ARTIFICIAL INTELLIGENCE

OVERVIEW

Students will investigate and categorize types of artificial intelligence to determine a protocol for the Turing Test. The protocol serves as a foundation for students to construct a workflow for an interactive app. Students will compare and evaluate their workflows to determine which protocols would serve as an adequate Turing Test.

STEM LESSON FOCUS

Engineering Design Cycle	**21st Century Skills**
• Creating or Prototyping	• Collaboration • Creativity

OBJECTIVES

Students will be able to:

- classify types of artificial intelligence according to types of representations formed.
- formulate a protocol that could serve as a simulation for the Turing Test.

MATERIALS

- A computer with access to the internet
- A computer with flowchart diagramming software* (Optional if diagramming materials are available.)
- What is Artificial Intelligence? student handoutAenean pulvinar tortor id tristique sagittis.

*Free flowchart software is available online for educators and students including:
Draw.io
Gliffy
Lucidchart
Creately

ARTIFICIAL INTELLIGENCE

SIEMENS STEM DAY Science Technology Engineering Math

HAVE YOU EVER WONDERED…

- Could machines show human levels of intelligence? If you've used a website with an online chatbot, it make have taken you a few questions and answers before you realized it was not human. A major goal for software engineers and computer designers is to build a computer that shows human intelligence.
- How do computers compare in measures and types of intelligence? You have probably heard of IBM's Big Blue chess playing machine, which can beat the world's best chess players. Self-driving cars need situational awareness in order to deal with varying road and traffic conditions. Sophisticated programs can help doctors diagnose and treat disease. Scientists have yet to agree on how to classify and measure these different types of artificial intelligence.

MAKE CONNECTIONS!

How does this connect to students?	**How does this connect to careers?**	**How does this connect to our world?**
How does this connect to students? Artificial intelligence capability is already being deployed by businesses and even in the home. Everyday AI applications include voice responsive query systems, diagnostic software, finance, image analysis, traffic management, and robotics.	**Machine learning engineer:** typically specializes in an AI sub-discipline such as natural language processing, prediction or recommendation engines and computer vision. **AI software developer:** creates, tests, and manages systems that process input data via machine learning algorithms. **Data mining analyst:** researches high data volumes to generate solutions by identifying patterns and relationships.	Organizations worldwide are utilizing AI applications that are already revolutionizing a wide of economic sectors that impact our daily lives including healthcare, transportation, finance and customer service. AI also holds promise for developing solutions to worldwide problems such as climate change, resource use, and biodiversity loss.

Please allow for more classroom time if you want students to further explore careers.

ARTIFICIAL INTELLIGENCE

BLUEPRINT FOR DISCOVERY

Teacher note:
For background, you may wish to familiarize yourself with the Turing Test by reviewing the following resources:
https://plato.stanford.edu/entries/turing-test/
http://www.psych.toronto.edu/users/reingold/courses/ai/turing.html

1. Ask students if they have encountered an online chatbot, as commonly used on commercial websites.

   Working in pairs or small groups, students share their experiences with each other. Each group writes an answer to the question, “Did the chatbot you experienced exhibit intelligence?”

   Explain to students that chatbots are a type of artificial intelligence (AI). They will investigate types of artificial intelligence and develop a test for artificial intelligence.-

   Invite students to read the **What is Artificial Intelligence student handout.** This includes information from the 2016 White House report on artificial intelligence: Preparing For The Future Of Artificial Intelligence.

   Guide students to complete the table using information from the **What is Artificial Intelligence student handout** to help define Artificial Intelligence and its applications. Invite students to share their notes and check their thinking with a partner or small group.

2. Ask students if they have ever taken an IQ test. If so, students should not reveal results.

   Students write their own definition of intelligence. If students need guidance they can write a response to the question: Is the IQ test an adequate measure of intelligence?

   Working in pairs or small groups, students share their definitions with each other. Hold a brief class discussion, during which groups share their definitions with the class.

   Write the key points from the discussion on your white board, beginning with “Intelligence is…” and completing the sentence (e.g., Intelligence is… (a) the ability to learn from experience, (b) the application of knowledge to a new problem, etc.).

   Ask groups to brainstorm how they would test the intelligence of an AI. Explain to the groups that the computer scientist Alan Turing first proposed such a test in a 1950 paper.[1]

   Review this background information before beginning the main activity:

- The Turing Test is a method to determine whether or not a computer can "think" in way that is indistinguishable from a human. The basic idea is that a human judge would have two conversations, without knowing which conversation was with a computer and which was with another person. To pass the Turing Test, the computer would fool the judge. That is, the judge would be unable to tell whether the conversation was with the computer or with the human. No computer to date has definitively passed the Turing Test. The best that has been achieved was in 2014, when a Russian chatbot convinced a third of judges that it was human.[2]

3. Working in groups, students create a flow-chart or concept make to model the workflow for an interactive app that could be used to conduct the Turing Test. To construct their workflow, students can use drawing materials or free digital tools. Such a flowchart would include:

- A series of challenge questions (from the judge)
- Example responses for each of the questions
- Response ratings by the judge
- A rubric by which the responses enable the respondent to be judged as machine or human. For example, ratings could be scaled, such as:
    a) Definitely human
    b) Probably human
    c) Unable to decide
    d) Probably artificial
    e) Definitely artificial

    The rubric could specify that at least 30% of responses would have to be judged as "Definitely human" for the respondent to pass the Turing Test.

Take action!
Student groups can build a prototype of their Turing Test. A straightforward approach is for students to build a chatbot. Free software includes MIT's Scratch application, which provides examples of how to build a simple chatbot. Google's project, the open source Tensorflow, provides more advanced students with the necessary programming tools. For another extension activity, students could research critiques and alternatives to the Turing Test as a measure of machine intelligence.

ARTIFICIAL INTELLIGENCE

NATIONAL STANDARDS

Science	Next Generation Science Standards HS-ETS1-2. Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.
Technology Education	Next Generation Science Standards and International Technology and Engineering Educators Association 2.W Systems thinking applies logic and creativity with appropriate compromises in complex real-life problems. 2.CC New technologies create new processes 2.FF Complex systems have many layers of controls and feedback loops to provide information. 17.L Information and communication technologies include the inputs, processes, and outputs associated with sending and receiving information. 17.M M. Information and communication systems allow information to be transferred from human to human, human to machine, machine to human, and machine to machine.

WHAT IS ARTIFICIAL INTELLIGENCE?

There is no single definition of AI that is universally accepted by practitioners. Some define AI loosely as a computerized system that exhibits behavior that is commonly thought of as requiring intelligence. Others define AI as a system capable of rationally solving complex problems or taking appropriate actions to achieve its goals in whatever real-world circumstances it encounters.

Experts offer differing taxonomies of AI problems and solutions. A popular AI textbook used the following taxonomy:
(1) systems that think like humans (e.g., cognitive architectures and neural networks)
(2) systems that act like humans (e.g., pass the Turing test via natural language processing; knowledge representation, automated reasoning, and learning)

(3) systems that think rationally (e.g., logic solvers, inference, and optimization);
and
(4) systems that act rationally (e.g., intelligent software agents and embodied robots that achieve goals via perception, planning, reasoning, learning, communicating, decision-making, and acting).

Separately, venture capitalist Frank Chen broke down the problem space of AI into five general categories: logical reasoning, knowledge representation, planning and navigation, natural language processing, and perception. And AI researcher Pedro Domingos ascribed AI researchers to five “tribes” based on the methods they use: “symbolists” use logical reasoning based on abstract symbols, “connectionists” build structures inspired by the human brain; “evolutionaries” use methods inspired by Darwinian evolution; “Bayesians” use probabilistic inference; and “analogizers” extrapolate from similar cases seen previously.

This diversity of AI problems and solutions, and the foundation of AI in human evaluation of the performance and accuracy of algorithms, makes it difficult to clearly define a bright-line distinction between what constitutes AI and what does not. For example, many techniques used to analyze large volumes of data were developed by AI researchers and are now identified as “Big Data” algorithms and systems. In some cases, opinion may shift, meaning that a problem is considered as requiring AI before it has been solved, but once a solution is well known it is considered routine data processing. Although the boundaries of AI can be uncertain and have tended to shift over time, what is important is that a core objective of AI research and applications over the years has been to automate or replicate intelligent behavior.

ARTIFICIAL INTELLIGENCE

AI categories	Example in the real world	Example in AI world
1.		
2.		
3.		
4.		
5.		

ARTIFICIAL INTELLIGENCE

Cited Works

[1] Turing, A.M. (1950). Computing machinery and intelligence. Mind, 59, 433-460. http://www.loebner.net/Prizef/TuringArticle.html

[2] BBC News. Computer AI passes Turing test in 'world first' June 9, 2014. http://www.bbc.com/news/technology-27762088