Unit 8 -Python Programming- Artificial Intelligence and Machine Learning Unit

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AI and Machine Learning Unit

Department of Curriculum and Instruction

Belleville Public Schools

Curriculum Guide

Introduction to Python Programming, Grades 9-12

AI and Machine Learning Module

Belleville Board of Education

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Unit Overview

This unit is a hands-on introduction to developing a machine learning model with tabular data. Students explore how computers learn from data to make decisions, then develop machine learning projects around real-world data. The unit culminates in designing a machine learning app to solve a personally relevant problem.

Students are introduced to a form of artificial intelligence called machine learning and how they can use the Problem Solving Process to help train a robot to solve problems. They participate in three machine learning activities where a robot - A.I. Bot - is learning how to detect patterns in fish.

The primary objective of this Unit is to introduce the basic principles, techniques, and applications of Artificial Intelligence. Emphasis will be placed on the teaching of these fundamentals, not on providing a mastery of specific software tools or programming environments. Assigned projects promote a 'hands-on' approach for understanding, as well as a challenging avenue for exploration and creativity.

Specifically:

1. Gain a historical perspective of AI and its foundations.

2. Become familiar with basic principles of AI toward problem solving, inference, perception, knowledge representation, and learning.

3. Investigate applications of AI techniques in intelligent agents, expert systems, artificial neural networks and other machine learning models.

4. Experience AI development tools such as an ‘AI language’, expert system shell, and/or data mining tool.

5. Experiment with a machine learning model for simulation and analysis.

6. Explore the current scope, potential, limitations, and implications of intelligent systems.

Enduring Understanding

What Is AI? At a basic level, artificial intelligence is when a computer program mimics the intelligence of a human being. This can appear as solving a problem, engaging in conversations, displaying emotions, and many other forms.

Artificial Intelligence is used in a lot of different places in our lives - from facial recognition in our phones to personal recommendations when we browse the web, and even in driverless cars.

Essential Questions

How can we use the Problem Solving Process to solve a problem with machine learning?

What’s an example of AI either in your personal life or that you’ve seen in a movie or book?

What are different types of machine learning?
Think of a skill you commonly use, like speaking, tying your shoes, cooking, or playing a game. How did you learn this skill?

How are human learning and machine learning similar? How are they different?

Exit Skills

Students understand and can explain AI and Machine Learning concepts

Students will know how to create apps to solve a problem for their own interests

New Jersey Student Learning Standards (NJSLS-S)

8.1.12.AP.1	Design algorithms to solve computational problems using a combination of original and existing algorithms.
8.1.12.AP.8	Evaluate and refine computational artifacts to make them more usable and accessible.
8.2.12.ED.4	Design a product or system that addresses a global problem and document decisions made based on research, constraints, trade-offs, and aesthetic and ethical considerations and share this information with an appropriate audience.
TECH.8.1.12	Educational Technology: All students will use digital tools to access, manage, evaluate, and synthesize information in order to solve problems individually and collaborate and to create and communicate knowledge.
TECH.8.1.12.A	Technology Operations and Concepts: Students demonstrate a sound understanding of technology concepts, systems and operations.
TECH.8.1.12.A.CS1	Understand and use technology systems.
TECH.8.2.12.D.4	Assess the impacts of emerging technologies on developing countries.
TECH.8.2.12.D.5	Explain how material processing impacts the quality of engineered and fabricated products.
TECH.8.2.12.D.6	Synthesize data, analyze trends and draw conclusions regarding the effect of a technology on the individual, society, or the environment and publish conclusions.
TECH.8.2.12.E.1	Demonstrate an understanding of the problem-solving capacity of computers in our world.

TECH.8.2.12.E.3	Use a programming language to solve problems or accomplish a task (e.g., robotic functions, website designs, applications, and games).
TECH.8.2.12.E.4	Use appropriate terms in conversation (e.g., troubleshooting, peripherals, diagnostic software, GUI, abstraction, variables, data types and conditional statements).
TECH.8.2.12.E.CS1	Computational thinking and computer programming as tools used in design and engineering.

Interdisciplinary Connections

CAEP.9.2.12.C.3	Identify transferable career skills and design alternate career plans.
CAEP.9.2.12.C.8	Assess the impact of litigation and court decisions on employment laws and practices.

Suggested Activities & Best Practices

https://docs.google.com/presentation/d/1GdcVNyPqtkw5LQPAC0SlvSgCUF515lHOX7uplp6p5DI/edit?usp=sharing

Students are introduced to a form of artificial intelligence called machine learning and how they can use the Problem Solving Process to help train a robot to solve problems. They participate in three machine learning activities where a robot - A.I. Bot - is learning how to detect patterns in fish.

Additionally students will consider how they create “mental” models when learning new concepts, and how those can be similar to a “machine learning” model. They participate in a color pattern activity to simulate building a machine learning model without help, then they play a game called "Green Glass Door" as an example of supervised learning, and finally, they will sort several scenarios into “supervised” or “unsupervised” learning.

Moreover, students explore an application of AI called Seeing AI and examine how it is supporting people with visual impairments. Then, students research other examples of how AI is impacting society, focusing on users who are impacted by the examples they find. Finally, students share their findings with each other.

Assessment Evidence - Checking for Understanding (CFU)

Students will design an app.

Students develop an AI app that addresses the social issue they have returned to throughout the unit. After looking at a sample app, students follow a project guide to complete this multi-day activity. In the first step, students prepare the data they will use to train their model in AI Lab. After training, testing, and generating a model card, they export their model into App Lab for development. Here they use their model to create a user-friendly app based on their mockup from the previous lesson, “Planning Your App”. Students perform a peer review and make any necessary updates to their projects before preparing a presentation to the class.

Question of the Unit: How can I create an AI App the solves a problem in my community?

- Admit Tickets
- Anticipation Guide
- Common Benchmarks
- Compare & Contrast
- Create a Multimedia Poster
- DBQ's
- Define
- Describe
- Evaluate
- Evaluation rubrics
- Exit Tickets
- Explaining
- Fist- to-Five or Thumb-Ometer
- Illustration
- Journals
- KWL Chart
- Learning Center Activities
- Multimedia Reports
- Newspaper Headline
- Outline
- Question Stems
- Quickwrite
- Quizzes

- Red Light, Green Light
- Self- assessments
- Socratic Seminar
- Study Guide
- Surveys
- Teacher Observation Checklist
- Think, Pair, Share
- Think, Write, Pair, Share
- Top 10 List
- Unit review/Test prep
- Unit tests
- Web-Based Assessments
- Written Reports

Primary Resources & Materials

Learn about Artificial Intelligence (AI) | Code.org

Learn about Artificial Intelligence (AI) | Code.org

https://www.futureoftech.org/assets/documents/FoT_Lesson_Plan-Artificial_Intelligence.pdf

https://www.digitaltechnologieshub.edu.au/teachers/lesson-ideas/ai-lesson-plans

Ancillary Resources

WEBSITE RESOURCES: Scratch Machine Learning for Kids Dr. Scratch Particle Intel TEDtalks 4 Lessons From Robots about Being Human (20 minutes) Don’t fear Intelligent Machines. Work with them (15 minutes) CISCO Morrison Foerster GSMA IoT for all

Technology Infusion

Technnology is infused in lesson as it is on the computer learning about computer science concepts

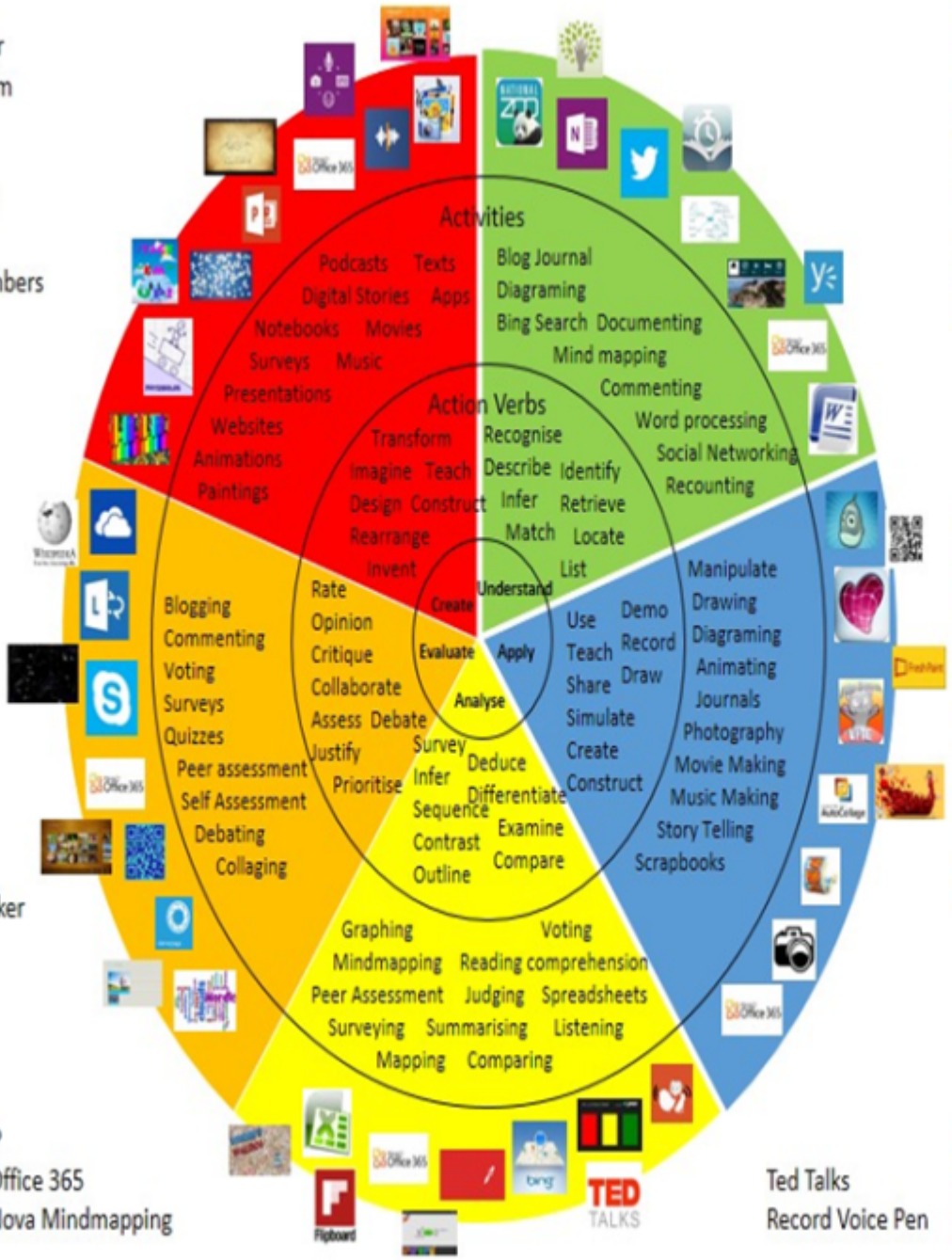
Win 8.1 Apps/Tools Pedagogy Wheel

Podcasts
Photostory 3
Kid Story Builder
Music Maker Jam
Paint A Story
Office 365
MS PowerPoint
Stack 'Em Up
NqSquared Numbers
Physamajig
Xylophone 8

Wikipedia
Skydrive
Lync
SkyMap
Skype
Office 365
Puzzle Touch
Easy QR
Memorylage
Life Moments
Word Cloud Maker

Where's Waldo?
MS Excel
Flipboard
Office 365
Nova Mindmapping

Ted Talks
Record Voice Pen



Originally taken from http://www.coetail.com/vzimmer/files/2013/02/iPadagogy-Wheel.001.jpg
And adapted for Windows 8.1 devices by Charlotte Beckhurst @CharBeckhurst

Alignment to 21st Century Skills & Technology

Upon completion of this section, please remove all remaining descriptions, notes, outlines, examples and/or illustrations that are not needed or used.

Mastery and infusion of **21st Century Skills & Technology** and their Alignment to the core content areas is essential to student learning. The core content areas include:

- English Language Arts;
- Mathematics;
- Science and Scientific Inquiry (Next Generation);
- Social Studies, including American History, World History, Geography, Government and Civics, and Economics;
- World languages;
- Technology;
- Visual and Performing Arts.

21st Century Skills/Interdisciplinary Themes

Upon completion of this section, please remove all remaining descriptions, notes, outlines, examples and/or illustrations that are not needed or used.

Please list only the **21st Century/Interdisciplinary Themes** that will be incorporated into this unit.

- Communication and Collaboration
- Creativity and Innovation
- Critical thinking and Problem Solving
- ICT (Information, Communications and Technology) Literacy
- Information Literacy
- Life and Career Skills
- Media Literacy

21st Century Skills

Upon completion of this section, please remove all remaining descriptions, notes, outlines, examples and/or illustrations that are not

needed or used.

Please list only the **21st Century Skills** that will be incorporated into this unit.

- Civic Literacy
- Environmental Literacy
- Financial, Economic, Business and Entrepreneurial Literacy
- Global Awareness
- Health Literacy

Differentiation

Upon completion of this section, please remove all remaining descriptions, notes, outlines, examples and/or illustrations that are not needed or used.

Please remember: Effective educational **Differentiation** in a lesson lies within content, process, and/or product.

Please identify the ones that will be employed in this unit.

Differentiations:

- Small group instruction
- Small group assignments
- Extra time to complete assignments
- Pairing oral instruction with visuals
- Repeat directions
- Use manipulatives
- Center-based instruction
- Token economy
- Study guides
- Teacher reads assessments allowed
- Scheduled breaks
- Rephrase written directions
- Multisensory approaches
- Additional time
- Preview vocabulary
- Preview content & concepts
- Story guides
- Behavior management plan

- Highlight text
- Student(s) work with assigned partner
- Visual presentation
- Assistive technology
- Auditory presentations
- Large print edition
- Dictation to scribe
- Small group setting

Hi-Prep Differentiations:

- Alternative formative and summative assessments
- Choice boards
- Games and tournaments
- Group investigations
- Guided Reading
- Independent research and projects
- Interest groups
- Learning contracts
- Leveled rubrics
- Literature circles
- Multiple intelligence options
- Multiple texts
- Personal agendas
- Project-based learning
- Problem-based learning
- Stations/centers
- Think-Tac-Toes
- Tiered activities/assignments
- Tiered products
- Varying organizers for instructions

Lo-Prep Differentiations

- Choice of books or activities
- Cubing activities
- Exploration by interest
- Flexible grouping
- Goal setting with students
- Jigsaw
- Mini workshops to re-teach or extend skills
- Open-ended activities
- Think-Pair-Share
- Reading buddies
- Varied journal prompts
- Varied supplemental materials

Special Education Learning (IEP's & 504's)

Please identify the **Special Education Learning** adaptations that will be employed in the unit, using the ones identified below.

- printed copy of board work/notes provided
- additional time for skill mastery
- assistive technology
- behavior management plan
- Center-Based Instruction
- check work frequently for understanding
- computer or electronic device utilizes
- extended time on tests/ quizzes
- have student repeat directions to check for understanding
- highlighted text visual presentation
- modified assignment format
- modified test content
- modified test format
- modified test length
- multi-sensory presentation
- multiple test sessions
- preferential seating
- preview of content, concepts, and vocabulary
- Provide modifications as dictated in the student's IEP/504 plan
- reduced/shortened reading assignments
- Reduced/shortened written assignments
- secure attention before giving instruction/directions
- shortened assignments
- student working with an assigned partner
- teacher initiated weekly assignment sheet
- Use open book, study guides, test prototypes

English Language Learning (ELL)

Please identify the **English Language Learning** adaptations that will be employed in the unit, using the ones identified below.

- teaching key aspects of a topic. Eliminate nonessential information
- using videos, illustrations, pictures, and drawings to explain or clarif
- allowing products (projects, timelines, demonstrations, models, drawings, dioramas, poster boards, charts, graphs, slide shows, videos, etc.) to demonstrate student's learning;
- allowing students to correct errors (looking for understanding)
- allowing the use of note cards or open-book during testing
- decreasing the amount of workpresented or required
- having peers take notes or providing a copy of the teacher's notes
- modifying tests to reflect selected objectives
- providing study guides
- reducing or omitting lengthy outside reading assignments
- reducing the number of answer choices on a multiple choice test
- tutoring by peers
- using computer word processing spell check and grammar check features
- using true/false, matching, or fill in the blank tests in lieu of essay tests

At Risk

Please identify Intervention Strategies that will be employed in the unit, using the ones identified below.

- allowing students to correct errors (looking for understanding)
- teaching key aspects of a topic. Eliminate nonessential information
- allowing products (projects, timelines, demonstrations, models, drawings, dioramas, poster boards, charts, graphs, slide shows, videos, etc.) to demonstrate student's learning
- allowing students to select from given choices
- allowing the use of note cards or open-book during testing
- collaborating (general education teacher and specialist) to modify vocabulary, omit or modify items to reflect objectives for the student, eliminate sections of the test, and determine how the grade will be determined prior to giving the test.
- decreasing the amount of workpresented or required
- having peers take notes or providing a copy of the teacher's notes
- marking students' correct and acceptable work, not the mistakes
- modifying tests to reflect selected objectives
- providing study guides
- reducing or omitting lengthy outside reading assignments
- reducing the number of answer choices on a multiple choice test
- tutoring by peers
- using authentic assessments with real-life problem-solving
- using true/false, matching, or fill in the blank tests in lieu of essay tests
- using videos, illustrations, pictures, and drawings to explain or clarify

Talented and Gifted Learning (T&G)

Please identify the **Talented and Gifted** adaptations that will be employed in the unit, using the ones identified below.

- Above grade level placement option for qualified students
- Advanced problem-solving
- Allow students to work at a faster pace
- Cluster grouping
- Complete activities aligned with above grade level text using Benchmark results
- Create a blog or social media page about their unit
- Create a plan to solve an issue presented in the class or in a text
- Debate issues with research to support arguments
- Flexible skill grouping within a class or across grade level for rigor
- Higher order, critical & creative thinking skills, and discovery
- Multi-disciplinary unit and/or project
- Teacher-selected instructional strategies that are focused to provide challenge, engagement, and growth opportunities
- Utilize exploratory connections to higher-grade concepts
- Utilize project-based learning for greater depth of knowledge

Sample Lesson

https://docs.google.com/presentation/d/1GdcVNyPqtkw5LQPAC0SlvSgCUF515lHOX7uplp6p5DI/edit?usp=sharing

https://www.futureoftech.org/assets/documents/FoT_Lesson_Plan-Artificial_Intelligence.pdf

https://skyteach.ru/wp-content/uploads/2019/01/Artificial-intelligence-a-worksheet.pdf

https://www.liveworksheets.com/bd40059vg

Using the template below, please develop a **Sample Lesson** for the first unit only.

Unit Name:

NJSLS:

Interdisciplinary Connection:

Statement of Objective:

Anticipatory Set/Do Now:

Learning Activity:

Student Assessment/CFU's:

Materials:

21st Century Themes and Skills:

Differentiation/Modifications:

Integration of Technology: