Computer Science: More Than Just Coding

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Motivation

While more students are being introduced to technology earlier in life, this exposure generally takes the form of games and apps. Therefore, when most students think of “Computer Science,” they believe it is just writing code or using premade software and not as something that is being used to change our lives on many levels. This limited thinking makes it very difficult to make the needed connections between the field of computer science and other content areas. To prepare them to make the next great innovations in the future, they need to have their imaginations fueled by being exposed to the many current uses of technology and be challenged to make it better. (Chidambaram, 2013)

Goals

Through this project I hope to...
• Expose students to computers in a multiple ways
• Show students ways they can use computer science in combination with different subject areas.
• Have students identify current activities that can be improved by using computer science.
• Get students to think about ways to improve current technologies and processes.
• Get students to think about new technologies that can be invented using computer science.
• Spread interest of computer science to new students in our school.
• Inspire my students to continue learning computer science after high school.

My Previous Students

Through beginning and end of the year surveys I have learned:
All my students receive a laptop from school, however, a large group don’t have internet access at home and have little to no experience using them outside of school work and gaming. Many see their devices as an entertainment device and a homework machine and not as a tool that can be used for creation and to solve problems.

My students have consisted of:
• 47% Free and Reduced Lunch
• 27% Female
• 38% Hispanic
• 24% Asian
• 8% African American

Most of my students have taken AP Comp. Sci. for the following reasons:
1. Want to create games or apps
2. Needed an AP course
3. Parents told them to take it

Females, minorities, and low income students are less likely to go to school or pursue careers in a stem field. (CS Education Statistics, 2017)

Methodology

To get the proper exposure I will be using many different techniques and resources. Students will participate in:
• Interactive Lessons
• Independent Research
• Group projects
• Problem Solving Activities
• Brainstorming + Invention activities
• Field Trips
• Guest Speakers

Integration

I will be integrating these lessons into both AP classes at different times and different ways.

AP Computer Science Principles:
• Machine Learning + Autonomous Vehicles
• Unit 2 – How computers work using computer science.
• Compare and Contrast Methods
• Future Uses
• Edge Detection + Image Analysis
• Unit 4 – Storing and Interpreting Data
• Storing Pictures
• Computer vs. Human examination
• How much can we leave to computers?

AP Computer Science A:
• Autonomous Vehicles
• Unit 5 – Creating Classes
• Break up different tasks
• Old Thinking vs New Thinking
• Problem analysis
• Machine Learning
• 2nd Semester Wrap-Up
• Compare and Contrast Methods
• Possible Uses
• Edge Detection + Image Analysis
• Full Curriculum Review
• Dealing with images as 2D array of numbers
• AP Question Practice
• Coding Solutions
• Brainstorming: Possible Implementation

References


Learning Goals:

Students will be able to:
• Describe the two major ways of thinking and constructing machine learning.
• Compare and contrast machine learning methods of Boosting and Neural Networking.
• Identify potential use in other fields and professions

Activities:
• Prior Knowledge Revision (Pre-assessment)
• Venn Diagram
• Old methods vs. New methods
• Pseudocode outline
• Discussion Board Post
• Current Problems and Future Developments

Edge Detection

Learning Goals:

Students will be able to:
• Understand and describe how image data is stored in a computer.
• Understand and describe the basics of edge detection.
• Identify potential use in other fields and professions

Activities:
• Finding Edges by hand activities
• Completing Code for classroom based edge detection technique
• Student program output vs Sobels output

Image Analysis

Learning Goals:

Students will be able to:
• Analyze and discuss current progress of computer vision in the medical field
• Identify potential use in other fields and professions.

Activities:
• Discussion and write-up on program example
• Group brain storm and short presentation
• Where else would you use this technique/technology

Autonomous Vehicles

Learning Goals:

Students will be able to:
• See how they can use what they have learned about object-oriented programming to solve current and future problems.
• See how the skills they are learning in Java can be translated into other languages.
• Identify potential use in other fields and professions

Activities:
• Prior Knowledge Revision (Pre-assessment)
• Venn Diagram
• Old methods vs. New methods
• Pseudocode outline
• Discussion Board Post
• Current Problems and Future Developments

Learning Goals:

Students will be able to:
• Describe the two major ways of thinking and constructing machine learning.
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Activities:
• Venn Diagram
• Boosting vs. Neural Networks
• Driving program discussion and analysis
• Code/Algorithm Analysis

Machine Learning