



HOUR OF CODE: AI FOR GOOD

EDUCATOR GUIDE

45 minutes



This Educator Guide includes

- theme overview
- talking points on Artificial Intelligence, coding, and fire prevention
- lesson procedures
- CSTA & ISTE standards
- ideas for extension activities

HOW TO GET STARTED

- Install Minecraft: Education Edition by visiting <https://aka.ms/minecrafthourofcode>
- [Watch the intro video](#) to get acquainted with this Hour of Code theme and learn how to start the lesson
- [Watch the walkthrough video](#) to get a better understanding of how to navigate the world
- Open the world and play through
- Need help downloading or accessing the lesson? Check out our [FAQ](#).

THEME OVERVIEW

Here is the lesson theme. Feel free to read or share this with your students:

A village is threatened by fire and needs you to code a solution! Meet your coding helper, the Minecraft Agent, then program the Agent to navigate the forest and collect data. This data will help the Agent predict where fires will occur. Then code the Agent to help prevent the spread of fire, save the village, and bring life back into the forest. Learn the basics of coding and explore a real-world example of artificial intelligence (AI).

LESSON OBJECTIVES

By the end of the lesson the students will:

- Get a high-level understanding of how Artificial Intelligence can be used to collect data about forest fires
- Create coding solutions that include sequences, events, loops, and conditionals
- Decompose (break down) the steps needed to solve a problem into a precise sequence of instructions
- Iterate on solutions to complete a task

The lesson also includes free time to explore coding concepts students have learned to deepen their understanding.

LESSON INTRODUCTION & LEAD-IN: 10 minutes

Tell the students that this lesson will be about preventing fires with the help of artificial intelligence. Fire sometimes poses a serious threat to forests, endanger homes and communities. Students will need to protect the village in the Minecraft world from potential spread of fire. Introduce the following questions or allow students discuss in groups:

- **What are the factors that contribute to forest fires?**
Although they are classified as natural disasters, only 10-15% of forest fires occur on their own in nature. The other 85-90% result from human causes.¹

¹ <https://www.nationalgeographic.com/environment/natural-disasters/wildfires/>



Generally, three conditions must be present for a fire to burn: fuel, oxygen and a heat source. Factors contributing to the spread of fire include strong winds which spread fire quickly, warm temperatures, dry weather, and dry vegetation.

Several factors have caused the number and severity of wildfires to increase in recent years. As humans live in communities closer to forests, forest management practices to suppress fire can lead to larger and more destructive wildfires later on. Climate change has also increased the risk of wildfires by drying forests and making them more likely to burn.²

- **How do people/ firefighters predict the fires in the forest?**

Fires are difficult to predict, but analyzing contributing factors like dry weather, dry vegetation, forest composition and wind conditions can help us identify risk-prone areas.

Having an automated, efficient way to monitor these conditions remotely, such as through Artificial Intelligence, will be important to identify these high-risk areas more quickly and allow us to take action to minimize the likelihood of a fire starting.

- **What are the outcomes of fires?**

- When wildfires rage uncontrollably through forests, they have harmful outcomes that include deforestation, irreparable damage to flora and fauna, adverse effects on the air quality, and loss of animal habitat.
- However, low-intensity natural fires can happen naturally and have benefits. For example, they burn dead or decaying matter, returning trapped nutrients to the soil. They also act as a disinfectant, removing disease-ridden plants and harmful insects from an ecosystem. This makes room for new life that will help keep the forest healthy in the long-term.

- **What is reforestation?**

² <https://www.nytimes.com/interactive/2018/11/27/climate/wildfire-global-warming.html>



- Reforestation is the process of establishing a new stand of trees on a previously forested site following a disturbance such as fire.
- There are two ways to re-establish a stand of trees. Natural regeneration is when you let nature handle the job of revegetating a site and artificial regeneration is when you bypass nature and seed or re-plant the site yourself.
- The success of any natural regeneration after a burn depends on the abundance of seed available, both in surviving species and in soil seedbanks, that remain after a burn. Natural regeneration does not allow for species selection, stocking levels, and spacing.
- The standard choice for artificial regeneration is to plant seedlings. Think about what plants will grow naturally in this area and their quantity.

Introducing coding concept: Artificial Intelligence (AI)

Tell the students that in this lesson they will learn about Artificial Intelligence and how it can be used to prevent fires from happening.

Artificial intelligence (AI) is the ability of a computer program or a machine to think and learn. It is also a field of study which tries to make computers "smart". They work on their own without being encoded with commands. John McCarthy came up with the term "artificial intelligence" in 1955.

An ideal intelligent machine is a flexible agent which perceives its environment and takes actions to maximize the chance of success at some goal.

Introduce the following questions or allow students discuss in groups:

What are some criteria you would use to classify a computer as "intelligent"?

There is no one definition, but researchers agree on some common traits:

- Ability to make 'smart' decisions
- Ability to learn and increase knowledge



- Ability to imitate humans (language/speech, vision/image recognition)

What are some things that computers could do if we had better AI programs?

Some examples: diagnose diseases, drive our cars, fly airplanes, order groceries for us, do our laundry, be our personal translator when we travel, do our banking and money management, etc.

If a computer is intelligent, does that mean it has its own consciousness, meaning, is it self-aware?

AI doesn't necessarily mean that a computer can feel, or that it has its own personality. However, researchers have been studying whether there are "robot rights" that we may need to consider in the future.

CODING ACTIVITIES: 30-40 minutes

Students start their coding journey in front of a Fire Research Center. Here are the coding quests:

Quest 1: Open the Gate. Students are introduced to coding for the first time. Their first quest is to open the gate to the Research Center.

Quest 2: Meet the Agent. The students meet the Agent, their coding sidekick for the first time. Their quest is to move the Agent 3 blocks forward.

Quest 3: Agent Move. Now the time has come for the Agent to analyze some dry brush!

Quest 4: Gather Data. Students need to gather more data with the help of the Agent. Students need to program the Agent to move closer to dry brush to gather data on any material that could cause a fire.

After the data is collected, students need to return to the Research Center and upload all the data that has been gathered. Time to train the Agent on the factors contributing to the fire. Students need to answer the question correctly, 'Is this object a fire threat?' Combining the input responses with the data collected, the Agent will have learned what qualifies as a fire hazard and what doesn't.



Quest 5: Eliminate all the Hazards. Students need to program the Agent so that it can make the right choice about the objects presented in front of it, if it is a flammable object – destroy, if it is not flammable – do not destroy.

The Agent is back in training, learning more from satellite images taken from around the globe and determining when and where the next fire could strike.

Quest 6: Field Mission! This is the first real mission for the students and the Agent! Students need to code the Agent to clear the dry brush between the village and the plains.

Quest 7: Save the Village! Students need to code the Agent to remove all the flammable materials from the area to protect the village.

Quest 8: Reforestation. Students are tasked with bringing life back to the area affected by fire.

LESSON CONCLUSION: 5 minutes

Introduce the following questions or allow students discuss in groups:

- What role do computers play in preventing forest fires?
- What data is important when fighting forest fires?
- How can we prevent forest fires from happening?
- What is reforestation? And how do you approach it?



ENHANCEMENT ACTIVITIES

Upon completion of the lesson in full, students can be offered a variety of options:

1. To do additional coding activities in the same world that will enable students to explore some creative building in Minecraft.
2. To explore more on assessing wildfire risk with machine learning go here:
 - <https://www.microsoft.com/en-us/ai/ai-for-earth-partners?activetab=pivot1:primaryr6>
 - <https://www.fastcompany.com/90269483/how-ai-software-could-help-fight-future-wildfires>
 - <http://www.bbc.com/future/story/20190226-how-to-bring-wildfires-back-under-control>
 - <https://www.wsj.com/articles/how-ai-might-be-used-to-battle-wildfires-11554168366>
3. Explore some real-world examples of reforestation:
 - <https://articles.extension.org/pages/73378/reforesting-your-forestland-after-a-wildfire>
 - <https://www.nationalforests.org/who-we-are/our-impact/replanting-after-california-wildfires>



Minecraft Control Guide

KEYBOARD

W – Move forward
S – Move Back
A – Move Left
D – Move Right
SPACE – Jump
C – Open coding window

MOUSE

Left Click – Mine or Attack
Right Click – Use or Interact with a character
Move mouse – Look around

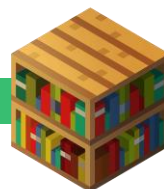
TOUCH

If you're using Minecraft with a touchscreen device, the game controls are different from a keyboard/mouse device.

- **Movement:** look for the movement control pad in the lower left corner of your screen.
- **Look around:** Drag anywhere on the screen to look around.
- **Talk with characters:** As you approach characters in the game, a “talk” button will appear allowing you to interact with them.
- **Code:** Tap the Agent/robot icon on the top of the screen to open the coding interface.
- **Jump:** The button on the lower right is for jumping.

For a printable .pdf file with more Minecraft controls, visit:

https://education.minecraft.net/wp-content/uploads/Key-Terms-and-Control-Guide_MEE.pdf



EDUCATION STANDARDS

CSTA K-12	
1A-AP-08	Model daily processes by creating and following algorithms (sets of step-by-step instructions) to complete tasks.
1A-AP-09	Model the way programs store and manipulate data by using numbers or other symbols to represent information.
1A-AP-11	Decompose (break down) the steps needed to solve a problem into a precise sequence of instructions.
1B-DA-07	Use data to highlight or propose cause-and-effect relationships, predict outcomes, or communicate an idea.
1B-AP-10	Create programs that include sequences, events, loops, and conditionals.
1B-AP-13	Use an iterative process to plan the development of a program by including others' perspectives and considering user preferences.
1B-IC-18	Discuss computing technologies that have changed the world, and express how those technologies influence, and are influenced by, cultural practices.
ISTE	
1C	Students use technology to seek feedback that informs and improves their practice and to demonstrate their learning in a variety of ways.
2B	Students engage in positive, safe, legal and ethical behavior when using technology, including social interactions online or when using networked devices.
3A	Create experiences for learners to make positive, socially responsible contributions and exhibit empathetic behavior online that build relationships and community.
3B	Establish a learning culture that promotes curiosity and critical examination of online resources and fosters digital literacy and media fluency.
6B	Manage the use of technology and student learning strategies in digital platforms, virtual environments, hands-on makerspaces or in the field.



CODING CONCEPTS

The lesson explores the following computer programming concepts including:

- **Sequencing:** The Agent will move in order that you sequenced. A sequence is one of the basic logic structures in computer programming. In a sequence structure, an action, or event, leads to the next ordered action in a predetermined order.
- **Iteration:** In Computer Science, “iteration” is just a fancy term to make things repeat over and over again. To learn more:
<https://minecraft.makecode.com/courses/csintro/iteration>
- **Artificial Intelligence:** Artificial Intelligence, or “AI” is the art and science of creating computer systems that mimic, and even surpass human intelligence. AI is an important field in computer science, and AI programs and computers are used in many different areas.
- **Conditionals:** Students are already familiar with the concept of conditionals in their daily lives. Have they ever had a parent say any of the following?
 - “If you clean your room, you can go out with your friends.”
 - “If your homework is done, you can play video games.”
 - IF it is snowing, THEN wear boots, ELSE wear shoes.
 - The ELSE portion makes sure that some action is performed regardless. Regardless of whether it is snowing or not, you should probably wear something on your feet.

To learn more:

<https://minecraft.makecode.com/courses/csintro/conditionals>

- **Loops:** The loop command only repeats when a condition is met (‘true’). The condition can only be ‘true’ or ‘false’. If it is ‘true’, the while coding block will repeat the code and if it is ‘false’ it will stop.
- **Events:** The animals and plants only appear when the event is triggered, in this case, the event is when the player walks in the area. More information can be found here:
<https://minecraft.makecode.com/courses/csintro/events>



Glossary

Mob – Mobs are living, moving, entities, such as animals and monsters.

Agent – The Agent is a Minecraft mob that helps students learn coding by getting them to code various actions. The Agent, which looks like a robot, can be coded to carry out tasks including moving, mining, building, planting and harvesting.

NPC Guide – Non-Player Characters in the game that provide guidance.

Spawn – The term used when a character, animal or mob is generated into Minecraft.

Relative position – The position coordinates based on an east/west, up/down, south/north direction from the location of the character.

Reforestation is the process of establishing a new stand of trees on a previously forested site following a disturbance such as fire.

Natural regeneration is when you let nature handle the job of revegetating a site with trees, whereas artificial regeneration is when you bypass nature and seed or plant the site yourself.

