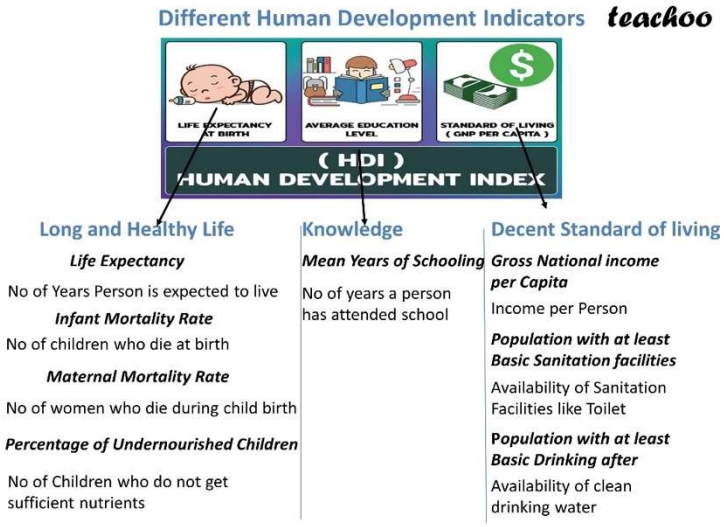
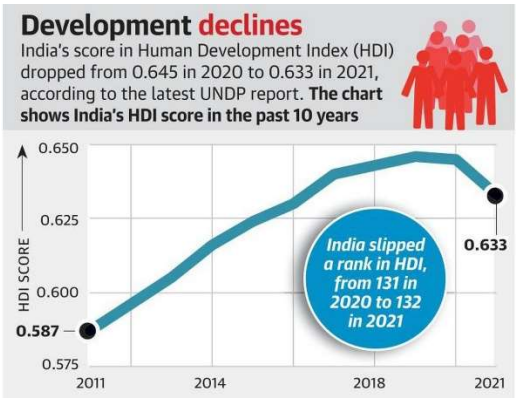
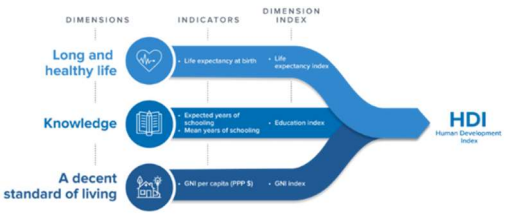
Class 10
Lesson –
Development – Chapter 1

Parameters	Descriptions	Notes for teachers
Chapter Covered	Chapter 1: Development Sub-topic: Skill development to improve HDI (Human Development Index)	
Name of the Book	NCERT, Understanding Economic Development, Social Science Textbook for Class X	
Learning Objectives	In this chapter, students will highlight the meaning and concept of human development. The students will learn about different parameters which is essential for the development of an economy. One of the parameters being HDI (Human Development Index). India's rank for HDI is 131 out of 188 countries in the world, according to the latest Human Development Report. To enable learners to: **Scholastic:** **Stage 1: Conceptualization** • Understand the role of the HDI as a measure of human development. • Recognize that the HDI provides a single index measure that captures three key dimensions of human development: a long and healthy life, access to knowledge and a decent standard of living. • Understand the four factors that the HDI uses to measure a country's social and economic development: mean years of schooling, expected years of schooling, life expectancy at birth, and GNI (Gross national Income) per capita. • To interpret how to associate the relationship between different parameters with the HDI of a country. • To examine the role of HDI in determining the level of development of a country. **AI and Tinkering:** **Stage 2: Apply Design Thinking framework** • Identify different parameters to determine the HDI of a country. • Develop a relationship between the parameters and HDI of a country. • Elucidate the role of employment to determine the development status of a country. • Explain importance of skill development to the students. **Stage 3: Making an AI enabled software** • Get the Human Development Data from available authentic and reliable resources. • Prepare a Python notebook to predict the HDI using Machine Learning. **Stage 4: Making 3D Object** • Explain 3D designing technique. • To create various designs and 3D printing it. • Learn 3D printing and understand the importance of skill development.	
Time Required	5 periods of 45 minutes each	
Classroom/ATL Arrangement	Seating arrangement: • Theory sessions – Regular class room arrangement • Activity sessions – Flexible (for group / pair work)	
Material Required	**Scholastic:** • Textbook • Smart Board / screen and projector • Pen and paper • White board and marker	

	AI and Tinkering: • Personal Computer/Laptop with Internet Connection • Tinkercad Software • 3D Printing Machine	
Pre – Preparation Activities	**Scholastic:** • A brainstorming session on the parameters that play a significant role in determining HDI rank of a country. Teacher shows a mind map to draw the relationship between HDI and its parameters and also mention its significance to interpret the development status of a country.  • The teacher also shows the graph depicting HDI of India for the past 10 years and discuss the reasons behind its decline.  • Students can be asked to make concept map or mind map of different parameters of HDI.  **AI and Tinkering:** • The teacher makes the arrangements for hardware and good Internet connection required to conduct the activity. • Design Thinking Flashcards to understand empathy, defining the problem and ideation. • The teacher needs to install Tinkercad into the available systems. The teacher can use the following link to understand the basics of tinkercad -	

	https://www.youtube.com/watch?v=gOs6Mdj7y_4 Resources for 3D Printing - https://youtu.be/gsz2PNcAcPA https://www.tinkercad.com Playlist - https://www.youtube.com/playlist?list=PLt4JWLrDaOYmjyhE08HbNdsHMGKAmX6jG	
Previous Knowledge	**Scholastic:** Students review their prior class learning and categorize key factors for a country's development. They also compare the concepts of economic growth and economic development, like employment, living standard etc. **AI and Tinkering:** • Basic understanding of Linear Regression in Machine Learning - https://www.javatpoint.com/simple-linear-regression-in-machine-learning • The ability to create basic designs in tinkercad. (If ATL lab already has few designs, they can use directly). • Basic knowledge to operate 3D Printer.	
Methodology	**Stage 1: Conceptualization Scholastic: (Social Science Teacher)** Warm-up Activity: • Teacher encourages students find out any 10 parameters that influences the HDI of a country. • The teacher will exemplify how HDI rank is calculated based on various parameters which helps in evaluating the development level of a country. The teacher can use the following link: • How to calculate Human Development Index? https://www.youtube.com/watch?v=lElJbtTYtuM • The teacher further shows another video interpreting the HDI of India and its impact on the economy. The teacher can use the following link: https://www.youtube.com/watch?v=Hf5h9oMCFTU • Teacher assigns students to conduct a survey on the values of HDI of India for the last 10 years to analyze its impact on the development of its economy. • The teacher asks the students to develop ideas based on the values of HDI and how it is used to depict the development status of Indian economy. **Contextualization: AI and Tinkering:** **Stage 2:** **Problem Statement /Scenario:** *The COVID-19 pandemic has resulted in widespread job loss, including the loss of job for Rohan's brother. Rohan wants to understand the factors contributing to the job loss and find a way to encourage and support their brother during the difficult times. Rohan's goal is to uplift their brother's spirits and provide encouragement in the face of the pandemic-induced job loss.* **Empathize:** Students are asked to brainstorm on the above scenario and they are made to think deeper about it by asking the following questions - • What parameters will affect the HDI of India? • How can you associate the value of HDI with the level of development of India or any region? • What are the future jobs? • Is skill development directly corelated with the job opportunities? • What are emerging technologies apart from AI which are empowering the world economy? **Define:** Ask students to identify the problems that one can face in the given scenario - • On what basis you can choose the parameters required to predict the HDI of India? • Wouldn't it be good if you can guess which parameters will truly reflect the value of HDI correctly?	

- How different parameters of HDI can be linked which will depict a clear picture of the development status of India over the years?

Ideate:

- Researching and identifying the specific parameters that contribute to the HDI value.
- Examining the relationship between these parameters and how they can be used to find the HDI.
- Brainstorming and generating ideas for how to effectively use the identified parameters and their relationship to determine the HDI.
- Evaluating and selecting the most promising ideas from the brainstormed list to move forward with.
- Developing a plan for implementing the chosen ideas and using them to accurately find the HDI.

Stage 2: Developing the dataset on the basis of parameters to determine the value of HDI of India

- Data Collection: Data acquisition will be done using the given link – https://hdr.undp.org/data-center/specific-country-data#/countries/IND

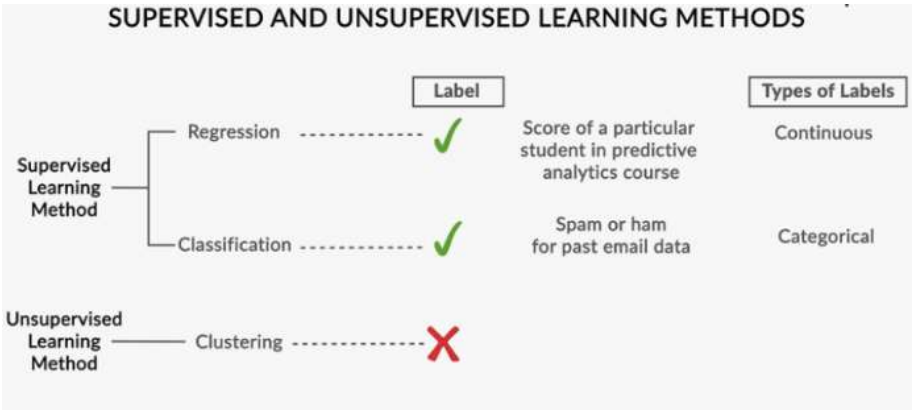
Year	Life Expectancy at Birth	Expected Years of Schooling	Mean Years of Schooling (years)	Gross National Income Per Capita	Gender Development Index	HDI female	Life Expectancy at Birth, female	Expected Years of Schooling, female	Mean Years of Schooling, female	Gross National Income Per Capita, female	HDI male	Life Expectancy at Birth, male	Expected Years of Schooling, male	Mean Years of Schooling, male	Gross National Income Per Capita, male	Human Development Index
1990	58.6516	7.996358	2.781576	1790.41	0.707	0.34708	59.5366	6.536914	1.793045	748.41	0.49118	57.876	9.352672	3.620609	2764.06	0.434
1991	59.0547	8.026843	2.884946	1768.86	0.707	0.34951	59.9565	6.609033	1.841278	740.615	0.49423	58.2557	9.339577	3.780342	2730	0.437
1992	59.4524	8.057444	2.988315	1828.85	0.71	0.35451	60.335	6.681946	1.889512	767.739	0.49962	58.6596	9.326501	3.940074	2820.93	0.442
1993	59.8152	8.088162	3.091684	1880.99	0.711	0.35907	60.6497	6.755665	1.937746	792.563	0.50468	59.0537	9.313442	4.099807	2898.67	0.446
1994	60.2158	8.118997	3.195054	1969.86	0.714	0.36489	61.0071	6.830196	1.98598	834.208	0.51077	59.4826	9.300402	4.25954	3031.56	0.452
1995	60.5962	8.14995	3.298423	2082	0.717	0.37101	61.3508	6.90555	2.034214	883.341	0.51727	59.8899	9.28738	4.419273	3202.29	0.458
1996	60.9841	8.17555	3.467573	2201.08	0.726	0.38058	61.7332	6.97819	2.296355	935.612	0.52436	60.2767	9.26803	4.63225	3383.36	0.466
1997	61.3876	8.20985	3.636723	2249.54	0.734	0.38863	62.1477	7.07933	2.558496	957.923	0.52967	60.6652	9.23941	4.845227	3455.76	0.471
1998	61.7919	8.242064	3.805873	2345.16	0.741	0.39749	62.5947	7.151193	2.820637	1000.38	0.53613	61.0281	9.23378	5.058204	3600.49	0.478
1999	62.2069	8.274277	3.975023	2509.05	0.75	0.40802	63.1109	7.223057	3.082778	1072.17	0.54371	61.3511	9.22815	5.271181	3849.84	0.486
2000	62.6693	8.30649	4.144173	2552.8	0.757	0.41567	63.6388	7.29492	3.344919	1092.83	0.54911	61.754	9.22252	5.484158	3914.74	0.491
2001	63.0913	8.33717	4.22123	2634.93	0.759	0.41966	64.1306	7.37128	3.284103	1137.13	0.55306	62.1135	9.2103	5.565799	4031.83	0.496
2002	63.616	8.52784	4.298287	2694.23	0.763	0.42595	64.7289	7.64939	3.223286	1172.12	0.55837	62.5727	9.32045	5.64744	4113.61	0.503
2003	64.0942	9.12217	4.375344	2856.49	0.78	0.44248	65.287	8.613	3.162469	1252.68	0.56704	62.9813	9.58274	5.729081	4351.97	0.516
2004	64.5244	9.386283	4.452401	3034.45	0.784	0.45085	65.8313	8.897337	3.101652	1341.18	0.57527	63.3128	9.827977	5.810722	4613.35	0.525
2005	64.9955	9.650395	4.529459	3222.76	0.787	0.45918	66.3787	9.181675	3.040836	1435.3	0.58379	63.7186	10.07322	5.892363	4889.6	0.534
2006	65.4123	9.914508	4.636587	3426.92	0.79	0.4683	66.8911	9.466012	3.179246	1485.66	0.59264	64.0534	10.31845	5.982879	5237.45	0.543
2007	65.7884	10.17862	4.743715	3646.93	0.793	0.47715	67.342	9.75035	3.317657	1537.81	0.60142	64.3653	10.56369	6.073394	5614.46	0.553
2008	66.149	10.48253	4.850844	3698.18	0.797	0.48252	67.7858	9.98877	3.456067	1515.71	0.60509	64.6543	10.57777	6.163909	5734.68	0.56
2009	66.5132	10.41897	4.957972	3933.12	0.803	0.49055	68.2151	10.22719	3.594478	1565.89	0.6112	64.962	10.59185	6.254424	6142.7	0.565
2010	66.9086	10.73543	5.0651	4189.43	0.81	0.50248	68.6449	10.53427	3.732888	1706.13	0.62048	65.3268	10.91616	6.34494	6508.16	0.575
2011	67.359	11.29448	5.30191	4361.09	0.813	0.51347	69.1058	11.01767	4.04536	1702.89	0.63152	65.7651	11.29704	6.52597	6844.05	0.588
2012	67.8872	11.52486	5.53872	4529.02	0.826	0.52702	69.5921	11.78787	4.357832	1693.86	0.63833	66.3242	11.26185	6.707	7178.31	0.598
2013	68.4598	11.54076	5.77553	4758.3	0.831	0.53633	70.0831	11.89287	4.670304	1764.42	0.64567	66.9607	11.22666	6.888031	7556.96	0.607
2014	69.0736	11.86649	6.01234	5056.67	0.835	0.54889	70.6017	12.24183	4.982776	1859.34	0.65755	67.6506	11.5312	7.069061	8046.44	0.619
2015	69.6363	11.947	6.249149	5401.49	0.838	0.55896	71.0767	12.33078	5.295248	1969.74	0.66688	68.2846	11.60335	7.250092	8611.23	0.629
2016	70.1167	12.34372	6.350639	5732.91	0.848	0.57209	71.5029	12.8807	5.534321	2073.85	0.67499	68.8102	11.86143	7.244767	9155.97	0.639
2017	70.4672	12.16333	6.452129	6116.06	0.851	0.57747	71.8561	12.63964	5.773394	2194.92	0.67835	69.1595	11.7344	7.239443	9785.09	0.644
2018	70.7095	11.81348	6.553619	6449.19	0.849	0.57724	72.1423	12.14679	6.012466	2219.47	0.67975	69.3672	11.5139	7.234118	10408	0.645
2019	70.9098	11.46362	6.655109	6650.05	0.852	0.57886	72.3954	11.65395	6.251539	2318.93	0.67925	69.5255	11.2934	7.228794	10705.1	0.645
2020	70.1499	11.87462	6.655109	6107.49	0.845	0.57245	71.8237	11.94211	6.251539	2069.81	0.67721	68.6147	11.81324	7.228794	9889.77	0.642
2021	67.2398	11.87462	6.655109	6589.98	0.849	0.56668	68.8864	11.94211	6.251539	2277.27	0.66781	65.7563	11.81324	7.228794	10632.9	0.633

- In this activity, the learners will learn the relationship between different factors responsible for the change in HDI.
- For each type of data values to be collected, they will use Python for analyzing.
- Python programming language can be used to do data processing and find trends in the data.
- It is not possible to predict the Human Development Index (HDI) for future years without any future data. The HDI is a measure of a country's progress based on various factors such as life expectancy, education, and per capita income. These factors are influenced by many complex and dynamic variables that are difficult to predict, such as economic growth, technological advancements, social and political changes, and environmental factors.
- However, if you have data for past years, you can use machine learning techniques to build a model that can make predictions about the HDI for a particular year based on past trends.
- Here, we could observe the HDI has the highest correlation with respect to years. We will perform linear regression to predict the HDI values for upcoming years. Students can not only analyze data from websites but also import the data and analyze it. Manipulation and visualization have become very easy.
- Data Processing and understanding the Use Case: Since the data collected consists of numbers w.r.t year, it is difficult to interpret the meaning out of it.
- We will use Python to see the relationship between different parameters to get hands-on the application.

Data Transfer and Modelling:
Stage 4: Making the prototype using AI (Subject Teacher and AI Faculty)

For this problem statement, we will start off with a quick introduction to Modelling and the three machine learning techniques — regression, classification, and clustering. Then, we will go deeper into one of the most important regression models in machine learning — Linear Regression.

- Modelling uses machine learning algorithms, in which the machine learns from the data just like humans learn from their experiences.
- Machine learning models can be classified into the following three types based on the task performed and the nature of the output:
- Regression: The output variable to be predicted is a continuous variable, e.g. scores of a student,
- Classification: The output variable to be predicted is a categorical variable, e.g. classifying incoming emails as spam or ham
- Clustering: No pre-defined notion of a label is allocated to groups/clusters formed, e.g. customer segmentation



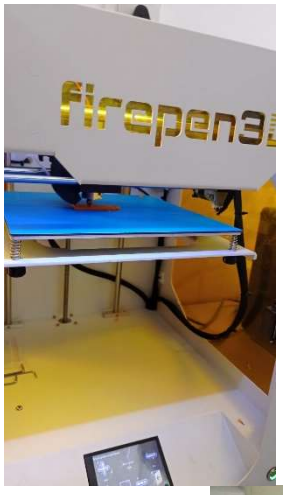
- Linear regression models can be classified into two types depending upon the number of independent variables -
  - Simple linear regression: When the number of independent variables is 1
  - Multiple linear regression: When the number of independent variables is more than 1
- A linear regression model attempts to explain the relationship between a dependent (output variables) and an independent variable (predictor variable) using a straight line.
- We can build a linear regression model to predict HDI year wise using relevant python libraries.
- Teacher can access the following sample notebook and dataset (Simple Linear Regression using 2 variables).
  https://drive.google.com/drive/folders/1oNuQrD9l_i3guFBJgU-6DkF8eHwkQAdF?usp=sharing

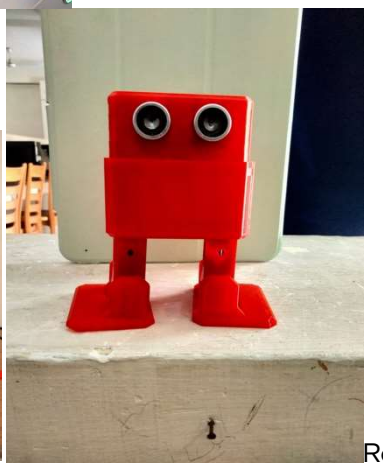
Stage 3 - Apply Design Thinking framework on the given scenario (Subject Teacher & ATL In-charge)

Skill Development – 3D Printing

- To perform the 3D Printing for any available design. (Or create a design using TinkerCad and perform 3D printing.)
- Teacher can use the following links to understand how to use a 3D Printer -
  https://aim.gov.in/pdf/3D_Printing-Guidelines_and_Links.pdf
  https://www.youtube.com/@roboticscafes2674/videos

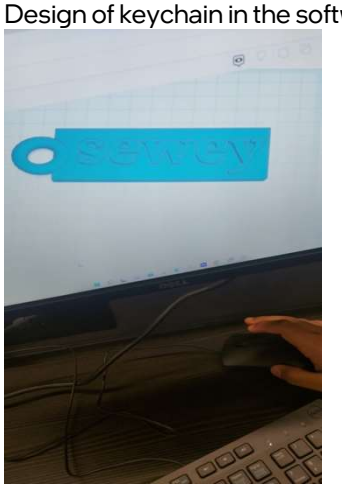
3D Printer



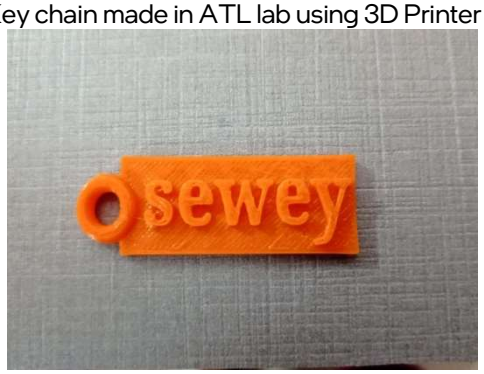


Robot made in ATL lab using 3D Printer

Design of keychain in the software

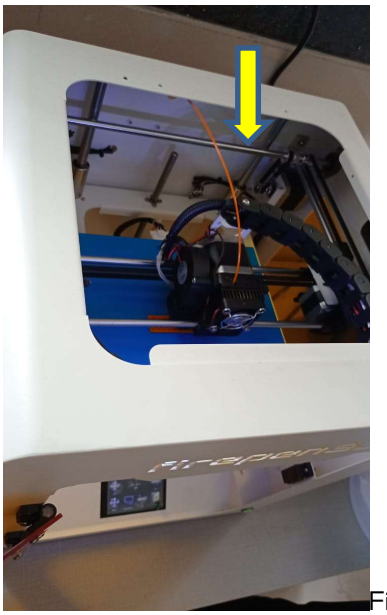


Key chain made in ATL lab using 3D Printer



3D Printer

KEYCHAIN

	 Filament used in 3D printer **References:** • https://www.who.int/data/nutrition/nlis/info/human-development-index • https://hdr.undp.org/data-center/human-development-index#/indicies/HDI • https://www.investopedia.com/terms/h/human-development-index-hdi.asp • https://ourworldindata.org/human-development-index
Learning Outcomes	The learners will be able to: • Identify the parameters required to evaluate the value of HDI • Appreciate the process of determining HDI which will infer about the development status of a country • Plan and conduct investigations or experiments to arrive at and verify the facts, principles, phenomena or to seek answers to queries on their own • Relate processes and phenomena with causes and effects, apply scientific concepts in daily life and solve problems • Communicate the findings and conclusions effectively • Gets familiar with 3D - Drawing and 3D Printing Apply learning to understand and improve the future employment opportunities
Glossary	• **Data Acquisition:** Data Acquisition refers to acquiring authentic data from reliable and authentic sources/ platforms that is required for the AI model. There can be various ways to collect data, such as camera, surveys, online websites, API's etc. • **Data Exploration:** 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. • **Data Visualization:** Data visualization is the graphical representation of information and data. By using visual elements like charts, graphs, and maps, data visualization tools provide an accessible way to see and understand trends, outliers, and patterns in data. • **Linear Regression:** The linear relationship between a dependent variable and a independent variable. • **Machine Learning:** Machine learning is a subfield of artificial intelligence, which enables computers to learn automatically from past data. • **TinkerCad:** Tinkercad is a web app that equips with the foundational skills for 3D design. **3D Printing:** 3D printing is an additive process whereby layers of material are built up to create a 3D part.
Reference Links	
Skill Outcome	**Tech Skill** • Digital learning

	• Algorithmic thinking • Data gathering • Model optimization Design thinking • Ideation • Prototyping **Mathematical and Quantitative Skill** • Probability • Statistical Analysis • Graphical Representation AI domain • AI for Data **Physical Computing** • Basic electrical and electronics **Social Impact Solution Building** • Problem identifying • Problem scoping • Problem solving • Prototyping the AI and tinkering solution • Intrapersonal skill • Observation skill • Creative mindset Interpersonal skill • Empathy **Collaboration Computational Thinking** • Python programming • 3D Printing	