

## Lesson Plan

<b>Title of the Lesson</b>	Soldering Brizzlebots as a Making Add-on
<b>Duration</b>	1,5 h
<b>Teaching methods and strategies</b>	<ul style="list-style-type: none"> <li>• Demonstration of safe soldering techniques</li> <li>• Hands-on experiments and guided making</li> <li>• Group discussion and creative variation of Brizzlebots</li> <li>• Peer collaboration and support</li> </ul>
<b>Learning Outcomes</b>	<ul style="list-style-type: none"> <li>• Understand the concept of energy conversion (electrical to mechanical)</li> <li>• Learn safe soldering techniques</li> <li>• Construct a functioning Brizzlebot</li> </ul>
<b>Steps to be Followed</b> [Each lesson could be divided into 3 sections: 1. Introduction (5-10 mins) 2. Main Content (30-40 mins) 3. Wrap-Up/Review (5 mins)]	<b>1. Introduction (10 minutes)</b> <ul style="list-style-type: none"> <li>• Start with a brief explanation of energy conversion: how electrical energy from a battery becomes mechanical movement in the Brizzlebot</li> <li>• Show and explain key components: motor, wires, coin cell battery, and vibration brush</li> <li>• Demonstrate safe and basic soldering techniques, with a strong emphasis on tool safety and proper handling</li> </ul> <b>Adaptation for Inclusivity:</b> <ul style="list-style-type: none"> <li>• Provide visual aids or a video demonstration for students who need repeated or non-verbal instruction</li> <li>• Use labelled, large-format diagrams of components for students with visual or learning differences</li> </ul>

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	<ul style="list-style-type: none"> <li>• Offer tactile models of a Brizzlebot for students who are blind or low vision</li> <li>• Use simplified language and printed vocabulary sheets for multilingual learners</li> <li>• Allow students with auditory processing difficulties to follow along with captions or written instructions</li> <li>• Make available adaptive safety gear (e.g., heat-resistant gloves, larger soldering handles) for students with physical disabilities</li> </ul> <p><b>2. Main Content (60 minutes)</b></p> <p><b>Step 1: Guided Assembly (15–20 mins)</b></p> <ul style="list-style-type: none"> <li>• Walk students through connecting motor leads and preparing wires. Pre-cut wires may be available for easier handling.</li> </ul> <p><b>Step 2: Safe Soldering (15–20 mins)</b></p> <ul style="list-style-type: none"> <li>• Under direct supervision, students solder connections between the battery, motor, and wires.</li> </ul> <p><b>Step 3: Final Assembly and Testing (10–15 mins)</b></p> <ul style="list-style-type: none"> <li>• Attach brushes or vibration elements. Place the battery, test connections, and adjust for balance or function.</li> </ul> <p><b>Step 4: Creative Variations (Optional / Ongoing)</b></p> <ul style="list-style-type: none"> <li>• Encourage students to personalize their Brizzlebots with materials like pipe cleaners, googly eyes, or colored tape.</li> </ul> <p><b>Adaptation for Inclusivity:</b></p>
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#### Assembly:

- Use color-coded wires and large print guides
- Provide guided hand-over-hand support if needed for wiring
- Allow pairing for students who benefit from peer support

#### Soldering:

- Offer optional solderless alternatives (e.g., battery clips or conductive tape) for students who are unable or uncomfortable using a soldering iron
- Ensure close adult supervision and use of low-heat soldering stations for safety
- Set up a quiet, well-ventilated, distraction-free work zone for students with sensory sensitivities

#### Testing and Adjusting:

- Offer verbal or visual troubleshooting guides
- Allow different ways of observing success (e.g., tactile vibration, visual movement)
- Provide timers or checklists for students who need help with pacing

#### Creative Variation:

- Let students choose whether or not to decorate
- Provide a range of materials that accommodate motor or sensory needs (e.g., textured vs. smooth decorations)
- Offer voice-to-text tools for students who wish to name or describe their bots digitally

### **3. Wrap-Up / Review (10 minutes)**

	<ul style="list-style-type: none"> <li>• Invite students to present their Brizzlebots, either by showing them in action or describing their design choices</li> <li>• Facilitate a discussion on energy conversion and how the motor made the bot move</li> <li>• Ask reflective questions: <i>What was easy? What was challenging? What would they change next time?</i></li> </ul> <p><b>Adaptation for Inclusivity:</b></p> <ul style="list-style-type: none"> <li>• Allow students to share in their preferred format—verbally, through drawings, or a short video clip</li> <li>• Provide reflection prompts or sentence starters to support those with language or cognitive challenges</li> <li>• Create a group board (physical or digital) to showcase all Brizzlebots equally, regardless of how they function</li> <li>• Celebrate effort and creativity, not just technical success</li> </ul>
<p><b>Required material and resources</b></p>	<ul style="list-style-type: none"> <li>• Small vibrating motors</li> <li>• Coin cell batteries</li> <li>• Wires (pre-stripped and color-coded, if possible)</li> <li>• Soldering irons and lead-free solder</li> <li>• Heat-resistant mats and safety goggles</li> <li>• Brushes or vibration components (e.g., toothbrush heads)</li> <li>• Optional: pipe cleaners, googly eyes, markers for decoration</li> <li>• Printed or visual assembly guides</li> <li>• Accessible work surfaces and tools for students with mobility challenges</li> </ul> <p><u>Extra resources:</u></p>

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	<ul style="list-style-type: none"> <li>• How to Make a Bristlebot – Science Buddies: This guide provides step-by-step instructions on building a simple bristlebot using a toothbrush head, a small motor, and a battery.</li> <li>• Intro to Soldering for Kids – Instructables: This tutorial introduces children to the basics of soldering, including vocabulary, safety precautions, and hands-on techniques. <a href="#">Instructables</a></li> <li>• Accessible Making &amp; Inclusive STEM – FabLearn: This resource discusses principles for creating inclusive and accessible making experiences in STEM education. <a href="http://cucfablab.web.illinois.edu">cucfablab.web.illinois.edu</a></li> <li>• Video: Bristlebot Build Tutorial – YouTube: This video demonstrates how to assemble a bristlebot, providing a visual guide to complement written instructions.</li> <li>• Soldering Safety Guide for Educators – MakerEd: This PDF outlines safety guidelines for soldering in educational settings, emphasizing best practices to ensure a safe learning environment.</li> <li>• <a href="#">Video: Bristlebot Build Tutorial – YouTube</a></li> </ul>
<p><b>Assessment or evaluation techniques</b></p> <p>[e.g., Participation in discussions, worksheet completion, group presentations.]</p>	<p><b>Safe Practice:</b> Observe how students handle tools and follow safety protocols during soldering</p> <p><b>Functionality:</b> Evaluate whether the Brizzlebots move and how well students troubleshoot issues</p> <p><b>Participation:</b> Assess engagement, collaboration, and perseverance during hands-on work</p>

	<p><b>Creativity and Reflection:</b> Consider how students personalize their bots and reflect on their learning experience</p>
<p><b>Ethical Considerations (if needed)</b></p>	<p><b>Safety and Supervision</b></p> <ul style="list-style-type: none"> <li>• Direct supervision is mandatory during all soldering activities</li> <li>• Clear, repeated safety instructions in multiple formats (visual, verbal, tactile)</li> <li>• Ensure tools are age-appropriate and cleaned between uses</li> </ul> <p><b>Inclusivity and Fair Participation</b></p> <ul style="list-style-type: none"> <li>• Offer alternatives to soldering for students who cannot or prefer not to use hot tools</li> <li>• Ensure every student has access to the necessary materials and time to complete the project</li> <li>• Provide optional pair or group work to support collaboration and social inclusion</li> </ul> <p><b>Respect for Diverse Abilities</b></p> <ul style="list-style-type: none"> <li>• Value all levels of participation—functioning bots, creative effort, or thoughtful reflections</li> <li>• Promote peer support and inclusive teamwork throughout the activity</li> </ul> <p><b>Environmental Awareness</b></p> <ul style="list-style-type: none"> <li>• Use rechargeable or recyclable batteries when possible</li> <li>• Encourage reuse of materials (e.g., old brushes for bot bases, extra wires for decoration)</li> <li>• Discuss responsible disposal of electronics and safe solder waste handling</li> </ul>