



Integration Opportunities

Science 4.1c Compare two different representations of the same data and the process for data collection in an experiment.

English 4.RI.3c Have students describe how humans and computing technologies process data using words that pertain to comparison, sequence, or cause and effect.

4.CSY.3 Computing Systems

The student will describe the learning process of humans and computers. (a) Compare and contrast how humans and computing technologies collect, store, and process data. (b) Identify similarities and differences on how humans and computing technologies infer and extract meaning from data. (c) Define machine learning and identify machine learning approaches: supervised, unsupervised, and reinforcement learning.

Understanding the Standard

Computing devices are tools that are intended to help humans with thinking work, but the process by which that thinking work happens differs between humans and computers. Humans are uniquely capable of metacognition, allowing them to question the data they are given and to seek out new information. Humans may also attach emotion to their experiences and originate ideas. Machines are dependent on the data made available to them, and learning is specialized and task-oriented. Machine learning, while rooted in the study of artificial intelligence (AI), is different from the generative AI popular in contemporary media. Machine learning is more useful in finding practical approaches to analyzing massive, complex data sets that may be too cumbersome to process with an explicit, human-written algorithm.

Term	Definition
Machine learning (ML)	A branch of AI (artificial intelligence) focused on creating computer systems that accomplish tasks without explicit instructions. (from ComputerHope)
Supervised machine learning	A type of machine learning in which a model is trained on a labeled dataset. The model identifies patterns in the training data and applies these patterns to make predictions or classifications on new, unseen data.
Unsupervised machine learning	A type of machine learning in which training data is "unlabeled," meaning its desired output is not provided to the algorithm. (from ComputerHope)
Reinforcement learning	A type of machine learning in which the system focuses on how to increase the chances of accumulating a quantifiable reward. (from ComputerHope)

Prerequisite Knowledge

Students should be able to practice basic metacognition, monitoring and articulating their learning or understanding.

Summary of a Lesson

As a class, play the [Guess My Rule](#) game, in which the teacher decides on a "rule" that has to be followed, but does not reveal the rule. Students try to guess the rule based on the information discovered. Discuss how students made decisions about which numbers to suggest and how each piece of information revealed helped them determine what the rule might be. Define supervised machine learning and unsupervised machine learning, and discuss which type of learning this game best represents (unsupervised). Introduce [Teachable Machine](#) and provide opportunities for students to train the machine using data in the form of images, sounds, or movements.