



DETAILED TRAINER CURRICULUM & LESSON PLANS

Minute by minute. **Day** **by day.**

The full working curriculum for trainers: timing, scripts, build steps, safety checkpoints, and troubleshooting for every session of the Junior Robotics Camp.

FOR TRAINER USE

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Junior Robotics Camp · Five Days

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60 MINUTES

Electricity, Safety & The First Circuit

LEARNING OBJECTIVE

By the end of today, every child can explain what a wire, switch, and battery each do, and can build a working circuit that turns an LED on and off.

Time	Activity
0-8 min	Welcome & icebreaker. Ask: "Where have you seen a robot today?" Collect 4-5 answers (phone, fan, car, toy). Introduce camp theme: electricity + movement = robots.
8-18 min	Explain electricity using the "water in a pipe" analogy. Show a battery, ask children to guess what's inside. Pass batteries around (AA, 9V) for them to hold — supervised.
18-25 min	Safety briefing (see box below). This is non-negotiable before any wiring begins.
25-50 min	Guided build: each child wires their battery → switch → LED circuit on a breadboard, following the numbered steps below. Trainers circulate continuously.
50-58 min	Everyone presses their switch at the same time on a countdown — the whole room lights up together. Big celebratory moment.
58-60 min	Pack away safely. Preview Day 2: "Tomorrow, the same wires make something spin."

TRAINER SCRIPT — OPENING LINE

"Robots are just electricity and movement working together. This week, you're going to build both parts yourselves — starting with electricity, today."

SAFETY BRIEFING — SAY THIS WORD-FOR-WORD

- We only use small batteries today — never a wall socket, ever.
- If a wire or battery ever feels hot, stop and put your hand up immediately.
- Never put a battery in water or your mouth.
- Always disconnect the battery before changing any wire.

Build Steps — The First Circuit

- 1 Place the breadboard flat on the table. Identify the two power rails (+ and -).
- 2 Connect the battery clip's red wire to the + rail, black wire to the - rail.
- 3 Insert the LED — long leg toward +, short leg toward -. (If it doesn't light up, this is the first thing to check.)
- 4 Wire the push-button switch in line between the LED and the + rail.
- 5 Connect the 9V battery. Press the switch — the LED should light up only while pressed.

COMMON ISSUES & FIXES

- **LED doesn't light:** check it isn't inserted backwards (flip it around).
- **LED stays on permanently:** the switch is wired to the wrong rail — move it in line with the LED, not parallel to it.
- **Nothing happens at all:** check the battery clip is fully seated and the breadboard rows are making contact.



2

60 MINUTES

Motors, Rotation & Building a Fan

LEARNING OBJECTIVE

By the end of today, every team can wire a motor to spin, reverse its direction by swapping wires, and control its speed with a dial.

Time	Activity
0-8 min	Recap Day 1: "What did electricity do yesterday?" (lit a bulb). Introduce today's twist — same electricity, different job: spinning.
8-15 min	Open a motor casing (pre-prepared, safe to handle) so children see the spinning rotor and magnets inside.
15-22 min	Live demo: spin a motor forward, then swap the two wires and spin it backward. Ask the group to predict what will happen before you do it.
22-50 min	Guided build in pairs: wire motor + switch + speed dial + fan blade, following steps below.
50-58 min	Each pair demonstrates: spin forward, reverse direction, then slow down and speed up using the dial.
58-60 min	Preview Day 3: "Tomorrow this same spin moves a car, not just air."

TRAINER SCRIPT — REVERSING DIRECTION

"Watch the motor spin this way. Now I'm going to swap these two wires — just swap them, nothing else changes. What do you think will happen?"

Build Steps — The Fan

- 1 Mount the DC motor securely onto the base bracket.
- 2 Wire the motor through the potentiometer (speed dial) and the switch from Day 1.
- 3 Connect the battery and test — the motor shaft should spin when the switch is pressed.
- 4 Attach the fan blade onto the motor shaft. Confirm it spins freely without wobbling.
- 5 Test reversing: disconnect, swap the two motor wires, reconnect, and confirm it now spins the opposite way.
- 6 Turn the speed dial while running — confirm the fan visibly slows and speeds up.

COMMON ISSUES & FIXES

- **Motor doesn't spin:** check battery polarity and that the switch circuit is closed.
- **Fan blade wobbles badly:** the blade isn't pushed fully onto the motor shaft — press it on firmly.
- **Dial doesn't change speed:** potentiometer may be wired to the wrong terminal — check the wiring diagram.

DC motor (TT/N20)
Fan blade attachment
Potentiometer (speed dial)
9V battery + clip

Switch & wires (from Day 1 kit)

3

60 MINUTES

Kinetics — Building a Moving Car

LEARNING OBJECTIVE

By the end of today, every team can build a two-motor car chassis that drives forward and reverses on command.

Time	Activity
0-7 min	Recap Day 2: "What did the motor spin yesterday?" (a fan blade, moving air). Today, point that same spin at the ground.
7-15 min	Explain kinetics simply: anything that moves has kinetic energy. Demonstrate a wheel rolling when pushed by hand, then by a motor.
15-22 min	Explain steering: one motor reversed while the other runs forward turns the car. Demonstrate on a finished sample chassis.
22-50 min	Guided build in pairs: assemble the chassis, mount two motors and wheels, wire to a shared switch, following steps below.
50-58 min	Floor test: each team drives their car forward, then reverses the wiring connections and drives it backward.
58-60 min	Preview Day 4: "Tomorrow we build something that moves like an animal, not just a car."

TRAINER SCRIPT — INTRODUCING KINETICS

"Yesterday your motor spun a fan blade and moved air. Today, the exact same spin is going to move a wheel — and the wheel is going to move your whole car."

Build Steps — The Car

- 1 Assemble the chassis base and mount the caster wheel at the rear for balance.
- 2 Mount one DC motor on each side of the chassis, each with a wheel attached.
- 3 Wire both motors in parallel to the same battery pack and switch.
- 4 Test on the floor — press the switch and confirm the car rolls forward in a straight line.
- 5 Disconnect, swap the wires on both motors, reconnect, and confirm the car now reverses.
- 6 Optional challenge for fast finishers: reverse only one motor's wires to make the car turn instead of reverse.

COMMON ISSUES & FIXES

- **Car drives in a circle:** the two motors are spinning at different speeds or in opposite directions — check both wiring directions match.
- **Car won't move at all:** check the caster wheel isn't dragging or jammed against the chassis.
- **One wheel spins, the other doesn't:** a loose connection on one motor — check both terminals.

Chassis kit

2x DC motors + wheels

Caster wheel

Battery pack

Direction switch

4

60 MINUTES

Servos — Robots That Move Like Us

LEARNING OBJECTIVE

By the end of today, every team can assemble and power a pre-programmed Arduino-driven creature with a moving servo limb, LED, and buzzer.

Time	Activity
0-7 min	Recap Day 3: cars moved forward and back. Today's robots move like living things — a leg, a tail, a hand.
7-15 min	Demonstrate a servo moving to an exact angle and holding it, vs. a motor that just spins continuously. Let children feel the difference by hand.
15-20 min	Show the pre-programmed Arduino board. Explain simply: "Tonny already taught this board what to do — today you build its body."
20-22 min	Teams choose their creature: crawling insect, walking dog, or waving hand.
22-50 min	Guided assembly: mount the Arduino board, attach the servo limb, wire the LED and buzzer, following steps below.
50-58 min	Power-on moment: each team powers their creature and watches it move, light up, and buzz for the first time.
58-60 min	Preview Day 5: "Tomorrow, you build everything from this whole week again — on your own."

TRAINER SCRIPT — INTRODUCING THE SERVO

"A motor spins forever in one direction. A servo is different — it moves to an exact spot and stops right there, just like your elbow stops when your arm is straight. That's what makes a robot able to wave, crawl, or walk."

Build Steps — The Creature

- 1 Mount the pre-programmed Arduino board onto the creature frame base.
- 2 Attach the servo to its designated limb mount (leg, tail, or hand depending on creature choice).
- 3 Connect the servo signal wire to the labelled pin on the board — do not connect it to any other pin.
- 4 Wire the LED and buzzer module to their labelled pins.
- 5 Connect the battery pack last, after every other connection is checked.
- 6 Power on and observe: the limb should move on its own, the LED should light, and the buzzer should sound in sequence.

SAFETY NOTE FOR TRAINERS

Always connect the battery last and disconnect it first when making any adjustment. Children should never force a servo limb by hand while it is powered — this can damage the gear inside.

COMMON ISSUES & FIXES

- **Servo doesn't move:** check the signal wire is on the correct labelled pin, not swapped with power or ground.
- **LED or buzzer silent:** check polarity and that the wire is fully seated in its pin header.
- **Servo moves but jitters:** check the battery has sufficient charge — swap in a fresh pack.



5

60 MINUTES

Capstone — Build, Present, Celebrate

LEARNING OBJECTIVE

Each child independently assembles a complete capstone kit covering circuit, motor, wheel, and servo elements, then presents it to the group.

Time	Activity
0-5 min	Brief reminder: "No new lesson today — this is everything from the week, in your hands, on your own."
5-40 min	Independent capstone build. Trainers observe and only intervene if a child is stuck for more than 2 minutes or there is a safety concern.
40-50 min	Final testing — each child powers on their build and confirms it works as intended.
50-58 min	Presentations: each child or team shows their robot to the group — what it does, how it's powered, and what they're proudest of.
58-60 min	Certificates handed out. Group photo. Children take their robots home.

TRAINER SCRIPT — CAPSTONE INTRODUCTION

"This kit has a circuit, a motor, a wheel, and a servo in it — everything we built this week, just smaller. You already know how every part of this works. Build it your way."

Trainer Checklist Before Day 5 Begins

- All capstone kits pre-counted and complete (no missing parts)
- Spare batteries on hand for every group
- Certificates printed with each child's name
- Camera or phone ready for the group photo
- Presentation order assigned so every child gets a turn

WHAT "INDEPENDENT" MEANS TODAY

Trainers do not hand-hold today. If a child asks "what do I do next," the correct response is a question back: "What did we do on Day 2 when the motor didn't spin?" Let them recall it themselves — that recall is the entire point of Day 5.

APPENDIX

Master Materials & Logistics Checklist

For trainers preparing kits ahead of each session.

— Per-Child / Per-Team Kit Summary

Day	Per Team / Child	Quantity Basis
Day 1	9V battery + clip, push-button switch, LED, jumper wires, breadboard	Per child
Day 2	DC motor, fan blade, potentiometer, 9V battery, switch (reused from Day 1)	Per pair
Day 3	Chassis kit, 2x DC motors + wheels, caster wheel, battery pack, switch	Per pair
Day 4	Pre-programmed Arduino board, servo, LED+buzzer module, creature frame, battery pack	Per pair
Day 5	Full capstone kit (circuit + motor + wheel + servo elements)	Per child

— Trainer Setup Notes

- Arrive 20 minutes before each session to lay out kits per table
- Test one sample build from each day's kit the night before, to catch any faulty parts
- Keep a spares box (extra LEDs, wires, batteries) at the trainer table throughout the week
- Charge or replace Arduino board batteries before Day 4 and Day 5
- Confirm group sizes and seating before each session starts

— Group Sizing Guidance

Groups of 2–3 children per kit work best for Days 2–4, allowing every child a turn to wire, test, and observe. Day 1 and Day 5 are individual builds, as both are designed to test personal understanding rather than teamwork.