

AI Lesson Plan

The Turing Test – *Artificial Intelligence*

Summary

Artificial Intelligence is a growing and important field in Computer Science. While AI is a common buzzword, very few people stop to think about what AI actually is. This activity aims to get students thinking critically about what makes humans intelligent, and how computer scientists are designing computers to act more like us.

Timeline

What	Time	Where
Introduction	10 mins	Artificial Intelligence.pptx AI Lesson Plan.docx
Turing Test	20 mins	Class Questions.docx Turing Test Questions.docx Turing Test Student Slips.docx
Intelligent Piece of Paper	15 mins	Intelligent Piece of Paper.docx
What's It All About	5 mins	What's It All About

Materials

- ✓ One copy of Turing Test Computer Answers
- ✓ One copy of Turing Test Responses
- ✓ One laminated (or sturdy) copy of the Intelligent Piece of Paper, for lecture
- ✓ One copy of "Intelligent Piece of Paper" for each pair of students
- ✓ PowerPoint slides.

Introduction- Whole Class

When deploying this activity, start off with a classroom discussion about artificial intelligence. Some good questions to ask students might sound like

- What things are easy for computers to do that are hard for humans?
 - Math problems – adding/multiplying/dividing
 - Searching for an item from a list
 - Sorting items based on a particular attribute (numbers, letters, words, etc.)
- What tasks are easy for humans to do that are hard for computers?
 - Voice recognition – sarcasm
 - Voice recognition – the context and semantics of language
 - Image recognition – finding objects in images
 - Facial recognition – recognizing someone in a photo
- What makes a human intelligent?

After hearing some thoughts, come up with a definition for artificial intelligence to present to the class. One that might be useful for middle school students would be:

Artificial Intelligence: Making a computer act more like a human so that it is able to do tasks just as well (or better) than an actual person.

After we've defined AI, move on to the Turing Test. The Turing Test is named after mathematician Alan Turing. From Wikipedia:

The **Turing test**, developed by Alan Turing in 1950, is a test of a machine's ability to exhibit intelligent behaviour equivalent to, or indistinguishable from, that of a human. Turing proposed that a human evaluator would judge natural language conversations between a human and a machine designed to generate human-like responses. The evaluator would be aware that one of the two partners in conversation is a machine, and all participants would be separated from one another. The conversation would be limited to a text-only channel such as a computer keyboard and screen so the result would not depend on the machine's ability to render words as speech (see Figure 1). If the evaluator cannot reliably tell the machine from the human, the machine is said to have passed the test. The test does not check the ability to give correct answers to questions, only how closely answers resemble those a human would give.

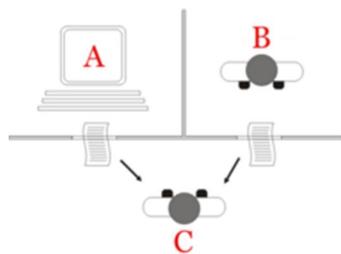


Figure 1: Typical Turing setup

Whole Class Discussion – Turing Test

In this discussion students will explore the idea of the Turing Test. Use the attached slides as a method of introducing the activity.

Slide #2: just continues to explore the idea of intelligence. Ask the students for their opinions. Below are some thoughts to get the discussion started:

- Cars
 - Onboard computers for anti-lock brakes
 - Parallel parking automatically
 - Lane drift detection
- Appliances
 - Dryers can automatically sense the wetness of clothing
- Cell Phones
 - They can observe your habits and learn where your home and work locations are
 - Automatically adjust to different environments (screen brightness in the daylight, holding your phone up to your head turns the screen off)
 - Apps to recognize objects (barcode scanners)
- Ear buds
 - Maybe not so smart
 - Some earbuds are smarter than others – noise cancellation, etc.
- RC Cars
 - Maybe not so smart

Slide #3: Introduces Alan Turing.

Slide #4: Introduces the Turing Test.

Slide #5: Get the students to think of how a computer might be programmed to answer questions, if the goal is for it to act like a human. For example, even though a computer might have “know” the capitol of Peru, it might answer “I don’t know.” Clearly a computer can’t dance, but it might claim to like dancing, or even to not dance because it’s bad for the knees or will look silly.

Slide #6: Our Turing Test activity will involve three students – one pretending to be a “computer” who will have a copy of questions and pre-defined answers (like a computer program), and another as a “human” who will just answer questions as they see fit.

Slide #7: These two students should be outside of the classroom so the class cannot see them (this is similar to the setup on slide 4, the “evaluator” – in this case the class – must not be able to see which is which). The third student will act as a go-between for the class and the human/computer actors. You might want to print the TuringTestStudentSlips to support this process (or use a blank piece of paper).

Be sure that the students who are acting as the computer, human and the go-between fully understand the rules and procedures of the activity beforehand so that the activity runs smoothly.

Slides #8-10: The class should select questions from the PowerPoint slides. Then, the go-between should relay the question to the human/computer and bring their answers back to the class. After each question, have the class take a vote of which student they believe is the computer. Keep a running tally on the board.

Slide #11: After several questions have been asked, have the class guess which set of answers belongs to the “human,” and which set of answers belongs to the “computer.”

Activity - Intelligent Piece of Paper

This activity is the idea of Paul Curzon from Queen Mary University of London.

The previous discussion introduced the idea that one goal of computer scientists is to make computers seem “intelligent” – more like humans. But those activities did not explore how that might be possible. This activity encourages students to think about what makes a computer “intelligent”, by showing that it’s the logic programmed into the computer.

The Hook: Announce that the piece of paper you are holding is more intelligent than anyone in the room (even the highly intelligent teachers there). Wax lyrical about how intelligent it is without saying why. Wave it around keeping the written side hidden from the audience.

The Set-up: Ask the audience if they believe you and have a show of hands first of those who believe it is intelligent and then those who “believe I am talking total garbage and no way just a piece of paper could be intelligent”.

Usually most will go for the garbage option. Congratulate them on their wisdom (both for believing such a wise person as you and especially those that don’t – after all no good scientist believes claims of random people making great pronouncements however great they are without some evidence.

Ask for suggestions of what might it be about the paper that could be the basis of such an outrageous claim.

- Students might suggest the ink or the lamination. Assure them the ink is normal, and the lamination is just to protect the paper.
- Students might suggest there’s a computer embedded. You might mention that a musical greeting card has an embedded chip, but your paper does not. Students might be interested to know that many small, embedded computers are as complex as the computer used to put Neil Armstrong on the moon... so it’s possible to have a lot of computing power with very small space.
- Another suggestion is what is written on the card. Ask what might be written to make it intelligent. Great equations? Wonderful poetry? Exciting facts? Suggest examples and ask if the audience think that would be intelligent. Remind the class that knowledge isn’t the same as intelligence – and that they surely don’t just try to memorize facts for exams but try to understand, which isn’t the same.

Containing a list of facts wouldn’t be enough for it to be intelligent, so the paper must be able to show that it is intelligent. What can the paper do?

Well it has ***never lost a game of Tic-tac-toe*** (and it plays regularly against humans). Remind them that it’s not possible to force a win in tic-tac-toe, but the game should end in a draw if both players play perfectly (i.e., the paper might have a draw, but it never loses).

The activity:

Ask them if they believe you or do they want to see some evidence? To show the evidence you will need two volunteers. This will be a battle between paperkind and humankind, so one student will represent

the paper, the other represents humanity. It may be best **not** to pick someone who was really keen and appearing to think they would never lose to do this to reduce the chances of it being a drawn game (though often such volunteers still lose).

The process:

- Draw a tic-tac-toe board on the whiteboard/flip chart.
- Give each volunteer a marker.
- Explain that the paper is 'peripherally challenged' – you didn't bring it a robotic arm or camera system (computer peripherals) - so it needs a servant to do its bidding. You might want to note that just because someone is paralyzed doesn't mean they aren't more intelligent than you.
- The student playing for the piece of paper must turn off their own intelligence and do *exactly* what the paper tells them. To ensure this, they should read the paper's instruction out loud, (so everyone can tell it is the paper playing, not them).
- The other player will play as well as they can. The audience may want to shout out options as well (note that another option is to have one student represent the paper and play against the whole class... so you can selectively "hear" options that will lead to a win for the paper).
- The person playing for the paper should now read the first instruction, which specifies that it is going first. If someone complains that it's unfair for it to go first, point out that the game should just end in a draw. Going second isn't a reason to lose.
- The paper's servant should then read out the first move and make the move – playing in a corner.
- The human player now makes a move (or the teacher will selectively hear/make the move based on input from the class)
- The two players will continue back and forth until either one wins or the game is a draw.
- If the game is a draw, remind the students that this is acceptable – the paper merely claims to never lose. By tic-tac-toe rules, it's not always possible to win.

Announce that once more the paper has kept its unbeaten run.

Ask again for a show of hands as to who now believes the paper is intelligent. Say you'll accept that perhaps it's not *more* intelligent than the humans but it has shown itself to be their equal, at least in the context of tic-tac-toe.

Ask for applause both for the volunteers as they return to their seats and the paper for its stunning performance.

The explanation:

Point out that it did show intelligent behavior, so there is intelligence somewhere. Where is it? Someone will almost certainly say it is in the person that wrote the instructions. Ask if everyone agrees that that is where the intelligence is and get a show of hands.

Now explain that on the paper is essentially a computer program: instructions to be blindly followed. Everything they have ever seen a computer do, it was just blindly following instructions in the same way. Point out that if they are saying the paper just by being only rules isn't intelligent then they are saying

no computer could ever be intelligent. BUT, programs can be written to emulate human intelligence, which often makes them more useful.

These instructions were written in a language so that a human can follow them. If they were to be written for a computer they would be written in a programming language: just a language a computer can understand and follow. Point out that if they think that it is the writer of the instructions who is the creative intelligent one, then they are saying that computer programmers are intelligent and creative (which is true). It is computer programmers who have written all the instructions all those computers are following.

Activity wrap-up: The demonstration only played tic-tac-toe one time. Does that mean the paper won't lose? Let students group into pairs and play tic-tac-toe with an intelligent piece of paper until they are convinced it is correct.

Since some student pairs might take longer to convince themselves the paper won't lose, as an extension, you might ask if it's possible to ensure no loss if the piece of paper goes second. Challenge the students to come up with a set of instructions if they can [**answer:** it isn't possible... even "intelligent" programs can't magically change constraints. Students who try should come to this conclusion].

What's It All About Discussion – Whole Class

This activity involves the class trying to judge who is human and who is a computer. Can they think of any examples where a computer might want to be the judge? A good example of a “reverse Turing Test” is CAPTCHAs – the images humans have to read to reset their passwords or perform other tasks on a computer.

Applications of artificial intelligence are all around us, and only going to become more common. Google’s self-driving car is another great example. How do we teach a computer to drive like a human and be able to process information from all around the car quickly? These are problems that take many computer scientists to work towards a solution.

Video Resources:

What is AI: <https://www.youtube.com/watch?v=mJeNghZXtMo>

IBM Watson: https://www.youtube.com/watch?v=ZPXCf5e1_HI