Unit I: Problem Solving and the Design Process

Content Area: **Business**
Course(s): **Introduction to Computer Science and Programing**
Time Period: **4 weeks**
Length: **Weeks**
Status: **Published**

Unit Overview

In this unit, students will learn the principles of a safe, organized and productive classroom environment, explore the problem-solving process and begin prototyping simple programs using the design process.

Transfer

Students will be able to independently use their learning to...

- apply problem-solving strategies to real-world problems
- answer the question "What is a computer?" and be able to identify the basic operations of a computer
- explain that a computer program is a sequence of simple operations and create simple programs for real-world tasks
- understand the principles of "User Centered Design", focusing on identifying the needs of their users and ways to ensure those needs are met
- reflect upon what processes will best allow them to efficiently create, test, and iterate upon their designs
- use the design process to create a simple program that performs a useful task

Meaning

Understandings

Students will understand that...

- Safety and organization are critical to success when working in an office environment
- The ability to solving problems in computing and programming is just another type of skill that can be developed and applied systematically
- Humans and computers solve problems in different ways; humans can apply creative thinking but computers are extremely fast at executing definite algorithms
- The Design Process can be used to create prototypes of programs that meet a need or want

Essential Questions

Students will keep considering...

- What is a program?
- How do programmers identify the needs of their users?
- How can we ensure that a user's needs are met by our designs?
- How do teams effectively work together to develop software?
- What roles beyond programming are necessary to design and develop software?

Application of Knowledge and Skill

Students will know...

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- Safety and organization are critical to success when working in an office environment
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- Humans and computers solve problems in different ways; humans can apply creative thinking but computers are extremely fast at executing definite algorithms
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Students will be skilled at...

Students will be skilled at...

- Applying safety and organization principles
- Solving problems in computing and programming using the problem-solving process
- Defining the difference between how humans and computers solve problems
- Using the Design Process to create prototypes of programs that meet a need or want

Academic Vocabulary

- Problem-solving process
- Input and output

- Algorithm
- Central Processing Unit (CPU)
- Storage
- Design Process
- User-Centered Design
- Software
- Usability
- Prototype
- User Interface
- Feature

Learning Goal 1

Students will cooperate in developing a safe, organized, collaborative and encouraging classroom environment.

CRP.K-12.CRP1	Act as a responsible and contributing citizen and employee.
CRP.K-12.CRP3	Attend to personal health and financial well-being.
CRP.K-12.CRP9	Model integrity, ethical leadership and effective management.
CRP.K-12.CRP11	Use technology to enhance productivity.
CRP.K-12.CRP12	Work productively in teams while using cultural global competence.
TECH.8.1.12.A.CS1	Understand and use technology systems.
TECH.8.1.12.D.CS1	Advocate and practice safe, legal, and responsible use of information and technology.

Target 1

Students will understand safety and classroom organization essentials.

Target 2

Students will develop a cooperative and helping attitude towards others.

Learning Goal 2

Students will explore the problem-solving process and the differences between how humans and computers

solve problems.

CRP.K-12.CRP2	Apply appropriate academic and technical skills.
CRP.K-12.CRP6	Demonstrate creativity and innovation.
CRP.K-12.CRP8	Utilize critical thinking to make sense of problems and persevere in solving them.
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.8.1.12.B.CS1	Apply existing knowledge to generate new ideas, products, or processes.
TECH.8.2.12.C.4	Explain and identify interdependent systems and their functions.
TECH.8.2.12.C.CS3	The role of troubleshooting, research and development, invention and innovation and experimentation in problem solving.
TECH.8.2.12.E	Computational Thinking: Programming: Computational thinking builds and enhances problem solving, allowing students to move beyond using knowledge to creating knowledge.
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.CS1	Computational thinking and computer programming as tools used in design and engineering.

Target 1

Students will practice problem-solving strategies through various challenges and problems.

Target 2

Students will reflect on the question "What is a computer?" and be able to identify the basic operations of a computer (input and output, processing, and storage)

Target 3

Students will understand that a computer program is a sequence of simple operations and be able to create simple programs for real-world tasks

Learning Goal 3

Students will prototype a simple program using the Design Process

CRP.K-12.CRP2	Apply appropriate academic and technical skills.
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.B.CS1	Apply existing knowledge to generate new ideas, products, or processes.
TECH.8.1.12.B.CS2	Create original works as a means of personal or group expression.
TECH.8.1.12.F.CS2	Plan and manage activities to develop a solution or complete a project.
TECH.8.2.12.C	Design: The design process is a systematic approach to solving problems.
TECH.8.2.12.C.1	Explain how open source technologies follow the design process.
TECH.8.2.12.C.7	Use a design process to devise a technological product or system that addresses a global problem, provide research, identify trade-offs and constraints, and document the process through drawings that include data and materials.
TECH.8.2.12.C.CS3	The role of troubleshooting, research and development, invention and innovation and experimentation in problem solving.
TECH.8.2.12.D.1	Design and create a prototype to solve a real world problem using a design process, identify constraints addressed during the creation of the prototype, identify trade-offs made, and present the solution for peer review.
TECH.8.2.12.E	Computational Thinking: Programming: Computational thinking builds and enhances problem solving, allowing students to move beyond using knowledge to creating knowledge.
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.CS1	Computational thinking and computer programming as tools used in design and engineering.

Target 1

Students will examine the principles of "User Centered Design", focusing on identifying the needs of their users and ways to ensure we meet those needs

Target 2

Students will reflect upon what processes will best allow them to efficiently create, test, and iterate upon our designs

Target 3

Students will use the design process to create a simple program or application that performs a useful task

Summative Assessment

- Quizzes & Tests
- Applied Projects
- Classroom Survey

Formative Assessment and Performance Opportunities

- Applied Activities/Projects
- Guided Practice
- Peer Review
- Reflective Discussion
- Teacher Observation
- Oral Questioning

Accommodations/Modifications

- Application problems for extra practice
- Scenarios for critical thinking
- Numerous optional tasks for the problem-solving process project (e.g. find a winning strategy for Connect Four from given starting positions)

Unit Resources

Internet Resources

- Code.org's Computer Science Discoveries-Units 1 and Unit 4 curriculum
  - *Some of the language in the Learning Goals, Targets and Essential Questions in these units borrows from or has been adapted from Code.org's curricula for its Computer Science Discoveries and Computer Science Principles courses, which are licensed via a Creative Commons license (Attribution-NonCommercial-ShareAlike 4.0 International-CC BY-NC-SA 4.0).*

Technology Software & Hardware

- Desktop computers

- Python programming language and IDE (Integrated Development Environment)

Textbooks (Online, pdf or print)

- Downey, Allen. *Think Python: How to Think Like a Computer Scientist* (2nd Edition). Needham, Massachusetts: Green Tea Press, 2015. http://www.thinkpython2.com.

Relevant Videos

- Code.org's video library

Interdisciplinary Connections

MA.K-12.1	Make sense of problems and persevere in solving them.
MA.K-12.2	Reason abstractly and quantitatively.
LA.RH.11-12.4	Determine the meaning of words and phrases as they are used in a text, including analyzing how an author uses and refines the meaning of a key term over the course of a text (e.g., how Madison defines faction in Federalist No. 10).
LA.WHST.11-12.4	Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.