**Lesson 10** Displaying Text in p5

**How are numbers different from strings?**

| **Overview** | |
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| In this lesson, students are introduced to a new data type: strings. They will compare strings and numbers, and use concatenation to display text on the canvas. | |
| **Lesson Objectives** | |
| Students will be able to   * Explain what a string is and how it is used * Create strings by using single or double quotes * Concatenate strings * Use the text() function to display messages on the canvas | |
| **Suggested Duration** | |
| One period (45 minutes) | |
| **Blueprint Foundations Student Outcomes (**https://blueprint.cs4all.nyc/outcomes/) | |
| Algorithms  Analyze | **Describe how** instructions can have different outputs depending on inputs. |
| Algorithms  Prototype | **Demonstrate** the benefit of using an event, conditional or loop in my prototype. |
| Programming Analyze | **Experiment** with the commands of a programming language. |
| Programming  Prototype | **Explain** why I chose specific commands to communicate my instructions. |
| **Vocabulary** | |
| * **String**: A sequence made up of letters or other keyboard characters. Strings are created by placing text in between single or double quotation marks. * **Concatenation**: The operation that combines two or more strings together. | |
| **Planning Notes** | |
| * N/A | |
| **Resources** | |
| * p5 Typography Functions - [Text and Type](https://creative-coding.decontextualize.com/text-and-type/) | |
| **Assessments** | |
| * Assess the **Student Activity**. Check for the ability to:   + Create strings using single or double quotes   + Use the text() function to display messages on the canvas   + Use concatenation to display the current score * Assess the **Wrap Up**. Check for the ability to:   + Explain how strings are used   + Differentiate between strings and numbers | |

| **Do Now:** |
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| **[Design Journal]** Share [this sketch](https://editor.p5js.org/mparker/sketches/xHyPCImYA) with students and instruct them to answer the following prompts:   1. What happens when the mouse is pressed? 2. Where have you seen += before? Infer what += means in this sketch.   Ask students to share their responses. |
| **Discussion: Strings and Numbers** |
| * Explain to students that in the **Do Now** sketch, the message variable is storing a new type of data called a **string**. * Strings are a sequence of characters (like letters, numbers, and punctuation) that are created using double or single quotation marks, and are often used to display messages on a screen. Here are some examples:   + “hello, my name is fred.”   + ‘HELLO! MY! NAME! IS! FRED!’   + ‘12345’   + “1010000111 @^~^@ beep boop” * In previous examples, students have used += as a **mathematical operation** to add a value to a number (for example, increasing the size of a circle by 10 pixels by typing size += 10 and using the size variable inside an ellipse function). In this example, += is performing a string operation by combining the strings “Hello” and “!” in a process called **concatenation**. * Students have concatenated without realizing it when they used “+” inside the text() function to display mouse position: text(mouseX + ", " + mouseY, 20, 20). When the “+” sign is used next to a string instead of a number, JavaScript joins the characters together. * Pair Exercise: Share [this sketch](https://editor.p5js.org/mparker/sketches/1WuSzuGPp) with students, and have them answer the following:   + Compare the code on line 14 to the code on line 11. Why do you think the code on line 14 is only showing words instead of the actual mouse position?   + The code on line 17 is missing the comma. What is the number that is being displayed, and why? * Note: If students are stumped on the second question, tell them to slowly move the mouse around the canvas and compare the top numbers (showing mouseX and mouseY) to the number on the bottom. You may also show them this image:      * Have pairs share their responses. You may expand on students’ responses by saying that on line 14, putting mouseX and mouseY in quotes turns the variables into **strings** (and that’s also why they appear as a different color). Anything inside quotations will appear on the canvas exactly as written. Meanwhile, there are no quotations in the code on line 17. mouseX and mouseY store **numbers**, not strings, so by default, the “+” sign is used **mathematically** and adds each number together. JavaScript needs a string to concatenate (like the comma on line 11). |
| **Teacher Demo: Worst Game Ever** |
| * Explain to students a common feature in computer games is keeping score. Build out the “[worst game ever](https://editor.p5js.org/mparker/sketches/2B8fmfvX-)” with your students that awards points whenever the mouse is pressed:      * After this demo, you may give students a quick example of how to style text in p5 by using fill(), stroke(), and [Typography](https://p5js.org/reference/#group-Typography) functions like textAlign() or textStyle() from the reference page. Alternatively, you may show students how to use Google Fonts (see steps below).    **Step 1**: Go to fonts.google.com and select a font (e.g., “Notable”)     **Step 2**: Copy the <link> code and paste it inside the index.html file <head>    **Step 3**: Use the textFont() function with the name of the font you imported |
| **Student Activity: Still A Pretty Bad Game** |
| * In this activity, students will work in pairs to create another game in which players score points when they press a button. Give them this [starter code](https://editor.p5js.org/mparker/sketches/lyOFJG_eP) and have them follow these instructions:  1. Using the text() function, make a title (e.g. “Still A Pretty Bad Game”) and instructions (e.g. “Click the button to score points”) 2. Create a score variable and display the score on the screen 3. Use a conditional to only increase the score when the button is pressed 4. BONUS: Subtract points when the mouse presses an area that is NOT the button 5. BONUS: Change the text font to a [Google font](https://fonts.google.com/) of your choice  * [Solution](https://editor.p5js.org/mparker/sketches/IyErjVwWq) for teacher reference |
| **Wrap Up** |
| * **[Design Journals]** Have students answer the following based on this code snippet:      * + Is firstVariable a string or a number?   + Is secondVariable a string or a number?   + Is thirdVariable a string or a number? Why?   + When is it useful to use strings in your code? |
| **Extension: N/A** |
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