**Lesson plan (# )**

| **Adopted from:** [**https://www.csunplugged.org/en/topics/binary-numbers/how-binary-digits-work-junior/#key-question**](https://www.csunplugged.org/en/topics/binary-numbers/how-binary-digits-work-junior/#key-question) | **Grade: K-6** | **Lesson duration:** |
| --- | --- | --- |
| **Topic/Title of lesson: Binary and Bugs: How do you think a digital device stores information?** |

| **STANDARD(s) ADDRESSED** | *(Student Learning Standards. Include the progress indicator number and text of each standard.)***3-5:** 8.1.5.CS.2: Model how computer software and hardware work together as a system to accomplish tasks. 8.1.5.DA.1: Collect, organize, and display data in order to highlight relationships or support a claim.  |
| --- | --- |
| **CENTRAL FOCUS** | *(The central focus is an overarching goal of the learning segment or big idea for student learning. The central focus is a description of the important understandings and core concepts that you want students to develop within the learning segment. The central focus should go beyond a list of facts and skills, align with content standards and learning objectives, and address the subject-specific components in the learning segment.)*Conceptualize how billions of circuits inside a digital device are like switches that turn on and off. By turning on and off, the device is able to communicate as a “bit” (binary digit) that can be on or off/black or white/ 0 or 1. Six bits together make up a byte.  |
| **EU/EQ** | (*What are Enduring Understanding(s) and/or Essential Question(s) that guide the lesson?)***How do you think a digital device stores information?** |
| **LEARNING OBJECTIVES** | *(Include specific, focused outcomes for students) Phrase this as “students will be able to X (objective) as demonstrated by Y (evidence)”*Explain a bit and byteDemonstrate how 0 and 1, black and dot-facing cards represent a bitAnalyze patterns in binary cards to code a messageApply computational thinkingCollaborate and develop interpersonal skills |
| **ASSESSMENT STRATEGY** | *What assessment(s) will you use to know that the students are meeting the learning objectives?* *State type(s) of assessment and what is being assessed [Pre-assessment, Formative, And Summative].*  |
| *[Pre-assessment]*Hand out binary cards to student volunteers at the front of classroom. As the class what the number of dots on the next card will be. Analyze the relationship between the dots and number sense to count up to 32. |
| Learning Objective | Assessment | Learning Criteria (How will you know that students have met and/or are moving toward meeting that LO?) | Implementation (whole class, grouped, individual, & adaptations) |
| Explain a bit and byte | Whole class discussion, think-pair-share with notes, exit slip.  | Students explain in their own words with a bit and byte are during class discussions, and individually on the exit slip. | * whole class discussion
* think-pair-share with notes during demonstration activity
* individual exit slip
 |
| Demonstrate how 0 and 1, black and white facing cards represent a bit | Students communicate how 0 and 1, black and dot-facing cards represent on and off.  | Students identify patterns in the relationship between 0 and 1, black and dot-facing cards represent a bit | * whole class discussion
* think-pair-share with notes during demonstration activity
 |
| Analyze patterns in binary cards to code a message | Students communicate how 0 and 1, black and dot-facing cards, on and off can represent letters, numbers, symbols. | Students can code and decode messages in binary in pairs or individually | individuals code/decode worksheet |
| Apply computational thinking | Students recognize patterns in numbers, face of card, and letters. | Students communicate how they arrived at answers.  | discussion, code/decode worksheet |
| Collaborate and develop interpersonal skills | Observe student participation by raising hands, volunteering, asking questions. | Student engagement in the form of volunteering to participate or answer a question, ask questions, positive interaction with peers, self-aware. | observation |
| **ACADEMIC VOCABULARY/****LANGUAGE**  | *Vocabulary:* bit, byte, binary, ASCII, code, decode, computational thinking | *Describe the supports for each language demand in this lesson. Address whole class and individual needs.*Vocabulary will be printed in the classroom, and provided in their worksheet. Terms will be spoken as they are applied in the lesson.  |
| **PRIOR KNOWLEDGE AND CONCEPTIONS** | *(What prior knowledge, skills and/or academic language do these students need to have that will help them be successful with this lesson? Any misconceptions you may anticipate?)*Number sense and pattern recognition |

**UDL/PLANNED SUPPORT**

*(Discuss the universally designed decision guided by learner diversity and/or individualized adaptations for the variety of learners in your class/group who may require different strategies/support (e.g., children with IEPs or 504 plans, English language learners, children at different points in the developmental continuum, struggling readers, and/or gifted children).*

| **UDL:*****How are you universally designing your lesson with your focus learner in mind? What other characteristic of diverse learners are considering through UDL?*** | Multiple means of representation | Multiple means of expression | Multiple Means of engagement |
| --- | --- | --- | --- |
| Vocabulary will be printed in the classroom, and provided in their worksheet. Terms will be spoken as they are applied in the lesson. Demonstration cards visually represent binary through color, dot, number of dots.  | Students can communicate what they know verbally, worksheet completion (individually or with a peer), and exit slip.  | Students can participate by volunteering in the activity, discussion, think-pair-share, individual work. |
| **ADAPTATIONS with focus learner noted: *If you were not able to meet your focus learners needs through UDL, what individual adaptations will you use to meet your focus learners needs (especially ELLS)*** |  |

**MATERIALS, RESOURCES, and INSTRUCTIONAL TECHNOLOGY**

| **What resources and technology do you need to teach the lesson:** | **What materials, technology will students need?** |
| --- | --- |
| **Weblink:** [**https://www.csunplugged.org/en/topics/binary-numbers/how-binary-digits-work-junior/#key-question**](https://www.csunplugged.org/en/topics/binary-numbers/how-binary-digits-work-junior/#key-question)**Video of lesson:**[**https://vimeo.com/437725275**](https://vimeo.com/437725275) | **Six copies of binary cards for demonstration** **Binary cards for for each student.****Code/decode worksheet for each student.****Exit slip for each student.** |

**INSTRUCTIONAL STRATEGIES AND LEARNING ACTIVITIES**

*(Describe explicitly what the teacher and the students will do to meet learning outcomes. Use bulleted or numbered list)*

|  | **What is the teacher doing?** | **What are students doing? (including adaptions)** |
| --- | --- | --- |
| **LAUNCH/****Beginning ( mins)***How will you engage students and capture their interest? 3-7 minutes* | **Ask what is the next card, and go through the subsequent cards to assess pattern recognition.** | **6 student volunteers hold large binary cards at the front of room. 1st bit “1 dot” card is on. Other cards are off.** |
| **LEARNING ACTIVITIES/****Middle ( mins)***“I do” “We do” “You do” How will you explain/ demonstrate knowledge /skills required of each objective? How will you ensure that students have multiple opportunities to practice? How will you address the academic language demands?* | **This activity is mostly teacher using inquiry to evaluate students understanding of bit, bytes, binary code.** **Example questions to pose:** **How would we show 3 dots? Begin by asking: how many dots are on the left-most card? Count together that there are 8 dots. Let’s look at the number line. Is 8 bigger than 3? Let’s hide it because it’s too big. Now let’s look at the next card, how many dots can we see?****How would you make the number 6?** | * **Group students into pairs**
* **Give each pair a set of the smaller binary cards**
* **Explain to students that we're working with just two digits, so they are called binary digits. (You could explore the meaning of the "bi" prefix with words like bicycle, biennial, bilingual and bicultural.) Binary digits are so common that we have a short name for them: write "binary digit" on a piece of paper, then rip off the "bi" at the start, and the "t" at the end, put it together and ask what the combined word ("bit") spells. This is the short name for a binary digit, which is why we've been referring to the cards as bits; the 4 cards that they have are actually 4 bits.**
* **Now let’s count from the smallest number that we can make, up to the highest numbera. What is the smallest number? (they may suggest 1, then realise that it’s actually 0).**
* **Get the number 0 displayed on the cards (i.e. no dots showing)**
* **Now count up 1, 2, 3, 4 …. (each pair should work out these numbers between them)**
* **Once they start to get into a routine, ask: how often are we seeing the 1-dot card? (every second time, every odd number)a. What other patterns are we seeing? (the 2-dot card flips on every second count, the 4-dot on every 4th and so on; the 8 dot card doesn't do much; this may be challenging for some students to recognise, and the main goal is that they are aware that the 1-dot card flips every time, and that every second number is an odd number).**
 |
| **CLOSURE/****End ( mins)***How will students summarize and state the significance of what they learned? 3-7 minutes* | **Teacher conducts whole group debrief to recall takeaways and distributes exist slip.** | **Students complete an exit slip** |
| **Extension/Reinforcement/Homework: TBD** |
| **Family/Community Engagement—TBD** |

**\* Please attach copies of assessments and/or handouts to be used**