Lesson Planning Template **Teacher: DeSIRE**

📆Date:	Topic: Download Action Group	Time Required: 60 minutes

🎯Learning Target/Objectives:

- I can control the functions of the xArm robot.
- I can improve the accuracy of the xArm by adjusting the servos.
- I can describe the performance of the xArm using mathematical terms.

📜Vocabulary:

- **Action Group**
- **Muscle Memory**
- **Mass Download**
- **Debug Mode**
- **Conflict**
- **Index**

❓Guiding Questions:

- Why must an "action group" be downloaded to the controller rather than just running directly from the PC software?
- How does the robot use "beeps" as a form of non-visual data feedback during the download process?
- In a complex task like "Omni-directional Rotational Detection Grip," why is it more efficient to use a stored action group than manual control?

📚Lesson Design Details:

- Activity 1: The Muscle Memory Map
  - Focus: Students compare human "muscle memory" (like tying a shoe) to the robot's "Action Group." They must list the specific steps required for the "Grip" action group based on the file names provided.
- Activity 2: Verification Station (Audio Diagnostics)
  - Focus: Students perform a Mass Download and count the number of "beeps." They must match the number of beeps to the number of action groups listed in their software Index.
- Activity 3: The Debug Discovery
  - Focus: Students enter "Servo Test" mode to view the "Read Status" dashboard. They must document the Voltage and Temperature readings while a download is in progress.

Key Points (Vocabulary):

- **Action Group:** A saved sequence of movements that the robot can perform repeatedly.
- **Muscle Memory:** A biological metaphor used to describe stored mechanical functions in a controller.
- **Mass Download:** The process of transferring multiple action group files from a computer to the robot's controller simultaneously.

- **Debug Mode:** A specific software state (Servo Test) used for adjusting and testing hardware before final operation.
- **Conflict:** A communication error that occurs if more than one servo is connected during certain adjustments.
- **Index:** The numerical list or serial numbers representing the order of imported action groups.

Key Points of Instruction

- **Data Transfer vs. Real-Time Control:** Explain that while "Servo Test" allows real-time movement, the "Mass Download" is what gives the robot independence from the computer.
- **The Beep Protocol:** Students must listen for the audible "beep" after each file transfer to verify a successful connection and data packet delivery.
- **The Conflict Warning:** Heavily emphasize the software warning: before adjusting a servo in this mode, ensure only one servo is connected to the board to prevent communication conflicts.
- **Sequential Logic:** Teach students that the "Index" order matters; for example, the "Initial Action" is usually designated as Number 0 to establish a starting posture.
- **Muscle Memory Analogy:** Explain that just as human limbs need training, the robot's limbs need action groups downloaded to perform their move function.
- **Software Prerequisites:** Before downloading, students must switch the PC interface to "Servo Test" to enable the correct debug mode.
- **The Importance of "Index":** Teach students that action groups are organized by numbers (Index), ranging from Initial Action (No. 0) to complex rotations (No. 11).
- **Auditory Verification:** Remind students to listen for the "beep" sound reminder, which signals that a file has successfully downloaded to the controller.

Teacher's Cheat Sheet

Feature	Critical Data Point
Target Mode	"Servo Test" for action group management
File Range	Standard actions range from No. 0 to No. 11
Success Signal	Auditor "Beep" per file plus "Download success!" pop-up
Safety Warning	Connect only one servo when adjusting to avoid conflicts

Critical Statuses	Over heat, Over voltage, Over position
Interface Language	Ensure "English" is selected in the top left

Category	Standard Organization	Standard/Benchmark Code and Description
Computer Science	NCSOS	**HS-CS-03:** Illustrate the ways computing systems implement logic, input, and output through hardware components
Technology	ITEEA	**STEL-2R:** Follow step-by-step instructions to safely use systems and troubleshoot common problems
Engineering	ITEEA	**STEL-2V:** Analyze the stability of a technological system and how it is influenced by components in the feedback loop
Digital Literacy	ISTE	**1.1 Empowered Learner:** Students demonstrate a sound understanding of technology concepts, systems, and operations
Computer Science	NCSOS	**HS-AP-12:** Use and adapt classic algorithms to solve computational problems