AInspire's 3-Day AI Curriculum:

Teacher's Notes

Contents

Acknowledgements

Thank you to:

Ms. Amy Gensemer, Senior Director for K-12 Instruction @ Discovery Education

Ms. Kennedy Greene, Justice Center Project Manager @ The American Bar Association

How to Use This Curriculum

THERE ARE MANY online courses that focus on teaching the fundamentals of AI, even to individuals without backgrounds in technology. However, there are no resources -- both offline or online -- that teach AI theory to students in a simplified manner starting at a young age.

Confidence develops through a strong foundation built at a young age. It's imperative that today's students are confident about their knowledge of AI starting from a young age, but there aren't any resources that are accessible for younger students. That's where AInspire's 3-Day Curriculum comes in.

Designed to be a bite-sized introduction to AI, each day in this curriculum gently introduces students to a new AI topic using a multisensory instructional approach (videos, activities, worksheets, and discussions) that will engage every student regardless of their learning style. Due to the versatility of this curriculum, it is suitable for students in grades K-12.

For ease of use, each day in the teacher's notes is divided into five sections: objectives, I can statements, Next Generation Science Standards alignments, materials, and instructions. Each day's instructions are further broken down into three parts: getting started, looking closer, and applying knowledge.

- GETTING STARTED: Entice students' interests and activate their prior knowledge, getting them excited about learning new topics.
- LOOKING CLOSER: Introduce new information and develop students' understanding. Through guided explorations, students are able to connect new topics with ones they learned prior, strengthening their foundational understanding.
- APPLYING KNOWLEDGE: Challenge students to apply their learning to completing performance tasks.

To complement the multisensory learning experience, almost every slide in the powerpoint presentation has an icon, which serves as a label for the type of activity students are engaging in during that time. The different icons and their meanings, while explained in the powerpoint presentation, are also included below:

 Computer Needed

 Class Think and Share

 Partner Turn and Talk

 Independent Worksheet

Day 1: Introduction to Artificial Intelligence

OBJECTIVES

After completing today's tasks, students will be able to:

- Define artificial intelligence
- Differentiate between artificial intelligence, machine learning, and deep learning
- Identify artificial intelligence from real-world examples

I CAN STATEMENTS

- I can define AI (remembering)
- I can explain the difference between artificial intelligence, machine learning, and deep learning (understanding)

NEXT GENERATION SCIENCE STANDARDS

K-2-ETS1-1 Engineering Design

Ask questions, make observations, and gather information about a situation people want to change to define a simple problem that can be solved through the development of a new or improved object or tool.
Performance Expectation | Grade: K-2, K

3-5-ETS1-1 Engineering Design

Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost.
Performance Expectation | Grade: 3-5, 4

MS-ETS1-1 Engineering Design

Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions.
Performance Expectation | Grade: Middle School (6-8)

HS-ETS1-1 Engineering Design

Analyze a major global challenge to specify qualitative and quantitative criteria and constraints for solutions that account for societal needs and wants.
Performance Expectation | Grade: High School (9-12)

MATERIALS

- Curriculum presentation
- Student worksheet
- Access to internet
- A device with Siri/Cortana/Alexa
- White board/poster paper
- Writing utensils

INSTRUCTIONS

- GETTING STARTED: Watch “What is AI” video
    - Before watching the video, ask students: What problems do you think can be solved by using artificial intelligence?
        - Write out student answers on a class list (maybe on a board) What questions do you have about AI? By a show of hands, how many of you have heard about artificial intelligence?
        - Ask students to copy the class list onto their individual worksheets
    - After watching the video, once again ask students: What problems do you think can be solved using artificial intelligence? What is something you would like to create using AI?
- LOOKING CLOSER: As a class, complete the following activities and watch the videos:
    - Artificial intelligence: Play with the ELIZA chatbot and read the story behind it
        - Ask for student volunteers to suggest responses for the bot
        - For younger students, you may need to explain some vocabulary in the story. The gist they should get is that ELIZA is rule-based.
        - Tell students that what they just experienced was artificial intelligence, but not machine learning or deep learning.
    - Machine learning: Play with Siri/Cortana/Alexa
        - Ask students how Siri/Cortana/Alexa is different from ELIZA
            - Guide students to the conclusion that ELIZA had predefined responses. If you wanted her to respond to “hi” in a certain way, you needed to tell her beforehand. Siri/Cortana/Alexa, on the other hand, has not been pre-loaded with responses. She knows the patterns between different types of words (ex: what words put together convey an angry tone) and uses that to converse with you.
        - Tell students that what they just experienced was machine learning
    - APPLYING KNOWLEDGE: Watch the video: AI vs ML vs DL to solidify the difference between the three types of AI
        - Ask students to turn and talk to a partner: use the class list created at the beginning of this session to discuss if they think any of the problems would be more appropriate for one type of AI vs the other
            - Do not worry about the accuracy of these responses

Day 2: Applications of Artificial Intelligence

OBJECTIVES

After completing today's tasks, students will be able to:

- Compare and contrast between different ML models
- Select appropriate ML models to solve real-world problems

I CAN STATEMENTS

- I can identify real-world applications of AI from examples (applying)
- I can list and compare between the different types of machine learning models (remembering and analyzing)
- I can choose the correct AI algorithm to solve a real-world problem (applying)

NEXT GENERATION SCIENCE STANDARDS

K-2-ETS1-3 Engineering Design

Analyze data from tests of two objects designed to solve the same problem to compare the strengths and weaknesses of how each performs.
Performance Expectation | Grade: K-2 (K)

4-PS4-3 Waves and Their Applications in Technologies for Information Transfer

Generate and compare multiple solutions that use patterns to transfer information.
Performance Expectation | Grade: 3-5 (4)

MS-ETS1-2 Engineering Design

Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.

Performance Expectation | Grade: Middle School (6-8)

MATERIALS

- Curriculum presentation
- Student worksheet
- Student-generated problems list from day 1
- Post it notes or posters
- Writing utensils
- Device with an internet connection

INSTRUCTIONS

- GETTING STARTED: Show students a slideshow of different types of technology
    - Ask them: AI or not AI? If AI, ML or DL? Tell them whether they were right or wrong immediately afterwards.
- LOOKING CLOSER: Show students a slideshow of different problems that can be solved with AI
    - Tell students: based on the student generated list from day 1 check off (on your individual student worksheets) which ones match the problems in the presentation
    - Ask students: How can you solve these problems using AI?
    - Ask students: What is the difference between all of these problems?
        - Possible answers: some are qualitative vs quantitative, regressive vs categorical, segmentation vs prediction, etc
        - If students do not come up with any of these ideas, prompt them with guiding questions such as: “Do some of these problems deal with numbers, while others deal with words? What do you call problems that deal with numbers (quantitative)?”
    - Ask students: Is there only one way to solve all of these problems? Or do they all require different approaches?
        - Guide students to the conclusion that they all require different approaches
- Watch video of different AI and ML algorithms
    - Ask students to complete the student worksheet as they watch the video
- APPLYING KNOWLEDGE: Class Activity: Post (on post-it notes or something similar) different types of AI algorithms around the room
    - Show students the same slideshow from earlier and ask them to move to the appropriate ML algorithm post-it note for each problem. Ask students to use their completed worksheet as reference. After calling out each problem, ask students at each ML algorithm to explain why they chose to use that ML algorithm to solve that problem.

Day 3: Creating Artificial Intelligence

OBJECTIVES

After completing today's tasks, students will be able to:

- Apply a linear regression algorithm to a real-world scenario
- Intuitively understand and create a neural network
- Discuss the ethical implications of AI (optional)

I CAN STATEMENTS

- I can apply a linear regression algorithm to a real world scenario (applying)
- I can create a neural network to solve a real-world problem (creating)

NEXT GENERATION SCIENCE STANDARDS

1-LS1-1 From Molecules to Organisms: Structures and Processes

Use materials to design a solution to a human problem by mimicking how plants and/or animals use their external parts to help them survive, grow, and meet their needs.*
Performance Expectation | Grade: K-2 (K)

MS-LS1-8 From Molecules to Organisms: Structures and Processes

Gather and synthesize information that sensory receptors respond to stimuli by sending messages to the brain for immediate behavior or storage as memories.
Performance Expectation | Grade: Middle School (6-8)

MATERIALS

- Curriculum presentation
- Student worksheet
- Writing utensils
- Device with an internet connection for all students (or at least pairs)

INSTRUCTIONS

- GETTING STARTED: Show students two points in a line and ask them to predict the third one
    - Guide students to putting the point at the correct location following the equation of a line
- Ask them how they think this relates to AI. Encourage them to refer to their worksheet from Day 2.
    - Guide students to the conclusion that the line that connects these points could be created using linear regression
- Watch video on linear regression theory

    - Ask students to compare AI linear regression to linear regression in math class
    - Ask students what type of AI it is: AI, ML, or DL?
    - Ask students what types of problems they think can be solved with linear regression
- Look at stock market graph
    - Turn and share with partners: ask students how they plan on using a linear regression algorithm to predicting the price of the stock market next week
    - Sample response: You can use linear regression to create a straight line to predict where the stock market will be in a week
- LOOKING CLOSER: Deep Learning: Become human neural networks
    - Show students pictures of venomous coral snakes and non venomous red milk snakes, labeled with what they are.
    - When students think they can differentiate, show them unlabeled pictures and ask them to write down their individual guesses on their worksheet. Ask students to calculate their accuracy rates.
    - Tell students that what they just experienced was themselves acting like a deep-learning neural network.
- Watch video on neural networks theory
    - Ask students to fill out the accompanying worksheet as they watch the videos
    - Turn and share with partners: How do our brains learn? How do neural networks learn? -> Walk around the classroom to highlight insightful student responses
    - Ask students to compare neural networks to our brains
        - Guide students to the conclusion that brains *are* an extremely complex type of neural network, and that they (like neural networks) learn by looking at thousands of examples and finding patterns that they can apply to identify unseen examples
    - Ask students (as a class): Are neural networks AI, ML, or DL?
    - Ask students: Referring back to the student-generated problem list from day 1, ask students which of these problems can be solved using neural networks?
- Ask each student to navigate to Tensorflow Playground on their computers
    - Allow students to change the parameters on there
    - Ask students to fill out a worksheet based on what happens when you change/increase:
        - Epochs: Training loss decreases, test loss decreases and then increases
        - Learning rate: Training and test loss increase
        - # of hidden layers: Training loss decreases, test loss decreases and then increases
        - # of neurons per hidden layer: Training loss decreases, test loss decreases and then increases (why? Because the model overfits to the data)
    - Class discussion: Ask students to raise their hands and share their thoughts on the following questions

        - What happened when:
            - Epochs increased?
                - Possible answer: Training loss decreases, test loss decreases and then increases (model got better and then worse)
            - Learning rate increased?
                - Possible answer: model learned faster, training and test loss increased (model got worse)
            - Number of hidden layers and neurons increased?
                - Possible answer: Training loss decreases, test loss decreases and then increases (model got better and then worse)
                - For advanced students: Why? Because the model overfits to the data
- APPLYING KNOWLEDGE: https://teachablemachine.withgoogle.com
    - Ask them to watch the introductory video on the page linked above
    - Turn to share (partners): How is teachable machine a neural network?
    - Lead the students in creating a neural network using Teachable Machine for an example of your choosing
    - Allow students to create their own neural networks to solve the problems they talked about earlier
    - Encourage students to share their neural networks with the class (ask them to come to the front of the room with their computers to demonstrate how their network works)
    - Ask students to write down a reflection on the worksheet (“I used to Think” and “Now I Think”)