Instructional Lesson Plan

Instructional Lesson Title	Explore Computing Innovation in an Area of Student's Choice		
Subject Areas	Computer Science / Science and Technology		
Keywords (4-10 words)	Technology computing innovation, science computing innovation, and engineering computing innovation		
Unit Duration (in min.)	612 minutes (12 hours) **Lesson 3 of 12**		
Focus Grade Level	11th Grade	**Grade Level Range**	10 to 12

Instructional Unit Summary
This lesson is hour 3 of a 12-hour unit. Students have selected a computer innovation to explore. Examples may be biomedical diagnostics, motion sensing, energy, etc. Students are initially provided an Explore Sheet to use as a daily aid. This sheet helps the student stay focused while researching articles written on the innovation they choose. It also serves as a daily closure and provides outline information that is used to prepare a presentation. Students view an example of a research sheet completed by a prior year's student.

Engineering Connection	**Engineering Category**
The students perform a literature search of the computing innovation of their choice. There is a requirement that at least three of the cited articles are no more than 12 months old. Students explain how the innovation is classified within the computing field. Based on the student's knowledge of different types of algorithms used in Machine Learning (ML), students predict what type of algorithm may have been used and analyze its design and structure. Students develop a hypothesis of how the innovation could be used in the future or used in an alternative way.	Engineering with some science/math

Materials & Equipment
Computer, internet connection, search engines, paper, and writing implement.

Attachments
1. Explore Sheet 2. Student Example 3. Written Response Submission Template

Prerequisite Student Knowledge

- Identify a computing technology innovation
- Identify a computing engineering innovation
- Create an outline
- Create slide presentations

Educational Standards

Arizona State Standards

Computer Science Framework Software and App Design

Domain 3: Computer Principles

STANDARD 1.0 APPLY PROBLEM-SOLVING AND CRITICAL THINKING SKILLS

1.1 Students will be able to explain objectives and outcomes for a task.

Engineering Sciences Framework

Domain 2: Engineering Technology and Documentation

STANDARD 6.0 APPLY DOCUMENTATION AND COMMUNICATION SKILLS

6.2 Students will be able to communicate status, assumptions, results, and conclusions using written and oral techniques.

Next Generation Science Standards (NGSS)

HS-ETS1-3. Evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs that account for a range of constraints, including cost, safety, reliability, and aesthetics, as well as possible social, cultural, and environmental impacts.

International Technology and Engineering Educators Association (ITEEA) Standards

STEL-1Q. Conduct research to inform intentional inventions and innovations that address specific needs and wants.

Learning Objectives

1. Students will be able to catalog their research.
2. Students will be able to communicate their findings.
3. Students will be able to predict what type of algorithm may have been used, given different types of algorithms used in Machine Learning (ML) and analyze its design and structure.
4. Students develop a hypothesis of how the innovation could be used in the future or used in an alternative way.

Vocabulary	Definitions
Algorithm	A set of rules for solving a problem in a finite number of steps
Innovation	An instance of building off of an existing invention to make it better or more specialized
Technology	Creation and use of technical means and their interrelation with life, society, and the environment, drawing upon such subjects as industrial arts, engineering, applied science, and pure science.
Machine Learning	Machine learning algorithms build a mathematical model based on sample data, known as "training data", in order to make predictions or decisions without being explicitly programmed to do so.

Lesson Procedure

Introduction/Motivation

Opener: PowerPoint presentation of a prior year student's work.

Lesson Background/Teacher Concepts

Knowledge of search engines is required. List of academic search engines: Google Scholar, Microsoft Academic, BASE (Bielefeld Academic Search Engine), core, refseek, science.gov, worldwidescience, semantic scholar, ERIC (educational resources information center), VLRC (virtual learning resources center), iseek, and infotopia. There are over 100 research engines, but these are more than enough for this unit.

Learning Activities/Strategies

Opener: PowerPoint presentation of a prior year student is shown. Take time to ask if the students are able to communicate what the research was about. Give 5 minutes for students to discuss.

Students will be online researching their chosen topic and taking notes for the next 45 minutes. Students will use the Explore Sheet and Written Response Submission template to help keep them focused.

Closure is performed during the last 5 minutes of class. Circulate and scan every checklist, making sure it is stamped with the date stamp.

Closure

Students have a checklist that serves as closure.

Assessment

Formative Assessment

The Explore Sheet is used daily as a documented assessment of student's learning.

Summative Assessment

After lesson 12 of 12, students will present a PowerPoint and a final paper chronicling their process.

Contributors

Individuals

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Supporting Program

RET Site: Sensor, Signal and Information Processing Algorithms and Software

Sensor, Signal and Information Processing Center (SenSIP), in partnership with Arizona State University and the National Science Foundation.

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