Lesson Planning Template **Teacher: DeSIRE**

📅Date:	Topic: Action Programming	Time Required: 45 minutes

🎯**Learning Target/Objectives:**

- **I can** program a sequence of nine distinct robotic actions to perform a complex task like gripping and moving an object.
- **I can** use software sliders to calibrate individual servo motors and "Add Action" to build a logical timeline of movement.
- **I can** save custom action files to a computer and download them into a hardware controller for independent execution.

📜**Vocabulary:**

- **Action Group**
- **Run-Online**
- **Manual Coding**
- **Index**
- **Time (ms)**
- **Download**

❓**Guiding Questions:**

- Why is it important to "Run-online" before you begin programming a new sequence of movements?
- How does changing the "Time (ms)" value for an index change the physical behavior or "smoothness" of the robot's movement?
- If the robotic arm fails to pick up the block, which servo IDs would you likely need to adjust in your index list?

📚**Lesson Design Details:**

Activity 1: The Human Robot (Kinesthetic Programming)

- **Focus:** Before using the computer, students work in pairs. One student is the "programmer" and the other is the "robot." The programmer must give exact numerical "servo" instructions for the "robot" to pick up a cup. Project Outcome: Program 9 actions to grip.

Activity 2: Precision Calibration Lab

- **Focus:** Students are given a "target pose" image. They must use the software sliders to match the robot to the image and record the ID values for Servos 1 through 6. Step 3: Drag sliders for ID1, 3, 4, 5.

Activity 3: The Efficiency Challenge

- **Focus:** After completing the 9-action grip sequence, students attempt to reduce the "Total Duration" of the task by adjusting the "Time (ms)" of individual actions without dropping the object.

Key Points (Vocabulary):

- **Action Group:** A collection of individual poses or "actions" saved as a single file to execute a complete task.
- **Run-Online:** A software command that synchronizes the physical robot's position with the digital data on the screen.
- **Manual Coding:** The process of dragging digital sliders to set specific numerical values for each servo motor.
- **Index:** The numerical position of an action within a sequence (e.g., Action 1, Action 2).
- **Time (ms):** The duration, measured in milliseconds, that the robot takes to move from one pose to the next.
- **Download:** The process of transferring a finished action group from the computer to the robot's internal memory.

Key Points of Instruction

- **Logical Sequencing:** Students must understand that the robot moves linearly through the "Index." Action 1 must lead logically into Action 2 to avoid mechanical collisions.
- **The Importance of "Add Action":** Simply moving a slider does not save the movement. Students must click "Add Action" for every new pose they want the robot to remember.
- **Fine Adjustment Technique:** Instruct students to hold down the left mouse button while clicking the slider for precise control over the servo values.
- **Verification:** Successful downloads are confirmed by an audible "beep" from the xArm 1S controller.

Teacher's Cheat Sheet	
Parameter	**Standard Value / Instruction**
Action Group ID	Example uses Number 20 for grip objects
Standard Speed	800 to 1000 milliseconds (Time ms)
Initial Stance	Use Action Group No. 0 to start
Gripper Close	Approximately 550 value (ID 1)
Gripper Open	Approximately 300 value (ID 1)

Base Rotation	Controlled by ID 6
Success Confirmation	Audible "beep" sound during download.

Category	Standard Organization	Standard/Benchmark Code and Description
Computer Science	NCSOS	HS-AP-10: Create procedures with parameters to organize code and make it easier to reuse. [111]
Technology	ITEEA	STEL-2R: Follow step-by-step instructions to safely use systems and troubleshoot common problems. [2]
Engineering	ITEEA	STEL-7Q: Apply a broad range of making skills to follow a design process in the construction of a prototype. [33]
Digital Literacy	ISTE	1.5.d: Students understand how automation works and use algorithmic thinking to develop a sequence of steps. [444]
Mathematics	NCSOS	NC.M1.G-CO.2: Represent transformations in the plane; identifying specific coordinate-like values for servo positions. [55]