogram, Triangle, etc. Using AI tool to understand the shape concept of different polygons.	Autodraw.com
Learning Objectives	● Define area of different Polygons ● To understand the concept of area of different polygons. ● To derive formulas for calculating area ● To calculate the area of given polygons ● To calculate the area of assorted shapes	
Time Required	3 periods of 40 minutes each	
Classroom Management	Flexible	
Material Required	Pen, Paper, White Board, Markers, Laptop, Internet Connection, Jodo straws	
Pre-preparation Activity	Students will be asked to recall all 2D shapes and their area and perimeter.	
Previous knowledge	Questioning will be used to check students previous knowledge in the form of Quiz	
Introduction	Students will be asked to prepare 2D solids using JODO straws/paper folding.	
Methodology	**Design Making Activity:** Students will be divided into groups of 4 or 5 and they will use Quick draw tool to draw and identify different 2D geometrical shapes. It can be an animal, flower, geometrical design, etc. Then, they need to calculate the perimeter for the figure obtained. **Quiz Activity:** Students will be asked to search quiz in which they can see the maximum use of 2D shapes. Students will be motivated to create their own quiz which involves identification shapes and computing its area using quiz, mentimeter, padlet, etc. **Problem Solving Activity:** Students will be using the formula derived for the area of polygons to find the area in the real life problems of NCERT exercise. **Autodraw:** In this follow-up activity, students will use Autodraw tool to create shapes with different area that have been written on the board. For example, teacher can ask them to make different shapes	Quick Draw https://quickdraw.withgoogle.com/ Auto Draw https://autodraw.com

	To wrap up this activity, ask students to create four different polygons and record the area of each on their small dry erase boards. As teacher walk around, it is easy to see who has grasped the idea and who needs more time and practice	
Discussion on the Text	Open discussion for all new terms related to Area : Area, Parallelogram, Triangle, Circle, pie	
Learning Outcomes	Students will be able to ● To calculate the area of given shapes ● To solve real life word problems involving area of the shapes done.	
Self-Evaluation and Follow up	Peer assessment: Asking questions to each other in pairs and using peer tutoring. ● Flip teaching ● Google form	

GLOSSARY

AI Related Terminology

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/

Auto Draw: 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 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

MATHEMATICS
CLASS 7

3.12 Lines and Angles

PARAMETERS	DESCRIPTION	AI CONCEPTS INTEGRATED
Chapter Covered	**Chapter 5: Lines and Angles**	
Name of the Book	**Mathematics, Class 7, NCERT**	
Subject and Artificial Intelligence Integrated	Understanding the concept of Lines and Angles using AI Experiential Applications	
Learning Objectives	● To understand the concept of Line, Line segment, Ray. ● To understand the concept of Angle and types of angles using an AI game. ● To draw a transversal and intersecting line.	
Time Required	2 periods of 40 minutes each	
Classroom Arrangement	Flexible	
Material Required	Pen, paper, White Board, Marker, Laptops/ desktops and Internet connections.	
Pre – Preparation Activities	The Students would be asked to collect some objects e g, a piece of paper and color pen/pencil.	
Previous Knowledge	The students are asked to collect any four or five objects (like pen, book, cell phone etc.) and draw lines, line segments, and ray with the help of objects.	

Methodology	**Activity I** Students will take objects like matchsticks and mark a point by using the head of matchsticks. After that students will draw a line, line segment and ray by using matchsticks. https://youtu.be/2SUIMYpWhs8 Teacher will help them understand point, ray, line, line segment. **Activity II** Ask students to observe the objects (like wall clock/wrist watch) and observe the image and draw the lines for minute and second hand. This activity help them to understand the concept of different types of angles. https://youtu.be/UgfSwlqi4Qg **Activity III** Ask students to apply their understanding of angles to attempt questions of 5.1given in the exercise of the chapter. **Activity IV** AutoDraw - 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 of angle 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. Ask them to notice, at what step the machine is able to predict the image. Once the correct image comes on the screen, ask the students to observe the angle in it and describe it to the whole class.	Computer Vision enabled AI application Autodraw https://autodraw.com
Discussion on the Text	Open discussion and presentation on lines and angles and its application in real life like walls of room, couches in home, wall clock etc.	
Learning Outcomes	The students will: ● Understand the line. ● Understand and apply the concept of angles in solving the problems. ● Know the relationship between lines and angles. ● Apply their understanding to draw angles and lines on autodraw.com. ● Know and reason out that the machines can predict	
Follow up Activities	Ask students to make a chart with different figures showing angles and lines of angle. Ask them to present to small groups. Let them assess how accurate they are in their presentations.	
Reflections	Discuss with students: How do you like the site – autodraw.com? Do you know of any other tool/ app that can predict & draw? Would you be able to try this activity at home also?	

GLOSSARY:

AI Related Terminology

Autodraw : 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 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

MATHEMATICS

CLASS 7

3.13 Congruence of Triangles

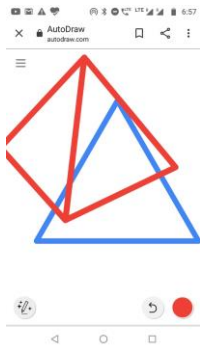| PARAMETERS	DESCRIPTION	AI CONCEPTS INTEGRATED
Chapter Covered	**Chapter 7: Congruence of Triangles**	
Name of the Book	**Mathematics, Class 7, NCERT**	
Subject and Artificial Intelligence Integrated	Understanding the concept of congruence using AI experiential applications.	
Learning Objectives	The students will able to ● Understand the concept of congruence using AI tools. ● Apply the congruence criterion in exercise questions.	Autodraw.com
Time Required	2 periods of 40 minutes each	
Classroom Arrangement	Seating arrangement – group of 2 for peer discussions	
Material Required	Pen, paper, Black Board chalk, Laptops/ desktops/tabs and Internet connections.	
Pre – Preparation Activities	The Students will be asked to collect some objects and observe their pattern of symmetry.	
Previous Knowledge	The students are asked to collect any four or five objects whose halves can be mirror images and to draw the line of symmetry on the object.	
Methodology	● The teacher will introduce the concept of congruence with the help of objects brought by students and using line symmetry in a single object, in order to explain half of the congruent part to the other half. ● Teacher will explain the criterions using presentation and will ask students to apply their understanding of congruence in the exercise questions. ● Autodraw - 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 would 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. Once the original drawing comes into picture form, ask the students to observe the line of symmetry in it and then describe it to the whole class how two parts are congruent using the criterion discussed.	Computer Vision enabled AI application Autodraw.

Learning Outcomes	● Students will understand the concept of congruence using line symmetry. ● Students will understand the congruence criterion and how to use those in questions.	
Follow up Activities	● Quiz to assess the students learning ● Ask students to prepare presentation on congruence of triangles to explain different criterions of congruence.	
Reflections	Discussion on importance of AI in Mathematics.	

GLOSSARY:

AI Related Terminology

Auto Draw: 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 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

MATHEMATICS
CLASS 7

3.14 Visualizing Solid Shapes

PARAMETERS	DESCRIPTION	AI CONCEPTS INTEGRATED
Chapter Covered	**Chapter 15: Visualizing Solid Shapes**	
Name of the Book	**Mathematics, Class 7, NCERT**	
Subject and Artificial Intelligence Integrated	Understanding the concept of 3-D shapes using AI tools	
Learning Objectives	To represent 3D shapes on a plane surface such as paper, blackboard etc. To identify the nets which can be used to form a Cube /cuboid To develop the concept of solid shapes and their nets using AI tool	
Time Required	40-minutes Class, 2 period	
Classroom Arrangement	Seating arrangement - Groups of 4 students in a class of 40	
Material Required	Pen, Paper, Blackboard, Chalk, cardboard, Scissors, Paper clips, desktop/laptop with good internet connection Sites: https://www.google.com/intl/en_in/earth/ https://www.autodraw.com/ https://www.nctm.org/Classroom-Resources/Illuminations/Interactives/Cube-Nets/	
Pre – Preparation Activities	Group of Students will be asked to collect any old cuboidal cardboard box (Toothpaste/Cake)/ Cylindrical cardboard (roll no 1-20 cuboidal box & roll no 20-40 cylindrical cardboard material)	
Previous Knowledge	Students will be asked to click on the given link of google earth and visit different famous place like pyramid of Giza, Leaning tower of Pisa and then they will be asked to draw rough sketch of these places using Students will use Quick draw and create various doodles mapping with the prompt asked in the tool. This activity will build the concept of different solid shapes in the student's mind. Students will be asked to draw the top/side& front faces of these places.	https://www.google.com/intl/en_in/earth/ https://quickdraw.withgoogle.com/

Methodology	**Activity 1 -** Students will be asked to sit in groups of 4(roll no wise), and cut the old cardboard 3-D shaped boxes along the edges. Now ask them to draw the nets of different 3D shapes. **Activity2 -** As the students have understood the nets of different 3D shapes, ask them to go on Cube Nets . Once they land on the website ask them to click on first net and submit the answer for the question 'Can a cube be formed with the given net' and then observe how their answer is correct or wrong by visualizing. https://www.nctm.org/Classroom-Resources/Illuminations/Interactives/Cube-Nets/ **Activity 3 -** Ask the students to apply their understanding of nets of different shapes to solve Ex 15.1 given in the exercise of the book.	
Learning Outcomes	● Students will understand how 2D shapes can be converted to 3D shapes ● Students will analyze the real life situations where nets of solid shapes are used ● Students will understand the importance of Artificial intelligence in developing their concept of 3D shapes and its nets	
Follow up Activities	Ask the students to analyze the real-life situations in where 3D shape are used and identify their nets and prepare a chart for it in groups and do classroom presentation	
Reflections	Discussion about how AI tool has been useful in developing their concept of 3D shapes and their nets Ask the students to explore any other AI tool	

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. Users can explore the globe by entering addresses and coordinates, or by using a keyboard or mouse

AI Activity Description

For this activity ask the students to go to https://www.google.com/intl/en_in/earth/ and enter a specific monument name. Once they have fed the input, they will be able to see that place from different views and hence can have a look at 3D shapes of different monuments. They can even notice the shape of the earth also.

Quickdraw: Quick Draw is a google experiment, an AI tool based on neural network in which the machine learns to recognise 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/

A *net* is a two-dimensional figure that can be folded into a three-dimensional object. Ask students to go on Cube Nets. Once they land on the website ask them to click on the first net A question will appear in the bottom 'Can a cube be formed with the given net', Submit the answer for the question and then observe how their answer is correct or wrong by visualizing.

https://www.nctm.org/Classroom-Resources/Illuminations/Interactives/Cube-Nets/
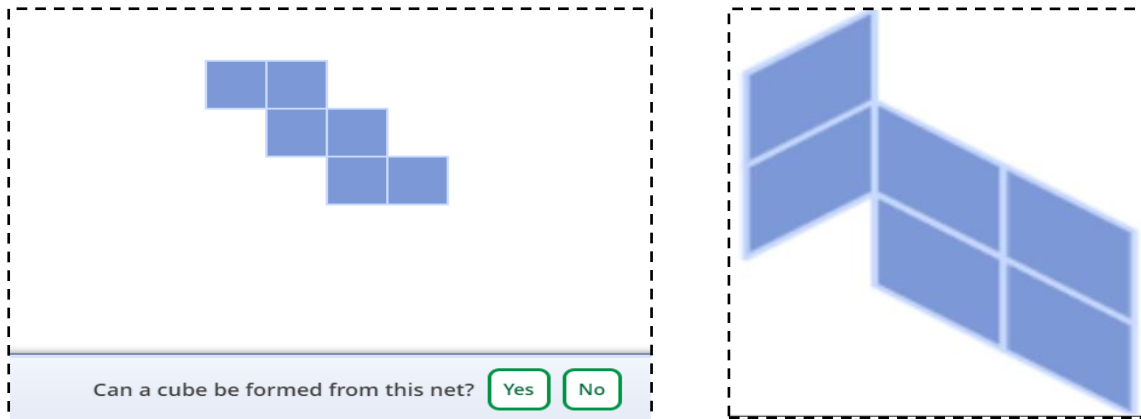
MATHEMATICS

CLASS 7

3.15 Symmetry

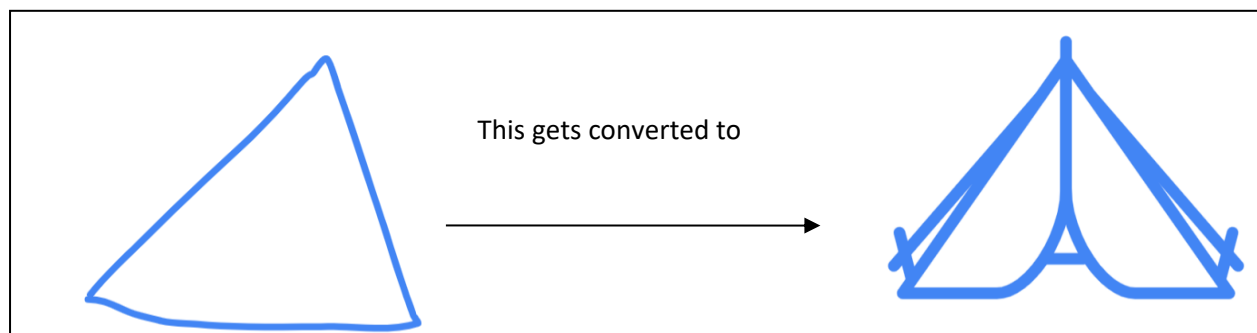| PARAMETERS	DESCRIPTION	AI CONCEPTS INTEGRATED
Chapter Covered	**Chapter 14: Symmetry**	
Name of the Book	**Mathematics, Class 7, NCERT**	
Subject and Artificial Intelligence Integrated	To understand the concept of Symmetry using AI	
Learning Objectives	● To understand the concept of symmetry. ● To understand the difference between symmetrical and asymmetrical objects. ● To identify the number of lines of symmetry in any object.	Autodraw
Time Required	2 periods of 40 minutes each.	
Classroom Arrangement	Flexible	
Material Required	Pen or Sketches, paper, White Board. Laptops/ desktops and Internet connections.	
Pre – Preparation Activities	The students will be asked to collect some objects and observe their pattern of symmetry.	
Previous Knowledge	● The students are asked to recall the knowledge about the line of symmetry. ● Some examples will be asked from the students of symmetrical objects.	
Methodology	**Divide the students into four groups** ● Display the image of the butterfly in the class. Using the link – www.scratch.mit.edu ● Ask the class to share some things they notice about the image. Some guiding questions would be: What are the colors of the butterfly's wings? How are the wings shaped? ● Once students touch on the idea that the wings match in some way introduce the word symmetry. Explain that something has symmetry if it can be split into two mirror image halves. ● **Rotational symmetry:** Draw two identical parallelograms, one - ABCD on a piece of paper and the other A' B' C' D' on a transparent sheet. Mark the points of intersection of their diagonals, O and O' respectively. Place the parallelograms such that A' lies on A, B' lies on B and so on, then falls on O. Stick a pin into the shapes at the point O.	

	Now turn the transparent shape in the clockwise direction. How many times do the shapes coincide in one full round? What is the order of rotational symmetry? ● **Autodraw :** ● For this activity, ask the students to go to http://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 student to draw any shape and let the AI algorithm detect and predict the possible drawings similar to it. The predictions would 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 and start drawing it roughly and see at what step the machine is able to predict the image. Once the original drawing comes into picture form, ask the students to observe the line of symmetry in it and describe it to the whole class. ● **Scratch AI tool** For this activity, ask to students to go to scratch.mit.edu Once they land on it. Ask the student to select the sprite list there they can draw any shape .By programming they can rotate the shape about any angle. Once they do that introduce the term rotation symmetry, angle of rotation and order of rotation. Ask to students to observe the rotation and find the order of rotation symmetry. Ask to students to draw any shape and draw the line of symmetry. Student can also draw the line of symmetry from the list of sprite ● Ask students to apply their understanding of symmetry to do questions of exercise 14.1, 14.2 and 14.3 given in the book.	Autodraw http://autodraw.com https://scratch.mit.edu
Learning Outcome	The Students will understand or recognize two types of symmetry ● Identify the shape's line of symmetry ● Identify a shape order of rotation.	
Follow up Activities	Make a group of 4 or 5 students and distribute drawing paper with coloured pencils, etc. ● Tell students to find as many symmetrical objects as possible. ● Make a sketch of each item and draw the line of symmetry of each ● Draw any shape using Autodraw AI tool and try to find out its symmetry.	
Reflections	Discussion on use of symmetry in real life	

GLOSSARY:

AI Related Terminology

Autodraw: 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 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://www.autodraw.com/

This gets converted to

Scratch: scratch.mit.edu

Scratch is a block-based visual programming language and website targeted primarily at children to help learn code. Users of the site can create online projects using a block-like interface.

MATHEMATICS

CLASS 7

3.16 Practical Geometry - Construction of Triangles

PARAMETERS	DESCRIPTION	AI CONCEPTS INTEGRATED
Chapter Covered	**Chapter 11: Practical Geometry - Construction of Triangles**	
Name of the Book	**Mathematics, Class 7, NCERT**	
Subject and Artificial Intelligence Integrated	Understanding the concept of constructing Triangles using AI Experiential Applications	
Learning Objectives	To understand the concept of construction of triangles when ● Three sides are given ● Two angles and included side is given ● Two sides and included angle is given ● Hypotenuse and one side is given	
Time Required	4-5 Periods of 40 minutes each	
Classroom Arrangement	Flexible	
Material Required	Pen, paper, Black board chalk, Laptop/desktops and Internet connections	
Pre – Preparation Activities	● The students will be asked to recall SSS. SAS, ASA and RHS congruence criterion. ● Students will be advised to practice the construction of angles using compass ● An introductory video will be shown to recall the properties of triangles. https://youtu.be/rBN_RTGu1Jg	
Previous Knowledge	The students are made to recall how to construct angles, angle bisectors and angle sum property of triangles in order to understand the concept of construction of triangles.	

Methodology	**Activity 1:** The class will be divided into four groups and each group is given an A-4 size paper. The members of each group will be asked to fold the paper to form a scalene, isosceles, equilateral and right angled triangle. Later they can measure the angles and sides of the triangle. **Activity II: Auto Draw** Students are asked to draw different types of triangles using Autodraw tool and the tool maps the image drawn with its trained model of triangles. Visualizing them students understand different types of triangles. **Activity III-** A video will be shared to make the students understand the construction of various types of triangles. https://youtu.be/UzNWf737nNk **Activity IV- Practice Activity** Ask students to apply their understanding of constructing triangles to attempt questions of 10.1. 10.2, 10.3 and 10.4 given in the exercise of the chapter.	Auto Draw https://autodraw.com
Learning Outcomes	● The students will understand to construct various types of triangles ● The students will understand the application of triangles in real life.	
Follow up Activities	The students will be asked to observe different types of triangles in their surroundings and identify them, and how they play an important role in architecture.	

GLOSSARY:

AI Related Terminology

Autodraw:

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 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://www.autodraw.com/

MATHEMATICS
CLASS 8

3.17 Direct and Inverse Proportions

PARAMETERS	DESCRIPTION	AI CONCEPTS INTEGRATED
Chapter Covered	**Chapter 13: Direct and Inverse Proportion**	
Name of the book	**Mathematics, Class 8, NCERT**	
Subject and Artificial Intelligence Integrated	Understanding the concept of Direct and Indirect Proportion using Google maps (AI App)	
Objectives	To understand the concept of Direct Proportion. To understand the concept of Inverse Proportion. To understand the concept of Direct and Inverse Proportion using an AI App. To understand the application of Direct and Inverse Proportion in real life.	Google map in determining real time and speed relation: Rule Based AI App.
Time Required	2 periods of 40 minutes each	
Classroom Arrangement	Flexible	
Material Required	Pen, paper, Black Board chalk, Laptops/ desktops and Internet connections.	
Pre- Preparation Activity	• Observe that change in one quantity leads to change in the other quantity. • If the number of articles purchased increases, the total cost also increases. • The more the money deposited in a bank, more is the interest earned. • As the speed of a vehicle increases, the time taken to cover the same distance decreases. • For a given job, the more the number of workers, the less will be the time taken to complete the work. • Two quantities may change in such a manner that if one quantity increases, the other quantity decreases and vice versa.	
Previous Knowledge	The students are made to recall about constant and variables in order to understand the concept of Direct and Inverse Proportion.	
Introduction	The teacher will introduce the concept of Direct and Inverse proportion with the help of real-life examples.	
Methodology	**Activity I:** **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	Google maps

	- car - bus - walking **Activity II:** **Real-life Problem Solving** Discuss to make students understand the concept and calculation of Direct and Inverse Proportion taking some real-life examples. - Number of workers required to complete a construction task**. (Impact of change in number of workers on duration of completion of task)** - Speed of vehicle and distance to be covered**. (Impact of change in speed on distance covered)** - Distance to be travelled and time taken in covering that distance **(Impact of change in distance travelled on time taken keeping speed as the constant factor)**	
Discussion on the Text	Discussion and presentation on: - Two quantities x and y are said to be in direct proportion if they increase (decrease) together in such a manner that the ratio of their corresponding values remains constant. That is if x / y =K. [k is a positive number], then x and y are said to vary directly. Two quantities x and y are said to be in inverse proportion if an increase in x causes a proportional decrease in y (and vice-versa) in such a manner that the product of their corresponding values remains constant. That is, if xy = k, then x and y are said to vary inversely.	
Learning Outcomes	- The students will understand the concept of Direct Proportion. - The students will understand the concept of Inverse Proportion. - The students will understand the concept of Direct and Inverse Proportion using the AI App. The students will understand the application of Direct and Inverse Proportion in real life.	
Self-Evaluation and Follow-Up	Ask the students to analyze the real-life problems in their daily life and apply the concept of direct and inverse proportion. - Ask the students to explore what other available AI applications can be used as a Rule Based AI App.	

GLOSSARY:

1. AI Related Terminology

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
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 proportionality between time, speed and distance.

MATHEMATICS

CLASS 8

3.18 Mensuration - Volume of Cube and Cuboids

PARAMETERS	DESCRIPTION	AI Integration
Chapter Covered	**Chapter 11- Mensuration - Volume of Cube and Cuboids**	
Name of the book	**Mathematics, Class 8, NCERT**	
Subject and Artificial Intelligence Integration	Understanding the concept of Volume different solids like cube, cuboid, using their nets, paper cutting activity and Geogebra tool. Geogebra, Quizziz (gamified quiz), Video Games, 3D modelling software	
Learning Objectives	● Define Volume ● To understand the concept of Volume of a solid. ● To derive formulas for calculating Volume ● To calculate the Volume of given solids ● To experiment with the Volume of different solids. ● To calculate the Volume of assorted objects	
Time Required	2 periods 40 minutes each	
Classroom Management	Flexible	
Material Required	Pen, Paper, White Board, Markers, Laptop, Internet Connection, Jodo straws	
Pre-preparation Activity	Students will be asked to recall all 2D shapes and their area and perimeter. Making of 3D objects using 2D shapes. Students will be asked to think creatively and compile a story thinking themselves as one of the 3D object and how they will measure their volumes using the dimensions, thus presenting the formula in creative way.	Inkle writer - Story Writing where it will be based on 3 characters L, B, H
Previous knowledge	Questioning will be used to check students previous knowledge in the form of Quiz	
Introduction	Students will be asked to prepare 3D solids using JODO straws/paper folding and deduce formula of Volume of it.	
Methodology	**Activity-1 :** **Use Of Geogebra Tool :** Students will be working in pairs with their partners in computer lab and individually at their home to understand the formulae of Volume and volume of solids by using geogebra tool wherein they can change measurements of the dimensions and explore the corresponding change in their Volume. This will help them to understand change in Volume in problems related to increase and decrease in dimensions.	

	Activity-2: **Video Game Activity:** Students will be asked to search the video games in which they can see the maximum use of 3D solids and shapes. Students can be motivated to create their own game which involves solids using the unity game maker or scratch or any video game maker app. **Activity-3:** **Quiz Activity :** Students will be asked to search quiz in which they can see the maximum use of 2D shapes. Students will be motivated to create their own quiz which involves identification shapes and computing its perimeter using quizziz , mentimeter, padlet, etc **Activity-4:** **Problem Solving Activity:** Students will be using the formula derived for the volume of solids to find the Volume of objects in the real life problems of NCERT exercises.	
Discussion on the Text	Open discussion for all new terms related to Volume: Volume, Cuboid. Cube, Capacity, etc.	
Learning Outcomes	Students will be able ● To calculate the Volume of given solid. ● To solve real life word problems involving Volume of the solids done.	
Self-Evaluation and Follow up	Peer assessment: Asking questions to each other in pairs and using peer tutoring. ● Flip teaching ● Google form Explore INSTA 3D volume measuring app to measure the volume of bulk without measuring any dimensions	INSTA 3D Volume measuring

GLOSSARY:

AI Related Terminology

INSTA 3D volume measurement

INSTA 3D uses AR and AI technologies and integrates them into the HHT APP in SDK form to make HHT understand the real environment, reconstruct and recover the 3D structure of the scenario and further restore the size of the measured object.

Inklewriter

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

MATHEMATICS

CLASS 8

3.19 Understanding Quadrilaterals

PARAMETERS	DESCRIPTION	AI CONCEPTS INTEGRATED
Chapter Covered	**Chapter 3: Understanding Quadrilaterals**	
Name of the Book	**Mathematics Text book for Class 8**	
Subject and Artificial Intelligence Integrated	Understanding the concept of Polygon and quadrilateral using AI experiential applications.	
Learning Objectives	● To understand the concept of Polygon.. ● To understand and identify different kinds of quadrilateral. ● To compare and describe different kinds of quadrilateral. ● To draw different kinds of quadrilateral.	
Time Required	2 periods of 40 minutes each	
Classroom Arrangement	Flexible	
Material Required	Pen, paper, White Board, Marker, Laptops/ desktops and Internet connection, Newspaper/white sheet, chart paper, color pens.	
Pre – Preparation Activities	Students will be introduced to Autodraw tool and its features.	Autodraw.com
Previous Knowledge	Students will be asked to draw different types of curves (e.g. closed curve, simple curve, rectangle, square etc.)	
Methodology	Teacher will show the video to the student to understand the concept of polygon and quadrilateral. https://youtu.be/VNRdl-cJ4wo(polygon,quadrilateral,types of quadrilateral) Activity 1: Each student will need a piece of newspaper/white sheet to understand the concept of quadrilateral. Now Teacher guides them to take the paper and observe the sides of the newspaper and tell them about the shape .After that teacher will tell them to join the opposite corners of the paper (diagonal concept).With the help of paper the students try to make the cutouts of different types of quadrilaterals. Activity 2: Each student will need a chart paper to paste all the shapes of the quadrilateral and write down all the properties of the	

	quadrilateral and the teacher will help them in differentiating all the shapes.	
	Activity 3: Practice Activity	Autodraw https://autodraw.com
	Ask students to apply their understanding of Quadrilaterals to attempt questions of 3.3 and 3.4 given in the exercise of the chapter.	
	Activity 4: Autodraw	
	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 and make shapes to show quadrilateral.	
	Students shall also be asked to play a quiz on iknowit.com to make the concept clearer. Once students land on the site they should click on the search option quadrilateral and try to play it.	
	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.	
Learning Outcomes	The students will: ● Understand and apply the concept of quadrilateral in solving the problems. ● Apply their Understanding in solving Quiz on iknowit.com the concept of ● Apply their understanding to draw images on autodraw.com. ● Know and reason out that the machines can predict.	
Follow up Activities	● Ask students to make a chart with different figures showing Quadrilaterals ● Ask them to present to small groups. ● Let them assess how accurate they are in their presentations.	
Reflections	Discuss with students: ● How do you like the site – autodraw.com and iknowit.com? ● Do you know of any other tool/ app that can predict & draw? ● Would you be able to try this activity at home also	

GLOSSARY:

AI Related Terminology

Autodraw: 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 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://www.autodraw.com/

MATHEMATICS

CLASS 8

3.20 Visualizing Solid Shapes

PARAMETERS	DESCRIPTION	AI CONCEPTS INTEGRATED
Chapter Covered	**Chapter 10: Visualizing Solid Shapes**	
Name of the Book	**Mathematics, Class 8, NCERT**	
Subject and Artificial Intelligence Integrated	Understanding the concept of Different views of solid shapes using kuki chatbot	
Learning Objectives	● To understand the concept of solid shape ● Difference between solid and 3D shapes ● Different views of solid shapes using AI app	Kuki chatbot
Time Required	2 periods of 40 minutes each	
Classroom Arrangement	Seating arrangement - group of 3 each	
Material Required	Pen, paper, Black Board chalk, Laptops/ desktops/tabs and Internet connection.	
Pre – Preparation Activities	Ask students to see different solid shapes using Math- kit in the lab.	
Previous Knowledge	Students are able to recall about 2 D shapes in order to understand the difference between 2D and 3D shapes.	
Methodology	**Activity1** In lab students will able to differentiate between 2D and 3D shapes using Math - kit. **Activity2** Using AI app kuki chatbot to see the actual view of different solid shapes and learn to form their names using their bottom face shape. **Activity3** Students will solve their exercise 10.1	

Learning Outcomes	Student will able to learn about different solid shapes and how to name those on the basis of their bottom surface	
Follow up Activities	Ask the students to analyze the different view of real life objects. Ask the students to explore what other available AI applications can be used as a Rule Based AI App.	
Reflections	Discussion with Students on the role of AI application Any other AI application that can be used as an alternative.	

GLOSSARY:

AI Related Terminology

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/

MATHEMATICS

CLASS 8

3.21 Mensuration - Surface Area of Cube, Cuboids and Cylinder

PARAMETERS	DESCRIPTION	AI CONCEPTS INTEGRATED
Chapter Covered	**Chapter 11: Mensuration - Surface Area of Cube, Cuboid and Cylinder**	
Name of the Book	**Mathematics, Class 8, NCERT**	
Subject and Artificial Intelligence Integrated	Understanding the concept of Surface area of Cube, Cuboid , Cylinder using AI tool	
Learning Objectives	- To understand the concept of Total & Lateral Surface area of cube, cuboid and cylinder - To differentiate between Lateral & Total surface area of solid shapes - To deduce the formula of Total & Lateral Surface area of cube, cuboid and cylinder. - To Apply the concept of Surface area in real life situations - To develop the concept of 3D shapes and their surface area using AI tool	
Time Required	2 classes 40 min each	
Classroom Arrangement	Flexible	
Material Required	NCERT Class 8 Mathematics Textbook, notebook, Pen, Paper, Net of any old cuboidal box like toothpaste/cake, Desktop/Laptop and good internet connection Website: https://www.nctm.org/Classroom-Resources/Illuminations/Interactives/cubes/	
Pre – Preparation Activities	Students should collect old boxes of cake/ toothpaste and cut them with along edges to get the nets of cubes /cuboid Students will be advised to prepare a short video, using any app from the play store, showing a photo frame of cube in which the pics of memories with their family members will be visible on different faces of cube. (optional) Any Play Store app for cubical video making 3D photo frame cube live wallpaper/ 3D photo frame photo editor	
Previous Knowledge	Students should have previous knowledge of nets of cubes & cuboids	

Methodology	**Introduction:** Divide the class into four groups (1-10, 10-20 & so on) • One of groups is asked to paint all the 6 faces of cuboidal net brought by them. • Second group is asked to paint only 4 faces leaving top and bottom of the cuboidal net • Third group will be asked to paint all the three faces of cylindrical net • Fourth group will be asked to paint only the rectangle part of the cylindrical net leaving top & bottom. Now introduce them with the concept of total surface area and lateral surface area. Give a few real life examples like painting of four walls of a room, paint on a pipe etc. **Activity 1:** Students will be explained that the photo frame video which they prepared also pasted the pics selected by them on the surface of the cube, hence covered the total surface area of the cube. **Activity 2:** The above activity will help students to derive the formula of Total & lateral surface area of cuboid, cubes and cylinders **Activity 3 :** As the students have understood the concept of surface area , ask them to go on https://www.nctm.org/Classroom-Resources/Illuminations/Interactives/cubes/ 1) Once they land on the website, a cuboidal net will appear on the page, ask students to count the no of squares on all the faces this will give them value of surface area 2) Also ask them to look at the top left corner of the page, the length, width, height of the cuboid will be visible. Ask them to calculate the surface area using formulae and write the value in the box given in front of the surface area and click on the tick button and check whether the surface area is correct or not. Then click on the double arrow button in top right for the next net of cuboid. 3) Ask students to click on each of the face to check how the cuboid can be formed with the given net **Activity 4:** On the basis of their understanding of Surface area of Cubes, Cuboids and Cylinder students will be able to solve Ex11.3 in the chapter Mensuration.	https://www.nctm.org/Classroom-Resources/Illuminations/Interactives/cubes/
Learning Outcomes	● Students will understand the concept of Total & Lateral Surface area ● Students will deduce the formula of total & lateral surface area of solid shapes ● Students will understand the importance of AI tool in developing concept of 3D shapes ● Students will apply the concept of Surface area of 3D shapes in real life situations	
Follow up Activities	Ask the students to conduct a quiz on different real life situations where surface area of solids can be calculated. Discuss AI tools that helped them develop the concept of Surface area more easily and deeply	

GLOSSARY:

AI Related Terminology

The National Council of Teachers of Mathematics (NCTM) is Mathematics education organization in the world.

https://www.nctm.org/Classroom-Resources/Illuminations/Interactives/cubes/

AI Activity Description

- Once they land on the website, a cuboidal net will appear on the page, ask students to count the no of squares on all the faces this will give them value of surface area
- Also ask them to look at the top left corner of the page, the length , width, height of the cuboid will be visible. Ask them to calculate the surface area using formulae and write the value in the box given in front of the surface area and click on the tick button and check whether the surface area is correct or not.

Then click on the double arrow button in top right for the next net of cuboid.

- Ask students to click on each of the face to check how the cuboid can be formed with the given net

MATHEMATICS

CLASS 8

3.22 Introduction to Graphs

PARAMETERS	DESCRIPTION	AI CONCEPTS INTEGRATED
Chapter Covered	**Chapter 15: Introduction to Graphs**	
Name of the Book	**Mathematics, Class 8, NCERT**	
Subject and Artificial Intelligence Integrated	To understand the concept of Line graphs using AI project cycle process of Data Visualization.	

Learning Objectives	● To understand the concept of graphs.
	  - List the part of a graph.
	  - Application of graph.
	  - Visualization of graph.
	● To understand that line graph shows how two pieces of information are related and how data changes over time.
	● Visualization of graphs using AI tools- Data Visualization.
		Data Visualization http://datavizcatalogue.com

Time Required	2 periods of 40 minutes each.	
Classroom Arrangement	Flexible	
Material Required	Graph paper, pencil, scale, eraser, White Board. Laptops/ desktops and Internet connection.	
Pre – Preparation Activities	**Activity** The students will be asked to collect the data of population increases from 2011 - 2019 and observe the pattern.	
Previous Knowledge	The students are asked to recall the knowledge of the bar graph and circle graph. Some questions will be asked related to graphs.	

Methodology	**Activity 1** Ask students to think of graphs that they have seen in the real world. For what purposes were they used? Have students hunt for e.g. in books, in magazines, on the internet, newspapers etc. **Activity 2** ● Display the image of the line graph using AI tool Data visualization. ● Ask the students to share something about the line graph. Some guiding questions would be" what coordinate axis actually represents here? ● Once students touch on the idea about the variation of line in coordinate plane, introduce how data changes continuously over a period of time? ● Ask the students to apply their understanding and solve the exercises.	
Learning Outcome	Upon completion of this lesson, students will be able to ● List and Identify the parts of a graph ○ Cartesian plane, ○ Plotting of point ○ Construction of graph ● Discuss the purpose of each part of a graph. ● Visualize the graph using an datavizcatalogue.com ● Line graphs are used to analyze the nature of change in quantities.	Data Visualization. https://datavizcatalo gue.com
Follow up Activities	● Tell students to find out their math test marks of the last month. ● Represent marks in terms of graph. ● See their progress using AI tool Data visualization. Let them assess how accurate they are in their presentation.	

GLOSSARY:

AI Related Terminology

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

MATHEMATICS

CLASS 8

3.23 Linear Equations in one Variable

PARAMETERS	DESCRIPTION	AI CONCEPTS INTEGRATED
Chapter Covered	**Chapter 2: Linear Equations in One Variable**	
Name of the Book	**Mathematics, Class 8, NCERT**	
Subject and Artificial Intelligence Integrated	Understanding the concept of Linear equations in one variable using 'Uber App' AI Applications and 'Swiggy Food Graph'	Using **data analytics**
Learning Objectives	- To understand the concept of Linear equation in one variable - To be able to solve equations. - To be able to set up equation based on real life situations - To be able to solve the equations based on day to day life experiences.	
Time Required	5 Periods of 40 minutes each	
Classroom Arrangement	Flexible	
Material Required	Pen, paper, Black board chalk, Laptop/desktops and Internet connection	
Pre – Preparation Activities	First, Teacher gives a picture related to linear equation and the students are asked to think and give the answer Second, teacher gives the chance to the students to make a linear equation **x + 2 = 4** Third, the students work by themselves to determine the variable x in the give equation **x + 2 -2 = 4 - 2** **x = 2**	
Previous Knowledge	The students are made to recall about constants, variables and algebraic equations in order to understand the concept of linear equation in one variable An introductory video will be shown to the students to recall how to solve the equation. https://youtu.be/lN20VrPmxdk	

Methodology	**Activity 1** The teacher will introduce the concept of linear equations with the help the activity The entire class will be divided into groups. Each group will be given some pebbles, matchsticks to demonstrate a linear equation in one variable. Then, they will be asked to solve it by rearranging the pebbles and matchsticks Later each group will be advised to demonstrate the equation mathematically and write the solution. **Activity 2- Real life Problem Solving** Discuss to make students understand the linear equations by taking some real life examples. i) Age related problems ii) Perimeter and dimensions iii) Money/denominations iv) work and time The students will understand the problem, Interpret it, frame the equation and solve it. **Activity 3- Equality Explorer** https://images.app.goo.gl/tyXheeyTnZEbqJvd8 **Activity 4- Practical Activity** Ask the students to apply their understanding of solving linear equations to attempt questions of Ex2.1, 2.2, 2.3, 2.4 from the exercise in the chapter.	
Learning Outcomes	● The students understand the concept of linear equation in two variables· ● The students understand the term constants, variables and algebraic equations ● The students will be able to successfully solve the linear equations ● The students will be able to interpret the word problems and be able to frame and solve the equations	
Follow up Activities	● The students will be divided into groups and asked to make 'Tarsia Puzzle' in which each group has to demonstrate the linear equations and their solutions in the form of Jigsaw puzzle ● Students will be asked to research how linear equations (Linear programming) plays an important role in other fields of sciences and industries.	
Reflections	Ask the students to explore what other available AI applications can be used to integrate linear equations	

GLOSSARY:

AI Related Terminology

Swiggy Plans Food Graph to Enhance Customer Experience

Food delivery giants Zomato and Swiggy are increasingly turning to artificial intelligence (AI) and machine learning (ML) to drive growth amid increasing protests by restaurants in the so-called Logout campaign. Leveraging this, Swiggy is currently building a concept called "food graph" which breaks down a food dish by recipe, cooking style, ingredients used, calorie value, and variations of the dish.

The food delivery major will then combine the food graph with a customer's previous food preferences using **data analytics** to derive a personalized restaurant feed for each user. The list of restaurants will thus be according to the user's taste and preferences, and not just their location.

Data analytics is majorly aimed at reducing wait time for consumers. However, how such data will actually help Indian consumers, who are known to be unique in their choices and have varied taste palates is yet to be seen

MATHEMATICS

CLASS 8

3.24 Data Handling - Probability

PARAMETERS	DESCRIPTION	AI CONCEPTS INTEGRATED
Chapter Covered	**Chapter 5: Data Handling - Probability**	
Name of the Book	**Mathematics, Class 8, NCERT**	
Subject and Artificial Intelligence Integrated	Understanding the concept of Probability and apply to the real life situation • AI – Rock Paper Scissors, • Quiz, • Video Games	
Learning Objectives	• To define probability • To differentiate between sure event and impossible event • To derive formulas for calculating Probability • To calculate the probability for a defined event • To experiment with the probability in real life situation	
Time Required	2 periods of 40 minutes each	
Classroom Arrangement	Flexible and Open Discussion arrangement	
Material Required	Pen, Paper, White Board, Markers, Laptop, Internet Connection	
Pre – Preparation Activities	• Students will be asked to recall the basic terms – Event, Favourable outcomes, Total outcomes, Sure event, Impossible event • Students will also be introduced to AI based game of Rock, Paper & Scissors	https://www.afiniti.com/corporate/rock-paper-scissors
Previous Knowledge	Questioning will be used to check students previous knowledge in the form of Quiz	
Methodology	**Activity-1** : Rock, Paper, Scissors – Students will be asked to play the game of Rock, Paper, Scissors online and note down the note the total number of chances they have played, number of times they have won, number of times they have lost and number of times it was a tie. They will be then asked to find the probability for all situation by applying the formula of Probability. **Activity-2**: Playing Cards Game: It is probability game as a whole class. This game pits the teacher against the whole class. Students first choose a suit, either heart, diamond, club, or spade. Then, you let them choose a card. If they get a card with the suit they guessed they get a point. If they don't match the suit, then the teacher gets a point. You repeat this 10 times. **Activity-3**: Video Game Activity: Students will be asked to search the video games in which they can see the maximum use of Probability. Students can be motivated to create their own game which involves Probability using the unity game maker or scratch or any video game maker app. **Activity-4:** Quiz Activity : Students will be asked to search quiz or they will be motivated to create their own quiz which involves questions based on Probability.	https://www.afiniti.com/corporate/rock-paper-scissors

	Activity-5: Problem Solving Activity: Students will be using the formula of Probability to find the Probability in the real life problems of NCERT exercises.	
Learning Outcomes	Students will be able to • Calculate the probability of a defined event • Solve real life word problems involving Probability of an event.	
Follow up Activities	• Peer assessment: Asking questions to each other in pairs and using peer tutoring. • Flip teaching • Google form	

GLOSSARY:

AI Related Terminology

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

MATHEMATICS

CLASS 9

3.25 Probability

PARAMETERS	DESCRIPTION	AI CONCEPTS INTEGRATED
Chapter Covered	**Chapter 15: Probability**	
Name of the book	**Mathematics, Class 9 NCERT**	
Subject and Artificial Intelligence Integrated	Understanding the concept of Probability using AI Games.	
Objectives	● To understand concept of probability. ● To determine the outcome of probability using an AI Game. ● To understand the terms Experiment, Event and Outcome with regard to probability. ● To know how to calculate the Experimental Probability of any event. ● To understand why probability ranges between 0 to 1. ● To apply the concept of probability in real life situations.	https://www.afiniti.com/corporate/rock-paper-scissors
Time Required	2 periods of 40 minutes each	
Classroom Arrangement	Flexible	
Material Required	Pen, paper, Black Board chalk, Laptops and Internet connections.	
Pre- Preparation Activity	The Students will be asked to bring a number of coins, dice and packs of playing cards from their home, one day in advance.	
Previous Knowledge	The students are given an idea regarding terms of Probability: Experiment, Event and Outcome. They will be made to do different activities like Tossing a coin, throwing a dice and drawing a card from a pack of playing cards.	
Introduction	Based on the above mentioned activities students will get familiar with the basic terms of Probability- Experiment, Event and Outcome.	
Methodology	**Activity I:** students are divided into groups of two (pairs) and asked to play the AI Game: Rock, Paper and scissors in order to predict the probability of the desired outcome. **Activity II:** students are asked to perform different activities in their respective groups and make a record of the outcome: ● Tossing a coin and finding out the probability of getting Heads vs Tails. ● Throwing a Dice to find out the probability of getting an odd number. ● Getting a Queen from a pack of playing cards…. Etc. **Activity III: Practice Activity** Ask students to apply their understanding of Probability to attempt questions of 15.1.	https://www.afiniti.com/corporate/rock-paper-scissors
Discussion on the Text/ Activity	There is an open discussion on the occurrence of the experiment and the desired outcome of it. The students would be able to apply the concept understood in determining the Experimental Probability: **P(E)= Number of Favorable (Desired) Outcomes** **Total number of all possible outcomes of the experiment**	

Learning Outcomes	• The students understand the concept of probability. • The students understand the terms Experiment, Event and Outcome with regard to probability. • The students will be able to calculate the Experimental Probability of any event. • The students understand why probability ranges between 0 to 1. • The students will be able to apply the concept of probability in real life situations.	
Self-Evaluation and Follow-Up Activity	The students will be asked to observe and record the occurrence of different events at their home or surroundings with respect to probability. The teachers evaluate students' discussion and presentation on understanding concepts of Probability.	

GLOSSARY:

AI Related Terminologies

Rock, Paper Scissors: This rock-paper-scissors game illustrates the basic principles of an 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.

AI Activity Description

Rock-Paper-Scissors: Ask the students to go on the link: https://www.afiniti.com/corporate/rock-paper-scissors and click on play the game.

As soon as they land up in the game arena, they would 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. Remember that the hand at the left the human's hand while the one on the right side is of AI. As soon as the student makes a move, the AI also randomly selects one out of the three and according to the conventional rules, one would 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 20 rounds of the game and keep checking the scores.

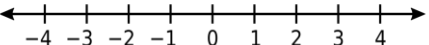Students will be able to identify how the AI-enabled machine is taking our choices as data to train itself in such a way that it can predict our future moves and can win against us. Ask the students to try the following:

• Try changing their moves randomly and observe how the machine copes with it.
• Try making the same move at least 7 times and then changing it abruptly. How does the machine react to it?

MATHEMATICS

CLASS 9

3.26 Coordinate Geometry

PARAMETERS	DESCRIPTION	AI CONCEPTS INTEGRATED
Chapter Covered	**Chapter 3: Coordinate Geometry**	
Name of the Book	**Mathematics, Class 9, NCERT**	
Subject and Artificial Intelligence Integrated	Understanding the concept of Coordinate Geometry. Using Geogebra and Google Maps.	Google Maps
Learning Objectives	The students will able to ● To explore the idea of location of an object with a frame of reference. ● Understand the elements of the Cartesian system i.e. x-axis, y-axis, origin, quadrants. ● To find a point in any quadrants with reference to x-axis and y-axis. ● The students will understand the concept of Coordinate Geometry using the Google AI App. ● To solve the real life problems of coordinate geometry.	
Time Required	3 period of 40 minutes each	
Classroom Arrangement	Flexible	
Material Required	Internet connection, laptop / desktop / smartphone, Graph Paper, Pen, paper.	
Pre – Preparation Activities	The Students will be asked to locate points on the Number Line on the graph.	
Previous Knowledge	The students will be made to recall about ● Knowledge of how to locate a point on the number line. ● Basic knowledge of x-axis and y- axis. ● Using (AI) demos basic knowledge of x-axis and y-axis will be checked. ● Also knowledge of how to locate a point on the number line will be checked. Students will use the Geogebra to locate points on the Number Line. https://www.geogebra.org/classic	
Methodology	Strategy Used: Brainstorming Brainstorming on the previous knowledge would be checked using mentimeter. Motivation:	

	Motivate the students by explaining the importance of Coordinate geometry day to day life. Use of coordinates and coordinate geometry in Google maps to calculate shortest distance between two destination points. Recapitulation: Oral test of basic concepts discussed in the class. Activity-1 seating Plan given in the NCERT Textbook will be discussed. Discussion of the topic through Collaborative Learning (Inductive Method) Guided Practice: Students will be given questions from the Textbook. Independent Practice: Students would Practice the given questions for Homework Closer: MCQ based test will be taken on Google forms/MS forms. Activity II: Practice Activity students will apply their understanding of Coordinate Geometry to attempt the questions of NCERT Textbook.	Google Maps https://maps.google.co.in
Learning Outcomes	● At the end of the topic, students will be able to: ● Demonstrate their knowledge by locating an object with a frame of reference. ● Describe the elements of the Cartesian plane ● Identify the x-axis and y-axis of any point on ● Cartesian plane ● Analyze the position of any point on the Cartesian system. ● Apply the concept of coordinate geometry in real life situations.	
Follow up Activities	Students will find a hidden picture by plotting and joining the various points with given coordinates in a Cartesian plane through an activity in Geogebra. https://www.geogebra.org/classic Home assignment: Crossword puzzles based on discussed topics in the class will be given.	
Reflections	● Ask the students to analyze the real-life problems in their daily life and apply the concept of Coordinate Geometry. ● Discussion with Students on the role of AI application: Ask and take feedback on the scope of the AI tools used and any problems they encountered while using the AI tool. ● Any other AI application that can be used as an alternative.	

GLOSSARY:

AI Related Terminology

Google Maps: You can find coordinates on Google Maps to give you the exact positioning (the latitude and longitude) of any location. It's easy to find coordinates on Google Maps on your phone or computer, and you can copy and paste your coordinates to share a precise location with others
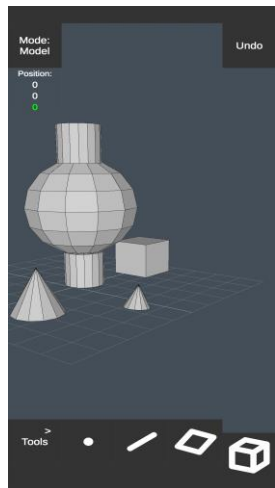
The coordinates of a point are a pair of numbers that define its exact location on a two-dimensional plane. Recall that the coordinate plane has two axes at right angles to each other, called the x and y axis. The coordinates of a given point represent how far along each axis the point is located.

https://maps.google.co.in

MATHEMATICS

CLASS 9

3.27 Surface Areas and Volume

PARAMETERS	DESCRIPTION	AI CONCEPTS INTEGRATED
Chapter Covered	**Chapter 13: Surface Areas and Volumes**	
Name of the book	**Mathematics, Class 9, NCERT**	
Subject and Artificial Intelligence Integration	Understanding the concept of surface area of solids: cube, cuboid, right circular cylinder and right circular cone using AI.	
Objectives	- To understand the concept of surface area. - To derive formulas for calculating surface area of given solids using their nets. - To calculate the surface area of cube and cuboid using their formula. - To calculate the curved surface area of cylinder and cone using their formula. - To calculate the total surface area of cylinder and cone using their formula. - To estimate the surface area of different prisms.	
Time Required	4 sessions of 40 minutes each	
Classroom Management	Flexible	
Material Required	Pen, Paper, White Board, Markers, Laptop, Internet Connection.	
Pre-preparation Activity	Students will be asked to recall all 2D shapes using Autodraw and their area and perimeter. Making of 3D shapes with the nets.	Autodraw https://autodraw.com
Previous knowledge	Questioning will be used to check students' previous knowledge in the form of a quiz.	

Methodology	Activity-1: Identifying Solids from Their Nets and Finding Their Surface Area: Students will be divided into groups of 4 or 5 and each student will make cube, cuboid, cylinder and cone using paper folding and cutting. They will then open and see the nets of each and find the area of the all 2D shapes obtained. Adding the area of all shapes of a given net of solid, they will arrive at the formula of surface area of that solid under the guidance of their teacher. **Exploring Nets of Solids**: Cube: https://www.geogebra.org/m/pCv2EvwD Cone: https://www.geogebra.org/m/knvtp9KK Cylinder: https://www.geogebra.org/m/WwTVKuVe Activity-2: Students will be working in pairs with their partners in computer lab and individually at their home to understand the formulae of surface area of solids by using Geogebra tool wherein they can change measurements of the dimensions and explore the corresponding change in their SA. This will help them to understand change in SA in problems related to increase and decrease of dimensions. Activity-3: Model making: Students will be divided into groups of 4 or 5 and they have to create a model which includes all solids discussed USING 3D MODELING APP. It can be a classroom scene, factory model, colony/society model, temple, galaxy model....etc. and will have to explain the need and use of the solids used to create it. Activity-4: Students will be using the formula derived for the SA of solids to find the surface area of objects in the real life problems of NCERT exercises and the assignments given. Activity-5: Research on shapes of beaker, test Tube, conical flask & gas cylinders: Students will do research in the use of various laboratory equipment and their shapes. They will identify the combination of solids used and will research on why beakers and test tubes are generally cylindrical but flasks are conical at the bottom and has cylindrical neck? Also, students will also do research on why gas cylinders and boilers are cylindrical in shape?	
Discussion on the Text	Open discussion on all new terms related to Surface Area: Lateral/Curved Surface Area, Total Surface Area, Cuboid, Cube, right circular cylinder, Right circular Cone, Right circular Cone, Slant Height.	
Learning Outcomes	Students will be able to ● Calculate the surface area of given solids. ● Solve real life word problems involving finding surface area of the solids done. ● Estimate the change in surface area due to change in their dimensions.	

| Self-Evaluation and Follow up | Teacher will observe students work and give individual feedback. Also, models made and research done will be assessed.
Peer assessment: Asking questions to each other in pairs and peer tutoring wherever required.
Flip teaching
Worksheets/Assignments | |

GLOSSARY:

AI Related Terminology

Autodraw: 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 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

MATHEMATICS

CLASS 9

3.28 Circles

PARAMETERS	DESCRIPTION	AI CONCEPTS INTEGRATED
Chapter Covered	**Chapter 10: Circles**	
Name of the Book	**Mathematics, Class 9, NCERT**	
Subject and Artificial Intelligence Integrated	Understanding the concept of Circles and integrating art and math with artificial intelligence	
Learning Objectives	● To understand the concept of Circles ● To discover the relationship between angles subtended by the equal chords at the center. ● To prove the theorem using triangle properties. ● To apply the theorem in solving problems.	AutoDraw https://goart.foto r.com/
Time Required	2 periods of 40 minutes each	
Classroom Arrangement	Flexible	
Material Required	Pen, paper, Black Board chalk, scissors, glue, cardboard, geometry box, Laptops/ desktops and Internet connection.	
Pre – Preparation Activities	Students will be asked to recall the circle shape, draw it and its related terms radius, diameter, chord etc. using https://www.autodraw.com/ and then see how many objects can you find showing the circle's terms they already know	https://www.auto draw.com/
Previous Knowledge	Introduce the angle subtended by a chord at a point in a circle. Ask the children to draw a circle and any two chords and measure the angles made by them at the center.	
Methodology	**Activity 1:** Ask students to paste a white paper on the cardboard and draw a circle with center O on this paper. Now make two equal chords on a circle using compasses. Joining end points of both the chords they will get 2 triangles. Trace one of the triangles on the tracing paper. Place this obtained triangle on the other triangle such that the chords overlap. They will observe that both triangles completely overlap. Thus both triangles are congruent and angle subtended by both angles are equal. Thus equal chords subtend equal angles at the center. **Activity 2:** Proof of theorem will be explained to the students. **Activity 3:** Ask students whether the converse is also true. Find by following the above procedure but this time they will make equal angles not equal chords. **Activity 4:** Ask students to apply their understanding of theorem to attempt questions of Exercise 10.2.	

Learning Outcomes	• The students will understand the concept of Circles. • The students will discover the relationship between angles subtended by the chords at the centre. • The students will be able to prove the theorem using triangle properties. • The students will apply the theorem in solving problems.	
Follow up Activities	**Activity:** Ask students to go to https://goart.fotor.com/ Create a beautiful art by uploading a photo of a circle showing angles made by equal chords at the centre and applying different art styles with this AI image generator. It uses an algorithm inspired by the human brain. It uses the stylistic elements of one image to draw the content of another. **Activity** Ask students to make a model showing the above theorem. Ask them to present to small groups. Let them assess how correct they are in their presentations	https://goart.fotor.com/
Reflections	Teacher will see how well the students are able to capture the concept and gain confidence while presenting their model. Teacher will discuss with students- • How do you like the AI tool? • Do you know any other tool that you can use in your concept? • Try using the tools at home.	

GLOSSARY:

AI Related Terminology

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/

AI Activity Description

Create a beautiful art by uploading a photo of a circle showing angles made by equal chords at the center and applying different art styles with this AI image generator.

Autodraw: 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 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

MATHEMATICS

CLASS 9

3.29 Statistics - Understanding Frequency Table

PARAMETERS	DESCRIPTION	AI CONCEPTS INTEGRATED
Chapter Covered	**Chapter 14: Statistics - Understanding Frequency Table**	
Name of the Book	**Mathematics, Class 9, NCERT**	
Subject and Artificial Intelligence Integrated	Analyzing the frequency tables using AI Tools. (Statistical Data).	
Learning Objectives	Students will able to ● Prepare and use the frequency tables. ● Analyze the frequency tables.	Rock, Paper & Scissors https://www.afiniti.com/corporate/rock-paper-scissors
Time Required	2 periods of 40 minutes each	
Classroom Arrangement	Seating arrangement -In pairs for both the sessions.	
Material Required	Pen, paper, Laptops/ desktops/ Tabs and Internet connection.	
Pre – Preparation Activities	● Students will be asked to look at some frequency tables in the handouts. ● Students will be asked a few questions based on the frequency tables. Like: What is the info given in the table? How many….. What is the Highest/Lowest?	
Previous Knowledge	Preparing a frequency table and reading it.	
Methodology	After a preliminary round of pre -knowledge testing, students will be guided to play the Markov Data Game. Students, Play Rock, Paper, Scissors with the evil Dr. Markov to save the dog. A video will be shown for the guidelines. https://www.youtube.com/watch?v=sjHCbms8NIE Students will play the game: https://codap.concord.org/releases/latest/static/dg/en/cert/index.html?di=https://concord-consortium.github.io/codap-data-interactives//Markov/index.html While playing the games the students will be asked to make a list of their moves and the Markov's moves. After round 1, they will be asked to prepare the frequency tables for their moves and try to analyze the same. Video 2 will be shown: https://www.youtube.com/watch?v=t9c_Y_TLPjw Now the students will be in a better position to win the game and save the dog.	Rock, Paper & Scissors https://www.afiniti.com/corporate/rock-paper-scissors

Learning Outcomes	Students prepared the tables with the data collected while playing the game. They analyzed the data in tables and won the game.	

Follow up Activities	The following worksheet will be shared.
	<u>Markov Student Worksheet</u>
	● Students may be asked to search and share more such games either online or offline.
	● Same tables can be later used to draw bar graphs.
	● We can collect data of win or loss from all pairs and it can be used to:
	   - Create discrete or grouped tables.
	   - Calculate the measures of central tendency: mean/median or mode.	

Reflections	● Markov uses a different strategy on each new level, but his strategy remains consistent throughout each game played on a single level. ● There is increasing variability in Markov's moves as the student progresses through the levels, which makes it more challenging to win. ● Discussion of the students' responses in the worksheet.	

GLOSSARY:

AI Related Terminology

Rock, Paper & Scissors: In this game, an 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 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

MATHEMATICS

CLASS 9

3.30 Statistics - Understanding the Concept of Data Handling

PARAMETERS	DESCRIPTION	AI CONCEPTS INTEGRATED
Chapter Covered	**Chapter 14 Statistics - Understanding the Concept of Data Handling**	
Name of the Book	**Mathematics, Class 9, NCERT**	
Subject and Artificial Intelligence Integrated	Understanding the concept of data handling using AI Experiential applications	
Learning Objectives	To understand the concept of representing data in the form of various graphs. To understand the process of Data Handling: • Sources of data • Data Acquisition • Exploration To understand the process of Data Handling in real life situations using AI project cycle process of Data Acquisition.	
Time Required	2 periods of 40 minutes each.	
Classroom Arrangement	Flexible	
Material Required	Pen, paper, black board, chalk, Laptop/Desktop, and internet connections.	
Pre – Preparation Activities	The students are divided into three groups and asked to collect information on AQI. (pollution level)	
Previous Knowledge	The students should know the terms like average, range, median, and mode.	
Methodology	Divide the class into two teams Activity 1- Different types of graphs Ask the students to collect data in different types of graphs. Activity 2- Ask the students to collect and compare data on Fine Particulate Matter PM2.5 across SAFAR cities Ask the students to observe and write the activities that pollute the environment. Activity 3- Ask the students to collect the data on temperature and humidity and deduce the correlation between them. Activity 4- To make a chart on the weather forecast using http://safar.tropmet.res.in/ The students would be able to understand that using AI and past data, the weather forecasts are done.	Data Acquisition Data Exploration https://datavizcatalogue.com/

	Ask the students to draw and compare AQI of various cities of the world. Activity 5: To check which graph is suited for such type of data https://datavizcatalogue.com/	
Learning Outcomes	The students will ● Understand the importance of data collection in real life ● Appreciate the importance of data analysis and forecasting using AI. ● Develop skills of factual representation of data using AI ● Be able to interpret various graphs	
Follow up Activities	Ask students to make a presentation Stating facts and using pictorial representation of Data collected and analyzed.	
Reflections	Discussion with Students: How do you like the site http://safar.tropmet.res.in/? Try to analyze the data of past 10 years of a place. Observe the climate change. How AI and machine learning are transforming weather forecasting. Do you know of any other tool/app that can help you to access data?	

GLOSSARY:

AI Related Terminology

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

Data Exploration: https://datavizcatalogue.com

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.

MATHEMATICS

CLASS 9

3.31 Quadrilaterals

PARAMETERS	DESCRIPTION	AI CONCEPTS INTEGRATED
Chapter Covered	**Chapter 8: Quadrilaterals**	
Name of the Book	**Mathematics Text book for Class 9**	
Subject and Artificial Intelligence Integrated	To understand the concept of Quadrilaterals using AI tools.	

Learning Objectives	● To understand the concept of Quadrilaterals.
	  - Quadrilaterals
	  - Angle sum property of a quadrilateral
	  - Types of Quadrilaterals
	● Visualization of Quadrilaterals using AI tool Autodraw.
		Autodraw https://autodraw.com

Time Required	2 periods of 40 minutes each.	
Classroom Arrangement	Flexible	
Material Required	Scrapbook, paper, pencil, scale, scissor, eraser, White Board. Laptops/Desktops and Internet connection.	
Pre – Preparation Activities	**Play the game -** Ask the students to collect the sticks: Thirteen sticks of 6cm, one stick of 8 cm, 7 cm and 12cm each in length. Using the sticks, construct: ● Quadrilateral with two pairs of parallel sides. ● Quadrilateral with four right angles. ● Quadrilateral with four congruent sides. ● Quadrilateral with exactly one pair of parallel sides.	
Previous Knowledge	● The students are asked to recall the knowledge of parallel lines, perpendicular lines, triangles, rectangle, and square. ● List the objects of quadrilateral shapes they faced in daily - life. ● Some questions will be asked related to quadrilaterals.	

Methodology	● Ask students to go to www.kahoot.it Teacher will create the quiz on www.create.kahoot.it Ask the students to play the quiz, this will access previous knowledge about the topic. The Teacher would get results instantly and they can assess the students. The students will be divided into four groups. The teacher will provide each group with materials needed, each group will do the activity Activity 1. ● Ask students to take a scrap book and cut into two congruent triangles and join them in such a way that they form a 4 sided closed figure. ● As they got the idea of a four sided closed figure introduced the term quadrilateral. ● Make perfect quadrilaterals with the help of AI tool Autodraw and ask students to do the same thing. Activity, ask the students to go to http://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 student to draw any quadrilateral shape ● Ask students to go to https://ncase.me/loopy/ once they land on this activity, introduce the concept of similar factors and dissimilar factors of various forms of quadrilateral with the parallelogram .And then explain all properties of parallelogram and interrelation of parallelogram with many forms of quadrilateral. ● Ask students to solve the exercises	http://autodraw.com
Learning Outcome	Upon completion of the lesson , they are able ● To identify the all types of Quadrilateral ● To understand angle sum property of Quadrilateral ● Properties of parallelogram ● Properties of other quadrilaterals ● Visualization of interconnection of various quadrilaterals with parallelogram using AI tool loopy. ● Visualization of Quadrilaterals using AI tools- Autodraw	Autodraw.com
Follow up Activities	Make a table with the headings - know, want to know and learn about the quadrilaterals using fontjoy- an AI element. ● Students will be divided into four groups. Students will construct their own desired structures such as houses, schools and churches applying the idea of quadrilateral around The World. The students output will be assessed using constructed rubrics. ● Students would create their own quiz on www.create.kahoot.it and play with their friends.	

GLOSSARY:

AI Related Terminology

Autodraw: 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 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

MATHEMATICS

CLASS 9

3.32 Linear Equations in Two Variables

PARAMETERS	DESCRIPTION	AI CONCEPTS INTEGRATED
Chapter Covered	**Chapter 4: Linear Equation in Two Variables**	
Name of the Book	**Mathematics, Class 9, NCERT**	
Subject and Artificial Intelligence Integrated	Understanding the concept of Linear equations in two variables **Introductory video:** https://www.youtube.com/watch?v=vcPLmof6Gr0 Geogebra AI Applications How google map and Uber app are interconnected.	
Learning Objectives	To understand concept of Linear equation of 2 variables https://nroer.gov.in/55ab34ff81fccb4f1d806025/searchresults/?search_text=linear+equations+in+two+variables#results To understand concept of Framing of equations in two variables To find the solutions Represent graphically linear equation in two variable on graph paper. Students can practice of graph in Geogebra of different equations.	
Time Required	5 periods of 40 minutes each	
Classroom Arrangement	Flexible	
Material Required	Pen, paper, Black Board chalk, Graph paper Laptops and Internet connection	
Pre – Preparation Activities	Students will asked to arrange graph paper one day prior·	
Previous Knowledge	Students are given an idea of linear equations in one variable and its graph representation in class VIII	
Methodology	**Activity 1.** Teacher will assign the task in groups to the students Each group will create word problems by their own based on Linear equation in two variables and then they will plot the graph on graph paper. **Activity II:** Practice Activity Ask students to apply their understanding of Linear equations in two variables in solving ex 4.1 to ex 4.3. **Activity III** The points of intersection of two graphs represent common solutions to both equations. https://www.youtube.com/watch?v=75m60SxFfJg **Activity IV**: At the End of the chapter students were asked to gather a information on Uber or OLA App. How AI works in these apps. How these app calculating Distance And total Fare.	Google map, Uber App https://maps.google.co.in

Learning Outcomes	Students will understand concept of Linear equation of 2 variables Students will able to frame of equations in two variables. They will able to find the solutions. Students will able to Represent linear equation in two variable on graph paper. Students will able to draw graph of different linear equations in two variables in Geogebra	
Follow up Activities	Students will give the presentation in groups and teacher will give their inputs. In this way teacher will evaluate students' task in groups.	
Reflections	Ask the students to explore more AI based applications app. Where linear equations has used. Explore different app like Arogya app (predicting infectious people) Swiggy app. Zomato App.	

GLOSSARY:

AI Related Terminology

How Uber works: the technology stack
First, you let Uber know that you need a ride. Then, Uber asks you where you are. Next, Uber finds a nearby driver and tells you when this driver will arrive to pick you up. After your ride is over, Uber asks you how it went. You rate the ride and the cost is automatically charged to your credit card.

Identifying a device's location
The Uber app for iOS uses the Core Location framework to locate a user's device. The Core Location framework provides classes and protocols to configure and schedule location delivery and send location events to the server. The Core Location framework also lets Uber define geographic regions and monitor a device's movements as it crosses defined boundaries.

Geo location for the Android version of the Uber app was implemented using Google's Location APIs. They can intelligently manage underlying location technology while meeting various development needs when implementing location-based features.

Integrating with mapping software
Uber didn't go it alone with maps and did what you would expect any location-based service to do — implemented Google Maps for both iPhone and Android versions of their app. Now, Google Maps offers integration with Uber. But Google Maps isn't the only service that Uber uses. To avoid paying Google for access to their solutions, Uber buys mapping technology companies to solve their logistics issues. And why wouldn't they? After all, Uber wants to be the global king of "local logistics and delivery of people and things. "Geo location is indeed the most important technology in Uber's technology stack. But you might be interested in other functionalities as well if you want to know how to build an app like Uber.

Implementation
First, to illustrate the problem, we start with a problem that only involves four drivers and four pick-ups in the area. For this problem we assume that the waiting time vary, in integers, between 1 and 30 minutes. In reality it's pretty rare that a rider has to wait more than 10 minutes for the Ubers to arrive. We should keep in mind that waiting times would fluctuate depending on area, supply of drivers and pick-up demands, and so might not be 'random'.
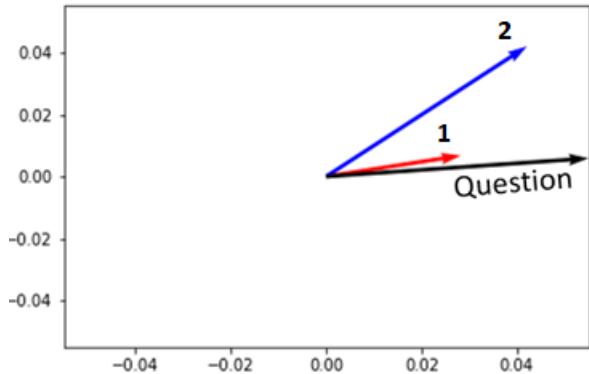
Based on these assumptions, we generated random data to populate the cost matrix. We then number the drivers 1–4 and the riders 5–8 (or, more generally, first half of vertices as drivers and second half as riders) to construct either matrices or lists of start nodes and end nodes as inputs to the implementation.

MATHEMATICS

CLASS 10

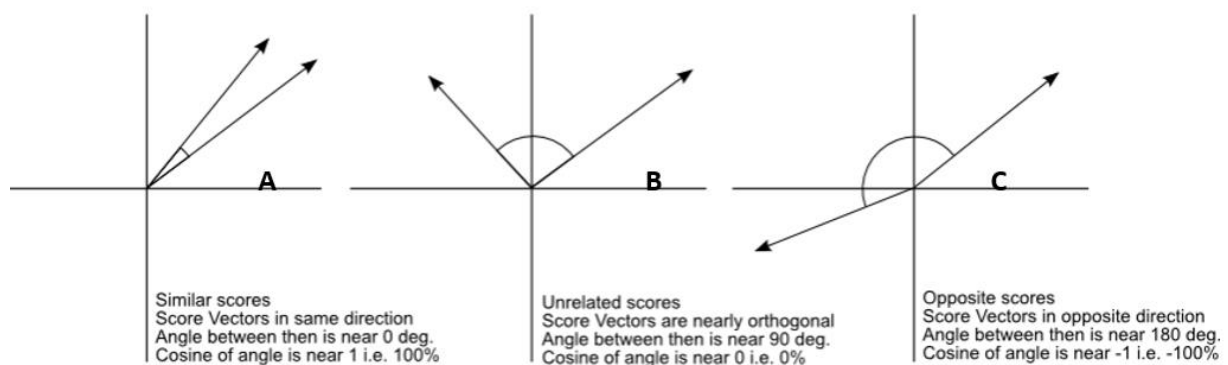### 3.33 Introduction to Trigonometry - Concept of Trigonometry

PARAMETERS	DESCRIPTION	AI CONCEPTS INTEGRATED
Chapter Covered	**Chapter 8: Introduction to Trigonometry - Concept of Trigonometry**	
Name of the book	**Mathematics, Class 10, NCERT**	
Subject and Artificial Intelligence Integrated	Understanding the concept of Trigonometry and identities using Cosine Similarities.	
Objectives	- To understand the concept of Trigonometry. - To understand about the trigonometric ratios of an acute angle in a right-angle triangle. - To understand the trigonometric ratios of complementary angles - To understand the trigonometric ratios of specifics angles such as 0, 30, 45, 60 and 90. - To study about different Trigonometric Identities.	Cosine Similarity
Time Required	3 periods of 40 minutes each	
Classroom Arrangement	Flexible	
Material Required	Pen, paper, Black Board chalk, Laptops and Internet connections.	
Pre- Preparation Activity	The Students will be asked to recall the Pythagoras Theorem. Introduce the Angle of elevation and the angle of depression using some practical examples.	
Previous Knowledge	The students are given an idea how a right-angled triangle can be imagined to be formed and used to calculate heights and distances with the help of trigonometry in these situations.	
Introduction	The teacher will explain the concept of Trigonometry and talk briefly about its history and usage in order to make the students understand about its real-life applications in constructing buildings, optics and statistics.	
Methodology	**The class is divided into two teams.** **Activity I: Flash card Activity:** Students are shown flash cards with an image of a right-angled triangle on every card and some questions regarding calculation of its trigonometric ratios. The team members will discuss among themselves and answer the questions. **Activity II: Grid Activity** Ask students to create a grid with angles and Trigonometry ratios. They will be able to write the values of different ratios of specific angles. The students will be able to solve the questions using Trigonometric Ratio and Trigonometric Ratio of Complementary Angles. **Activity III: Trigonometric Identities** Ask students to prepare a chart on Trigonometric ratios. They will be told that an equation involving different trigonometric ratios to an angle is called Trigonometric Identities. **Activity IV: Practice Activity** Ask students to apply their understanding of Trigonometry to attempt questions of 8.1, 8.2 and 8.3 **Activity V: Understanding Cosine Similarity**	

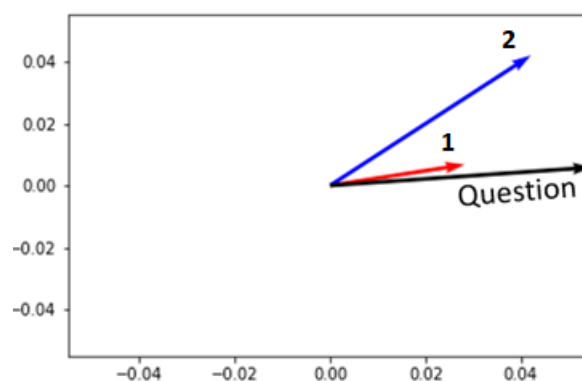| | With the help of the knowledge of trigonometric functions and terminologies, students will be able to understand the concept of Cosine Similarity. Give the students three statements:
• Mira is my mother.
• Jai is my father.
• Who is my mother?
 Now the students have to observe these statements and figure out which statement out of the first two is closer to the third statement in terms of the words used?

 Now, as they select the first statement to be closer, the concept of cosine similarity will be explained to them in which the sentences are taken as vectors having amplitude and direction. These sentences are then visually plotted in a 2D plane in such a way that all have the same origin. Now, to check which statement is closest to the question, we check the cosine angle between all the statements. The statement having minimum cosine angle with the question is considered to be the most similar statement to the question. This concept is known as cosine similarity.

 As shown in the diagram, three vectors have been plotted on a 2D map where the red, blue and black arrows depict statement 1, 2 and 3 respectively. Since statement 1 is more similar to the question, the angle between these two statements is less while statement 2's angle is more with the question. This shows how different the two statements are. | |
Discussion on the Text/ Activity	There is an open discussion and presentation on: • Trigonometry • Trigonometric Ratios. • Trigonometric Identities.	
Learning Outcomes	• The students will understand the concept of Trigonometry. • The students will understand about the trigonometric ratios of an acute angle in a right- angle triangle. • The students will understand about the trigonometric ratios of complementary angles • The students will understand about the trigonometric ratios of specifics angles such as 0, 30, 45, 60 and 90. • Students learn about different Trigonometric Identities.	
Self-Evaluation and Follow-Up	The students will be asked questions to find out the understanding of the concept of Trigonometry its Ratios & Identities. The students will be asked to find out about the concept of parallax and how it is used.	

GLOSSARY:

AI Related Terminologies

Cosine Similarity: Under the domain of Natural Language Processing in AI, the words are considered to be n-dimensional entities which can have much more information than what we can visualize. Also, all the statements which are to be processed under NLP for the AI algorithm, are considered as vectors which have an amplitude and direction. Now, to compare two statements to identify how similar they are, the cosine angle between these 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. Statements which have a 180degree angle in them are considered to be opposite to each other while those having almost perpendicular angles are said to be unrelated to each other. Here is a graphical representation for the same:

Similar scores
Score Vectors in same direction
Angle between then is near 0 deg.
Cosine of angle is near 1 i.e. 100%

Unrelated scores
Score Vectors are nearly orthogonal
Angle between then is near 90 deg.
Cosine of angle is near 0 i.e. 0%

Opposite scores
Score Vectors in opposite direction
Angle between then is near 180 deg.
Cosine of angle is near -1 i.e. -100%

For example, the dataset is of two statements which are:

- Mira is my mother.
- Jai is my father.
- Who is my mother?

Now, the third statement is the comparison statement for which the closest relatable sentence has to be identified. All the three statements after reducing the dimensions, are plotted on a 2D plane as follows:

As one can observe, statement 1 (Red) has a smaller cosine angle value with the question vector statement 3, (black) while statement 2 (blue) is farther from statement three. This shows how the similarity of two statements can be identified mathematically by calculating the cosine angles for the same. This concept is known as Cosine Similarity.
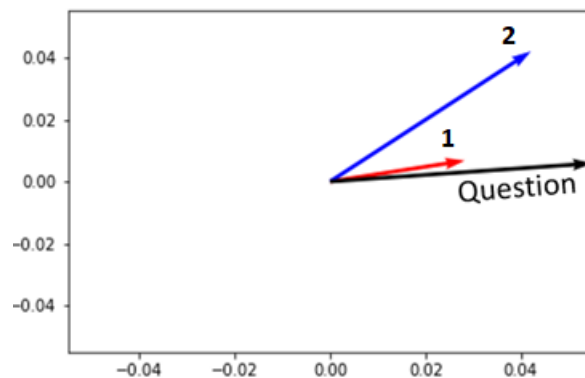
AI Activity Description

With the help of the knowledge of trigonometric functions and terminologies, students will be able to understand the concept of Cosine Similarity. Give the students three statements:

- Mira is my mother.
- Jai is my father.
- Who is my mother?

Now the students have to observe these statements and figure out which statement out of the first two is closer to the third statement in terms of the words used?

As they select the first statement to be closer, the concept of cosine similarity is explained to them in which the sentences are taken as vectors having amplitude and direction. These sentences are then visually plotted in a 2D plane in such a way that all have the same origin. Now, to check which statement is closest to the question, we check the cosine angle between all the statements. The statement having minimum cosine angle with the question is considered to be the most similar statement to the question. This concept is known as cosine similarity.

As shown in the diagram, three vectors have been plotted on a 2D map where the red, blue and black arrows depict statement 1, 2 and 3 respectively. Since statement 1 is more similar to the question, the angle between these two statements is less while statement 2's angle is more with the question. This shows how different the two statements are.

MATHEMATICS

CLASS 10

3.34 Coordinate Geometry

PARAMETERS	DESCRIPTION	AI CONCEPTS INTEGRATED
Chapter Covered	**Chapter 7- Coordinate Geometry**	
Name of the Book	**Mathematics Textbook for Class 10**	
Subject and Artificial Intelligence Integrated	Coordinate Geometry and Artificial Intelligence (Geogebra & Google Maps)	Google Map Onenote
Learning Objectives	The students will be able to: ● Know about the concept of a coordinate system. ● Understand the form of the coordinates of the point on the horizontal axis and on the vertical axis. ● Calculate the distance between a point and origin. ● Demonstrate the distance formula to calculate the distance between two given points on a Cartesian plane. ● Determine the coordinates of the point that divides a line segment into a given ratio.	
Time Required	4 periods of 40 minutes each	
Classroom Arrangement	Online	
Material Required	Physical classroom: Pen, paper, blackboard, chalk, smart-board/screen and projector, laptop/computer. Online class: Internet connection, laptop/desktop/smartphone, textbook, Microsoft whiteboard	
Pre – Preparation Activities	Students are given instructions on the starter activity. Locate the position of a point P (x ,y) on the coordinate plane. Basic plotting points in the Cartesian plane including plotting points from a table of values.	
Previous Knowledge	● Students are asked about Cartesian coordinate system. ● Students are asked to plot the given points on a graph using Geogebra. https://www.geogebra.org/classic) ● Students are asked to define Abscissa and Ordinate ● General Equation of a Line in two variables (ax+by+c=0).	

Methodology	Strategy Used: Brainstorming Brainstorming on the previous knowledge would be checked. Motivation: Motivate the students by explaining the importance of Coordinate geometry day to day life. Use of Google Maps while travelling from one place to other. Finding the shortest route etc. Discussion of the topics through Collaborative Learning (Inductive Method) . <u>Activity-1</u> Students ask to find the coordinates of four students and to calculate the distance between them. (Using desmos) • Guided Practice: Students will ask to practice the questions from the NCERT Textbook. • Independent Practice: Students would Practice the given questions in the Homework Recapitulation: Oral test of basic concepts discussed in the class. • Closer: MCQ based test will be taken on the google forms/MS forms. • Activity II: Practice Activity students will apply their understanding of Coordinate Geometry to attempt the questions of NCERT Textbook.	Google Maps (https://maps.google.co.in) Onenote (https://www.onenote.com)
Learning Outcomes	At the end of the lesson, students will be able to: ● The need of a coordinate system in real life ● Locate the position of any point On a Cartesian plane.. ● Find the distance of a point from origin using Pythagoras theorem and verify it using Geogebra. ● Derive the distance formula. ● Apply and find coordinates of a point using section formula.	
Follow up Activities	In class Activity: Students will use the concept of distance formula and section formula based on day to day life situations using Geogebra and Google Map. Home assignment: Crossword puzzles based on discussed topics in the class will be given.	
Reflections	Discussion with Students on the role of AI application: Ask and take feedback on the scope of the AI tools used and any problems they encountered while using the AI tool. And compatibility of AI tools for the students.	

GLOSSARY:

AI Related Terminology

Google Maps: You can find coordinates on Google Maps to give you the exact positioning (the latitude and longitude) of any location. It's easy to find coordinates on Google Maps on your phone or computer, and you can copy and paste your coordinates to share a precise location with others

The coordinates of a point are a pair of numbers that define its exact location on a two-dimensional plane.
Recall that the coordinate plane has two axes at right angles to each other, called the x and y axis.
The coordinates of a given point represent how far along each axis the point is located.
https://maps.google.co.in

MATHEMATICS

CLASS 10

3.35 Triangles - Similar Triangles
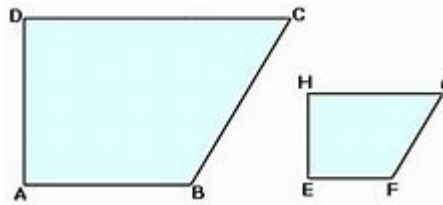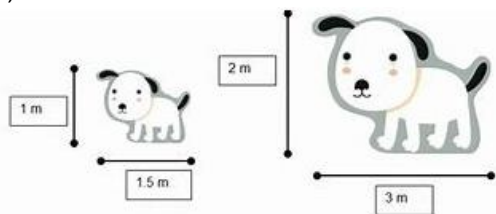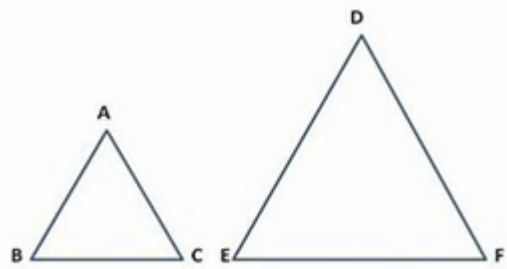
PARAMETERS	DESCRIPTION	AI CONCEPTS INTEGRATED
Chapter Covered	**Chapter 6: Triangles - Similar Triangles**	
Name of the book	**Mathematics, Class 10, NCERT**	
Subject and Artificial Intelligence Integration	Understanding the concept of similar figures and defining similar triangles and identifying similar figures in real life.	
Objectives	- To understand the concept of similar triangles. - To identify which figures are similar. - To differentiate similar triangles and congruent triangles. - To understand the rules of similarity	
Time Required	2 sessions of 40 minutes each	
Classroom Management	Flexible	
Material Required	Pen, Paper, White Board, Markers, Laptop, Internet Connection.	
Pre-preparation Activity	Students will be asked to recall about congruent triangles and the congruence rules.	
Previous knowledge	Questioning will be used to check students' previous knowledge in the form of a quiz.	
Introduction	Students will be asked to define congruent triangles and recall the rules of congruence. Teacher will talk about zooming word with same fonts, will show same pictures of different sizes to introduce similarity.	

Methodology	Activity-1: DISCUSSION ON SIMILAR FIGURES: Teacher will show students various pictures and will ask them that what do they observe in these pictures? Pictures given in Glossary(A). Students will observe the pictures carefully and after discussion may arrive at the conclusion that they are same in shape and have different sizes. In case they are unable to, teacher will help them to understand it and observe. Activity-2: Origami cutting and pasting activity Teacher will now ask students to cut triangles of same shape and different sizes and will ask them: What mathematically determines the shape of the triangle? What determines the size of the triangle? After this, teacher will take two triangles with same angles and proportional sides and define similar triangles, will introduce its symbol'≈'. The discussion of similarity will involve other polygons also and when can we call them similar. Activity-3: Explore similarity & understand scale factor : Students will be working in pairs with their partners in computer lab and understand the proportionality of sides and scale factor using Geogebra tool. https://w-ww.geogebra.org/m/bb9EBTdG And students will work in pairs and make a drawing/rangoli on Autodraw by using similar shapes. Activity-4: Exploring rules of similarity and drawing conclusions: Teacher will ask students to recall rules of congruence and discuss rules of similarity and their differences. Students will work in pairs and explore the rules of similarity on Geogebra tool after its discussion in the class. 　AAA SIMILARITY 　https://www.geogebra.org/m/Q8EYTUK2 　SAS SIMILARITY 　https://www.geogebra.org/m/ex24tymd 　SSS SIMILARITY 　https://www.geogebra.org/m/yKFwXvR	Autodraw https://www.autodraw.com
Discussion on the Text	Open discussion on all new terms related to Similar triangles like corresponding angles being equal, scale factor, shape and size being determined by angles and sides respectively	
Learning Outcomes	Students will be able to ● Identify similar triangles. ● Differentiate congruent and similar triangles. ● Define similar triangles ● Determine the scale factor of given similar triangles ● Prove two triangles similar by using the rules of similarity. ● Relate it with real life examples of similar objects.	
Self-Evaluation and Follow up	Students will be given feedback based on the similar figures they have used to make rangoli and a discussion based on it will be there. ● Flip teaching ● Worksheets/ Assignments	

GLOSSARY:

AI Related Terminology

(A) Students will observe these pictures and will discuss their observations with the teacher.

(a)

(b)

(c)

(d)

(e)

(f)

GLOSSARY:

AI Related Terminology

Autodraw: 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 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

MATHEMATICS

CLASS 10

3.36 Arithmetic Progressions

PARAMETERS	DESCRIPTION	AI CONCEPTS INTEGRATED
Chapter Covered	**Chapter 5: Arithmetic Progressions**	
Name of the Book	**Mathematics, Class 10, NCERT**	
Subject and Artificial Intelligence Integrated	Understanding the concept of Arithmetic Progressions and Artificial intelligence.	
Learning Objectives	- To identify if a given series of numbers form Arithmetic progression or not. - To identify first term 'a' and common term 'd' in a series - To derive the formula for the nth term of an AP. - To find the sum of first n terms of an AP. - To find the sum of first n positive integers.	
Time Required	3 periods of 40 minutes each	
Classroom Arrangement	Flexible	
Material Required	Pen, paper, Black Board chalk, Laptops/ desktops and Internet connection.	
Pre – Preparation Activities	Students will be asked to make a list of things in which they can see patterns and observe them.	
Previous Knowledge	Ask the students to come up with real life examples patterns. For example, stairs steps, the number of unit squares in squares with side 1, 2, 3, . . . units, age (1 year, 2 year, 3 year,…..), time (1second, 2second, 3second,……), Other examples would be an increment in salary by a fixed amount every year or the depreciation in the cost of an article by a fixed amount every year….). A YouTube video can be shown to show the examples of sequences. www.youtube.com/watch?v=KdqhUqur8Gs In some of these patterns we see the next number comes after adding the same number whereas in some by multiplying the same number etc. Students are divided into groups of two (pairs) and asked to play the AI Game: Rock, Paper and scissors in order to make them understand that machines also follow the patterns. In this chapter, we shall discuss one of the patterns in which succeeding terms are obtained by adding a fixed number to the preceding terms.	https://www.afiniti.com/corporate/rock-paperscissors

Methodology	**Activity I:** Introduce the term AP. Give examples of some sequences of AP. Also explain that the first term of the AP is denoted by 'a' and the common difference by'd'. Also explain that common differences can be positive or negative. **Activity II:** **Flash Card activity:** In this activity students need to answer the questions given on flashcards. Divide the class into a few groups. Prepare a few flashcards with number series written on them. Show one flashcard at a time to a group. Ask the students from the group to check if the number in the series forms an AP. If so, ask them to identify the next two terms of the AP. You can also ask the students to name the first term and the common difference of the AP. Similarly you can write the first term 'a' and the common difference 'd' of an AP and ask the students to identify the next four terms of the AP. Continue the activity with the other groups as well. The group that gets maximum correct answers will be the winner. **Activity III:** In this activity, after the teacher's explanation, students need to derive the formula for the nth term of an AP, the sum of first n terms of an AP and the sum of first n positive integers. Divide the class into 3 groups. Ask each group to make a presentation. The first group needs to derive the formula for the nth term of an AP, the second group has to derive the formula for the sum of first n terms of an AP and the third group has to derive the formula for the sum of first n positive integers with the guidance of the teacher. **Activity IV:** Ask students to apply their understanding of the topic to attempt questions of Exercise 5.1 and 5.2. **Activity IV:** Students will be 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-thefuture- for-weather-forecasting Ask the students to take two sequences and find out whether it is an arithmetic progression or not with the help of some graphical/pictorial representation. 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. Students will be able to recognize various patterns/trends out of their representations which can be used to represent AP series.	**Data exploration** https://datavizcatalogue.com
Learning Outcomes	The students will be able to identify if a given series of numbers form Arithmetic progression or not. ● The students will derive the formula for the nth term of an AP. ● The students will find the sum of first 'n' terms of an AP. ● To find the sum of first n positive integers.	

Follow up Activities	Students will be asked to: Research on arithmetic series, which is the sum of the numbers in a finite AP.	
Reflections	Teacher will see how well the student are able to capture the concept and gain confidence while presenting their model. Teacher will discuss with students- ● Do they like AI tools? ● Do you know any other tool or app where you can see patterns? ● Try these tools at home also.	

GLOSSARY:

AI Related Terminology

Rock, Paper & Scissors: In this game, an artificially intelligent system learns to identify patterns of a person's behaviour by analysing 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

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.
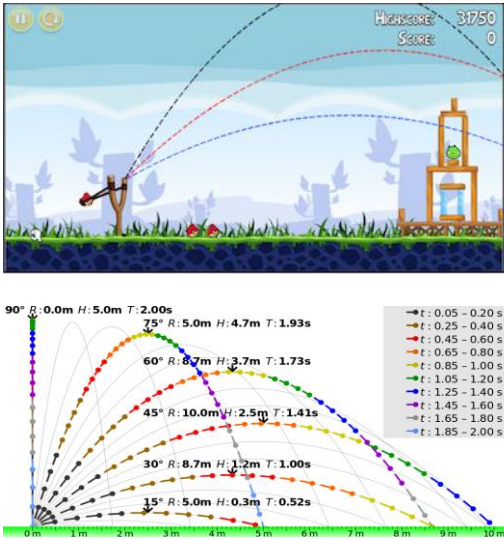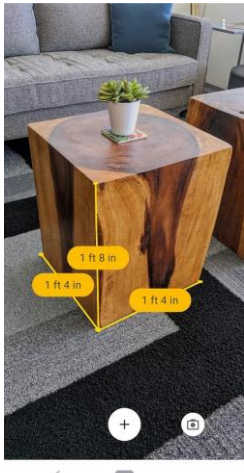
https://datavizcatalogue.com

MATHEMATICS

CLASS 10

3.37 Introduction to Trigonometry - Application of Trigonometry – Height & Distance

PARAMETERS	DESCRIPTION	AI CONCEPTS INTEGRATED
Chapter Covered	**Chapter 10: Introduction to Trigonometry - Applications of Trigonometry**	
Name of the Book	**Mathematics, Class 10, NCERT**	
Subject and Artificial Intelligence Integrated	Heights and Distances. Augmented Reality based on **computer vision and Data acquisition.**	
Learning Objectives	Students will able to ● Apply the Trigonometric ratios in real life situations to find the heights or distances. ● Understand the applications of the concepts in developing games like: Angry Birds.	Using the Google App: **"Measure".** Play the game: **Angry Bird.**
Time Required	2 periods of 40 minutes each	
Classroom Arrangement	Seating arrangement - In pairs for both the sessions while playing the game and using the App. Individual work during the follow up theory class.	
Material Required	Pen, paper, Laptops/ desktops/ Tablets and Internet connections.	
Pre – Preparation Activities	Trigonometric ratios, their definitions and values for specific angles. Names of the sides of the right angled triangle.	
Previous Knowledge	Definition of the Trigonometric ratios and their values for specific angles.	
Methodology	After the Pre Knowledge testing and discussion, the teacher will demonstrate the use of the Google App: **"Measure".** Followed by the discussion about what is happening in the app. How is the app able to give the heights and lengths of some objects? Then a small discussion about ML and AI will happen. This will be followed up by the general theoretical discussion about the general terms like: The line of sight, angle of elevation and depression. Making rough sketches to represent the situational problems. Then verifying the results shown by the App through manual calculation. In the second lesson, after a recap and general discussion, the students will be motivated to understand the relation between the angle of elevation and height of an object keeping the distance fixed. The same will be experienced by the students in the game **Angry Birds.**	

This will be followed by the discussion about the game and students will be motivated to think about the usage of trigonometry in such apps.

Learning Outcomes	The students would learn to: Represent a word problem in the form of a diagram. Apply the T-ratios to calculate the height and distances.	
Follow up Activities	Designing a device called **clinometer** and using it in school or at home to find the height of nearby buildings without actually climbing up or using any measuring tape. **Research** work about more such apps where we can experience the usage of Trigonometry directly. Like: Pedometer apps.	
Reflections	Students will be asked to ponder on and think how various levels of some games are different for different users?	

GLOSSARY:

AI Related Terminology

Goggle Measure App: Measure helps you with quick everyday measurements around the house or office, similar to a tape measure. With the Measure app, you can:

- Measure the length and height of objects on flat surfaces, like the size of a rug, the width of a sofa, or the height of a table
- Easily switch between imperial and metric units
- Take a photo of your measurement
- Copy measurement to clipboard

Move your phone around the space to find flat surfaces such as a tabletop or the floor. Point and tap to start your measurement and adjust it accordingly. When finished, tap on measurements to get quick reference to unit conversion, copy, and delete functions.

AR technology often uses **SLAM** (*simultaneous localization and mapping*): a computer vision algorithm that compares visual features between camera frames in order to map and track the environment. In combination with sensor data from the smartphone gyroscope and accelerometer, it is possible to achieve very reliable tracking.

MATHEMATICS

CLASS 10

3.38 Areas Related to Circle

PARAMETERS	DESCRIPTION	AI CONCEPTS INTEGRATED
Chapter Covered	**Chapter 12 - Areas Related to Circles**	
Name of the Book	**Mathematics Text book for Class 10**	
Subject and Artificial Intelligence Integrated	To understand the concept of area of a circle using AI tools Autodraw.	
Learning Objectives	● Introduction and definitions related to circle, radius, diameter, chord, segment, sector circumference etc. ● Circumference and perimeter of the circle, semicircle, quadrant and length of Arc. ● In calculating area of segment of a circle problem should be restricted to Central angle of 60 degree and 90 degree. ● Visualization of sector segment circle using AI tool auto draw.	
Time Required	3 periods of 40 minutes each.	
Classroom Arrangement	Flexible	
Material Required	Scrapbook, paper, pencil, scale, scissor, eraser, White Board, Laptops/ desktops and Internet connection.	
Pre – Preparation Activities	List the objects of circular shapes and list the circular objects with sectors they faced in daily - life like umbrella.	
Previous Knowledge	The students are asked to recall the methods of finding perimeters and areas of simple plane figures such as circle, rectangle, squares and triangles. List the objects of circular shapes they faced in daily - life. Some questions will be asked related to circles.	

Methodology	Students will be divided into four groups. The teacher will provide each group materials needed, each group will do the activity Activity 1. • Ask students to draw circle of any radius on a sheet paper using compass. • Ford it once along the diameter to obtain to semicircles. • Again for the semicircle to get quarter of circle. • Repeat this process of folding up to four force and then it look like a small sector. Introduce the term sector. • Present and 4 the circle it is divided into 16 equal sectors. • Colour half the circle • Cut these 16 different sector of circle. • Cut one of the sector of coloured into two equal parts. • Arrange these seventeen sectors in alternate manner so that they form a rectangular shape. • Derive the formula if area of circle using area of rectangle. • Make perfect circle with the help of Autodraw and try to make segment of circle. • Coloured the half part in Autodraw. • Then tell about sector to students. Activity, ask the students to go to http://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 student to draw any circular shape and let the AI algorithm detect and predict the possible drawings similar to it. The predictions would appear in the top row. After looking at the predictions and analysing how accurate the machine is, ask them to keep an image in mind and start drawing it roughly.	http://autodraw.com
Learning Outcome	Upon completion of the lesson , they are able • To know the circle and its components. • The area and perimeter related to the plane figures like circle, semi- circle, quadrant, segment, sector • Visualization of circles and sectors using AI tools- Auto draw.	
Follow up Activities	Students can prepare a presentation on the formulas related to the plane figures using fontjoy app AI tool.	

GLOSSARY:

AI Related Terminology

Autodraw: 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 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.
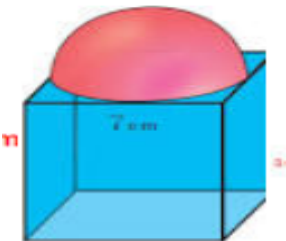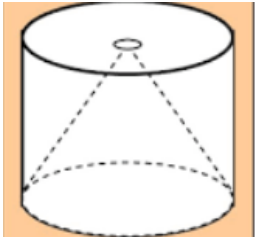
https://www.autodraw.com/

MATHEMATICS

CLASS 10

3.39 Surface Areas and Volumes

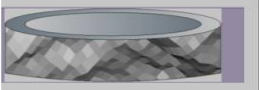| PARAMETERS	DESCRIPTION	AI CONCEPTS INTEGRATED
Chapter Covered	**Chapter 13: Surface Areas and Volumes**	
Name of the Book	**Mathematics, Class 10, NCERT**	
Subject and Artificial Intelligence Integrated	Understanding the concept of Surface area and Volume of Combination of solids using AI Experiential Applications of Data Acquisition process and used in architecture	
Learning Objectives	● To understand concept of Surface area of combination of solids ● To determine the surface area by observation/ Investigation. ● To understand concept of volume of combination of solids ● To determine the volume of combination of different solids by observation/ Investigation. ● To understand the concept of combination of solids in day today life.	
Time Required	8 periods of 40 minutes each	
Classroom Arrangement	Seating arrangement - circular Activities Sessions- Divide the class in groups as per class strength	
Material Required	Clay, cutter, Pen, paper, Black Board chalk, Laptops and Internet connection.	
Pre – Preparation Activities	Students will be asked to bring clay of different colour and cutter, Two days prior students will be informed.	
Previous Knowledge	The students are given an idea of how the calculate surface area and volume of individual solids like cylinder, cube, cylinder, con etc. in class IX. introductory video of an activity to compare the volume of a cone, hemisphere and cylinder https://nroer.gov.in/55ab34ff81fccb4f1d806025/page/57d17cb916b51c090c386770	

Methodology	**Hands on Activity I:** Students are asked to perform different activities on combination of solids in their respective groups using clay. For example - **Students can create their own situation of combination of solids.** • **First group** will prepare a cube and hemisphere with clay and put hemisphere on cube and observe its total surface area. **Second group** will prepare cylinder and scoop out conical cavity of same height and same diameter and then observe the total surface area of **remaining solid.** **Third group** bring an aluminum glass and find its actual capacity and then bent one surface and then find its apparent capacity. And so on various examples can be given. 	
Discussion of Activity		Data Acquisition Process
	Students can create their own situation of combination of solids. After given the brief by teacher lets the students decide what they want to make. **Activity** (By observation each group will prepare their own observation table. 	

Picture	Surface area	Volume

Each group will explain their own made combination solid along with surface area.

Activity III (conversion of solids)
https://www.youtube.com/watch?v=ZlIu_HgdjMU

Activity IV: Practice Activity Ask students to apply their understanding of surface area of combination of solids to attempt questions of exercise 13.1 to ex 13.3 from NCERT Book.

Activity IV: students will explore the information of AI tools used in architecture
Using techniques like visualization, simulation, and virtual prototyping, BIM allows architects to preview a series of potential scenarios before the process of building even starts

BIM can help project managers make better decisions at every stage of construction, even increasing health and safety on the job site.

Learning Outcomes	- The students understand the concept of surface area when solids were combined. - They will able to find surface area of different combination of solids. - The students understand the difference between curved surface area and Total surface area when solids were combined..

	● Students will able to find/ calculate the volume of different combination of solids. ● Students will able to create different example in day to day life.	
Follow up Activities	The students will be asked to observe and record the surface area of combination of solids. Tell the students to make more 3d combination shape and note down their surface area. The teachers evaluate students' discussion and presentation on understanding concepts of surface area of combination of solids.	
Reflections	Collect different examples of combination of solids and calculate its surface area and volume.	

GLOSSARY:

AI Related Terminology

Building Information Modeling (BIM) is an intelligent 3D model-based process that gives architecture, engineering, and construction (AEC) professionals the insight and tools to more efficiently plan, design, construct, and manage buildings and infrastructure. BIM software can now use machine learning to learn from data and detect patterns and from this, make independent decisions on how to automate and improve the model building process.

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

MATHEMATICS

CLASS 10

3.40 Probability

PARAMETERS	DESCRIPTION	AI CONCEPTS INTEGRATED
Chapter Covered	**Chapter 15: Probability**	
Name of the Book	**Mathematics, Class 10, NCERT**	
Subject and Artificial Intelligence Integrated	Verifying the relation between Theoretical and Practical probability by collecting data using the AI tool.	
Learning Objectives	Students will able to ● Find the probability of elementary events. ● Find the probability using data of the game played through AI. ● Verify the relation between Theoretical and Practical probability.	While Playing Rock Paper Scissors with a computer.
Time Required	2 periods of 40 minutes each	
Classroom Arrangement	Seating arrangement - In pairs for both the sessions.	
Material Required	Pen, paper, Laptops/ desktops/ Tabs and Internet connection.	
Pre – Preparation Activities	Students will be introduced to the AI based game: Rock, papers and Scissors. They will be divided into pairs and given a sheet to record the data.	https://www.afiniti.com/corporate/rock-paper-scissors
Previous Knowledge	Calculating the probability using the formula: $\frac{favourable\ outcomes}{Total\ possible\ outcomes}$. Preparation of Sample Space and calculating elementary probability	
Methodology	Part-1 ● Students will prepare the Sample Space for an experiment of playing Rock, Paper, and Scissors game. Calculate the probability for elementary events. The sample space will be: RR, RS, RP, PP, PS, PR, SS, SP, SR. So it will have 9 Total Possible Outcome (TPO) ● Students will be asked to calculate the probability of each elementary even which will be equal to 1/9. Part-2 ● Students will be asked to play the game Rock, paper, Scissor using the link ● They will play the game and try to beat the AI model while recording the data in the following table:	. https://www.afiniti.com/corporate/rock-paper-scissors

<table>
<tr><td colspan="3" align="center">Table 1 (first 9 games)</td></tr>
<tr><td align="center">Game</td><td align="center">Students</td><td align="center">AI Model</td></tr>
<tr><td align="center">1</td><td align="center">R</td><td align="center">P</td></tr>
<tr><td align="center">2</td><td align="center">R</td><td align="center">S</td></tr>
<tr><td align="center">3</td><td align="center">S</td><td align="center">P</td></tr>
</table>

	Then will calculate the Practical probability for each elementary event using the outcomes in the table. They will again be asked to play the game for another 90 times. Higher the trials, lesser the difference between practical and theoretical probability. They will repeat the task and explain their findings.
Learning Outcomes	Students would be able to verify that the practical probability is the same as the theoretical probability when the number of actual trials are higher.
Follow up Activities	Try the same experiment with tossing a coin 50 times. Throwing a die about 120 times.
Reflections	The students will be asked about the strategy they used to defeat the AI. An AI facilitator may be called to discuss the process of machine learning and AI used in the game. How AI model is able to predict the pattern?

GLOSSARY:

AI Related Terminology

Rock, Paper and 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

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** Introducing 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**	To understand and reflect on the ethical issues around AI.
		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.	
		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.
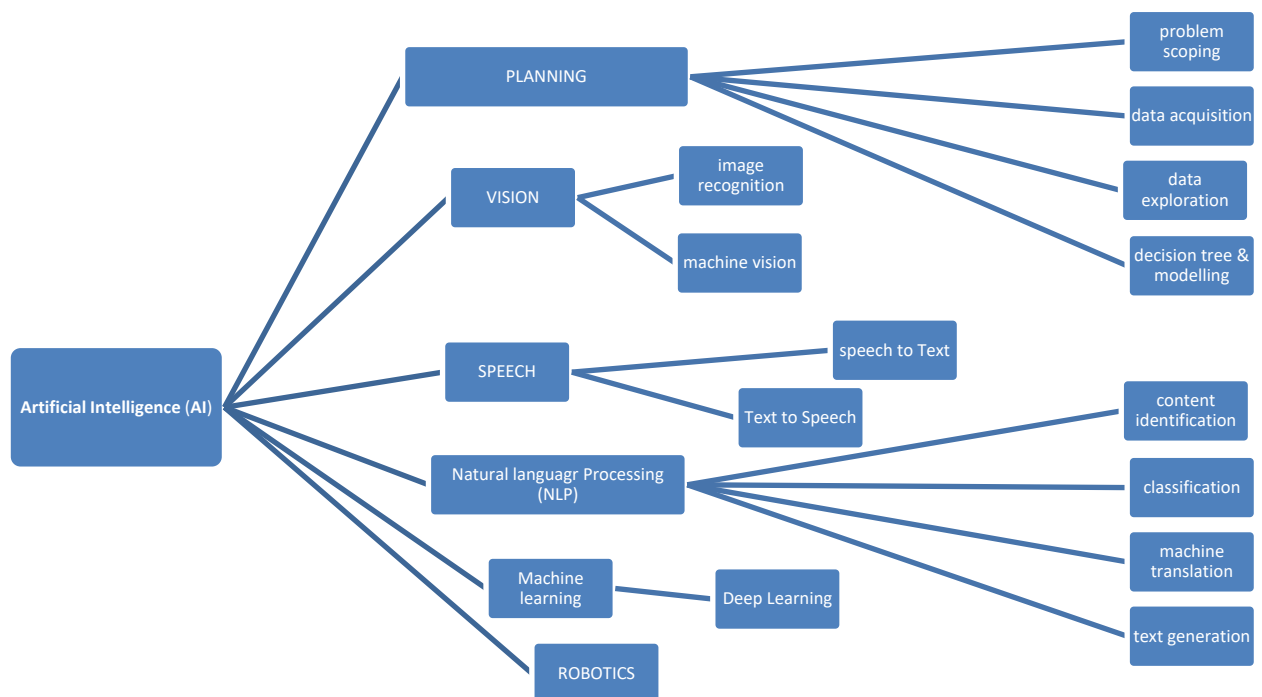
Appendix 5

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 **sufficient** supporting evidence when needed. Understands applications of AI in subject learning.	**18–7** **Somewhat** shows understanding of topic content. Provides **some** supporting 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** demonstrates 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.
Commitment	**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.with google.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.co m/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-kiczPCPI0wIaRgEZEsk1Wvl4r6jq6vPVCuKEf0PI1GNOB7ruNTUr0e5KhoCcXEQAvD_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://artsexperiment s.withgoogle.com/poe mportraits
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.imaginary soundscape.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.wi thgoogle.com/scribbli ng-speech