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Domain: Exploring Computer Science

Date Range: January 13, 2025 – January 17, 2025

ACOS Standard:

31- Reinforce the four steps of the problem-solving process.
39- Apply the problem-solving process. Use different strategies to plan and carry out the plan to solve several problems.
2 - Convert base ten into binary and binary into base ten.
2- Explain why binary numbers are important in computer science and how computers communicate differently than humans.
3- Use binary digits to encode and decode messages.
3- Compare problems in different contexts.

Student Friendly Outcome:

I CAN name and explain the steps in the problem-solving process.
I CAN solve a problem by applying the problem-solving process.
I CAN reinforce the four steps of the problem-solving process.
I CAN convert base ten into binary and binary into base ten.
I CAN explain why binary numbers are important in computer science and how computers communicate differently than humans.
I CAN use binary digits to encode and decode messages.
I CAN compare problems in different contexts.

Monday	Tuesday	Wednesday	Thursday	Friday
Objectives continued Journal entry Cornrow demonstration and hands-on tutorial Gallery Walk and Reflection	Objectives continued Journal entry CS Unplugged: Count the Dots— Binary Numbers CS Unplugged: Count the Dots— Working with Binary		Objectives continued Journal entry Count the Dots-Working with Binary cont. CS Unplugged: Count the Dots Sending Secret Messages	

Instructional Lesson # 4. Days 6-8

Topic Description: This lesson reinforces the four main phases in the problem-solving process.

Objectives

The students will be able to:

- Solve a problem by applying the problem-solving process.
- Express a solution using standard design tools.
- Determine if a given solution successfully solves a stated problem.
- Explain benefits of diversity in software development.

Outline of the Lesson

Segment	**Reason/Purpose**
Day 1 Identity Iceberg experience (15 minutes) Journal entry (10 minutes) Research on cornrow braiding (20) Begin group Presentations on historical cultural background of cornrow braiding (10 minutes)	ECS Problem solving *Step 1- Understanding the problem.* Connections to Unit 1 lesson 1 and Unit 1 Room Activity about benefits of Diversity and understanding their own importance as an individual in a diverse group where their voice is heard and valued. Students will be able to explain the benefits of diversity in software development teams.
Day 2 Complete group presentations (10 minutes) Cornrow curves design tool tutorial (20 minutes) Cornrow curves design tool Create a Project Plan (10 minutes) Cornrow curves project project (15 minutes)	*Problem Solving Step 2*- Making a Plan Learn to Express a solution using CSDT design tools. Work with an elbow partner to complete the tutorial. Work individually (or as a pair) to plan a project where you will create a unique pattern using cornrow curves software.
Day 3 Journal entry (10 minutes) Finalize cornrow curves project (30 minutes) Gallery Walk and Reflection (15 minutes) with reflection journal.	*Problem Solving Step 3*- Work individually to execute the plan for the cornrow curves project. Determine if a given solution successfully solves a stated problem. Connect the outcomes and effects of specific solutions of a given problem. *Problem Solving Step 4*- Participate in a gallery

	walk and reflection.

Student Activities

Day 1

- Complete Identity Iceberg Experience.
- Complete journal entry.
- Groups review the history of cornrow braiding and present to the class.

Day 2

- Complete the CSDT Cornrow Curves tutorial.
- Explain benefits of diversity in software development
- Design a unique pattern for their own cornrow curves project.

Day3

- Evaluate positive and negative consequences when algorithms and software is developed with or without hearing diverse voices and ideas.
- Complete the pattern designed and planned for the cornrow curves project;
- Determine if a given solution successfully solves a stated problem
- Participate in a gallery walk and reflection journal.

Teaching and Learning Strategies

Day 1

- Identity Iceberg Experience
    - Using the Iceberg Activity (See resources.) students work individually on the handout.
    - Share with an elbow partner to continue the activity. Student volunteers can share one feature from above the line and one from below.
    - Remind students about their learning from Unit 1 Human Computer Interaction- specifically lesson 1 and Room Activity lesson. This image can be added to their digital portfolio if one was created in Unit 1
- Introduction to CSDTs Culturally Situated Design Tools with Cornrow Curves software
    - Journal Entry: *Take a look at the software options in CSDT. How did you represent your own culture on your Identity Iceberg? What observations can you make about culture represented in the software you have reviewed in the CSDT collection? How can diverse groups show that individuals are important and valued?*
        - There are a variety of ways to set the stage for this activity. Displaying images of people with cornrow braids is one example. The first set of activities is intended for students to learn more about the historical and cultural context of cornrow braiding as part of the first step of the problem-solving process- understanding the problem itself. One example might be to have students read The CROWN act. (See resources.)https://www.thecrownact.com/

- Using the legacy math software and historical perspective. (https://csdt.rpi.edu/culture/legacy/index2.html. Depending on your internet blockers, you may occasionally need to temporarily disable some settings.) The legacy math software allows students to move forward together with these common core math concepts.
    - Divide students into five groups and ask each group to read and take notes on one of the following sections and find additional sources on their topic:
        - African Origins
        - Middle Passage
        - Civil War to Civil Rights
        - Hip Hop
        - AfroFuturism
    - Each group will be responsible for sharing their notes in a poster presentation from their group with the rest of the class.
    - Resources: Read: https://www.thecrownact.com/
    - Group discussion on cultural background of cornrow braiding.
        - Students collectively work on understanding the problem through this presentation activity from
        - CSDT historical perspectives.
        - Question to consider during conversations: What did you learn through the researching the history of cornrows about African American Culture that you did not know before the activity? What are the similarities and differences between the cultural identities of Native American and African American in Colonial America?

Day 2

- Cornrow curves design tool tutorial
    - View “How to Braid” with elbow partner.
    - Optional activity: Braiding with yarn to be able to experience and facilitate further discussion of the process of braiding as an algorithm.
    - Individual students complete Part I of the tutorial, following all instructions and checking their work with their elbow partner.
    - Students use their journal to take notes using the software tutorial.
    - Think about your learning about iterative algorithms from the mathematical work in CSDT. We continue our work with algorithms later in this unit.
    - Resource: Cornrow curves software tutorial
- Cornrow curves project plan and project
    - Each group of students should complete the following. Each step of the process should be documented by the students:
        - Students create their own plan of a cornrow design. Questions students should be asking themselves when planning their design: “What context of the history of cornrows does their design draw from?” “Is their design appropriate within the context they chose?” “What does their cornrow design communicate to

others?" *(These questions can be extended to other CSDT software such as Adinkra.)*
    - Students create their strategy for their design. Highlight the mathematical concepts used and where and how they are used. Reinforce the strategy of finding a similar problem that has already been solved to help solve the new problem.
    - Students create their own design using the Math software (Note: The programming software can be used in Unit 4 to allow students who are interested to create extensions of their designs.)
    - Students reflect upon their process and the outcome of their design.

Day 3

- Journal Entry: *How would you feel if you were discriminated against in any way? Describe a situation in which you feel you have experienced discrimination.*
    - Ask a few volunteers to share their thoughts with the whole class, leading to a class discussion. • Then ask students to follow up this conversation in their journals about how they would feel if the discrimination was happening due to an algorithm—meaning a non-human with which they had no recourse and were not able to even have a discussion regarding the discrimination.
        - Discussion: As AI tools continue to advance computers can solve some problems faster than humans, and human intelligence is needed to solve some kinds of problems. What kinds of problems do students face that might be able to be solved using AI tools or without AI tools? How might algorithmic bias be a factor to problem solving?
        - Discussion: As students learn to appreciate the impact of design, art and historical perspectives of diverse groups of people, could this type of learning and appreciation lead to less discrimination? How can software development team diversity be applied to algorithm and software development?
- Complete project
- Gallery Walk and final reflection journal
    - Students share their solutions on their screens with a Gallery Walk and Reflection journal.
    - Ask students questions that will get them to reflect on the importance of diverse cultural perspectives on computer science during the design and development of software.
- Journal Entry: *What went well for you in carrying out your plan? What was difficult for you? What might you do differently if you prepared another design plan?*

Resources

- https://www.oregon.gov/ode/students-and-family/equity/NativeAmericanEducation/Documents/SB13%20Curriculum/Materials_GR10_Identity_and_Survivance_Iceberg_Worksheet.pdf
- https://adl.org/sites/default/files/identity-iceberg/story.html

- The CROWN act: https://www.thecrownact.com/
- (https://csdt.rpi. edu/culture/legacy/index2.html. Depending on your internet blockers, you may occasionally need to temporarily disable some settings.)
- Barbershop computing https://csdt.org/culture/barbershop/index.html
- Afrofuturism https://csdt.org/culture/afrofuturism/index.html
- https://www.thecrownact.com/

Teacher Reflection Notes

Instructional Lesson # 5. Days 9-10

Topic Description: This lesson introduces the binary number system and how to count in binary. Students will learn how to convert between binary and decimal numbers in the context of topics that are important to computer science and human communication.

Objectives

The student will be able to

- Convert base ten into binary and binary into base ten.
- Explain why binary numbers are important in computer science and how computers communicate differently than humans.
- Use binary digits to encode and decode messages.
- Compare problems in different contexts.

Outline of the Lesson

Segment	**Reason/Purpose**
Day 1 Journal entry (10 minutes) CS Unplugged: Count the Dots— Binary Numbers (30 minutes) CS Unplugged: Count the Dots— Working with Binary (10 minutes) Journal entry (5 minutes)	Access previous knowledge. Become familiar with base then and base 2. Understanding Base 2. Connecting Base 2 to value representation. Connecting base 2 to how computers store information. How base 2 is used to code information
Day 2 Count the Dots-Working with Binary cont. (20 min) CS Unplugged: Count the Dots Sending Secret Messages (20 minutes) Journal entry (15 minutes)	How reiteration may be used to compress information into a small “space,” memory. If all files are only zeros and ones, what is the function of the extension of the file? How the binary number system relates to The Candy Bar Problem. Students find similarities to seemingly different problems.

Student Activities

Day 1

- Complete journal entry.
- Complete count the dots activities.
- Complete journal entry.

Day 2

- Complete Count the Dots Binary Number
- Complete the Sending Secret Messages activity
- Complete journal entry

Teaching and Learning Strategies

Day 1

- Journal Entry**:** *How high can you count using your hands only?*
- Count the Dots Activities
    - Teacher gives instructions for the Count the Dots activities and circulates while students participate in the Count the Dots activities.
        - Start with the introductory activity on p. 4 of the activity. This activity can be downloaded from http://exploringcs.org/curriculum. Download and unzip CSUnplugged files, then open. Note there are many additional resources listed that you may wish to explore.
        - It will be helpful to read through the entire activity in advance, so that you can revise questions, add your own questions, and think about how you might want to structure each part of the activity. The goal is for students to be actively involved in some way and for all students to be able to represent numbers and count in binary. What follows is the minimal suggestion.
        - Have 5 students come to the front of the room and demonstrate as you follow the instructions and ask the questions. (Each student should receive a large card with one of the numbers of dots—1, 2, 4, 8, 16.) Complete the Binary Numbers activity on p. 5.
    - Teacher gives instructions for the Working with Binary activity activities and circulates while students participate in the Working with Binary activity on p. 7.
        - Have 5 students come to the front of the room and try counting as you call out the numbers. (Each student should receive a large card with one of the numbers of dots— 1, 2, 4, 8, 16.)
        - Have different groups of 5 students at a time come to the front and have the other students provide counting and representation challenges. You could also have a competition with multiple teams of students each trying to get the answer. There are many other possibilities. Be creative!!
- Journal Entry: *How do you think technology influenced the choice of using a binary system?*
    - Discussion of *Why are binary numbers important in computer science?*

Day 2

- Sending Secret Messages
    - Teacher gives instructions for the Complete the Sending Secret Messages activity on p. 8 of the CS Unplugged: Count the Dots activity. (Solution is on p. 13.)
- Journal Entry**:** *How does the binary number system relate to The Candy Bar Problem? If all computer files are just a bunch of zeros and ones, what is the purpose of their extensions such as*

.txt, . jpeg, .mp3?

Resources

- Bell, Tim, Ian Witten and Mike Fellows. Computer Science Unplugged. Canterbury, New Zealand: 2002.
- Computer Science Unplugged Activity 1: Count the Dots—Binary Numbers, pp. 3–13
- Binary number cards for each student from Count the Dots—Binary Numbers, pp. 3–13
- Large binary number cards for the demonstrations

Teacher Reflection Notes