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Home Made Battery Interrupters/Adapted Switches for Student Engagement

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Abstract: *When students with disabilities have problems physically engaging with the curriculum, learning is more difficult. One possible solution to this problem may be the use of switches battery interrupters to help students learn the cause-and-effect relationships between switch activation and computer access. Battery interrupters are one way to help students learn switch access which may help them better become actively engaged with the curriculum and, as such, increase student learning.*

Key words*: Battery interrupters, switches, student engagement.*

Student engagement leads to positive outcomes in leaning (Carnahan et al., 2009; Iovanne et al., 2003). For children, engagement in play leads to increase in cognitive skills including those related to early literacy (Rand & Morrow, 2021) and Science, Technology, Engineering, Art, and Math (STEAM) (Hunter-Doniger, 2021). However, physical and/or cognitive challenges often create barriers to active participation in play or other learning activities. Adapting a toy to make it more accessible to all children adheres to the core principles of universal design; multiple means of representation, multiple means for engagement, and multiple means for action and expression (Brand et al., 2012).

Switches and battery interrupters provide an alternative way for children with disabilities to actively engage with toys (Bavonese et al., 2016). A battery interrupter is a tool that adds a switch jack (aka "switch adapts") to an electrical device. A switch is any device that can convert movement into a meaningful output (Johnston et al., 2012). Switches can be large objects to push about the size of like a tap light, to small buttons like the “try me” push buttons found on packages of battery operated toys or lights, to a device where blowing air from the mouth activates. Even the touch screen on a computer tablet or smart phone is a large switch.

When developing switch access, exploration, mistakes and incorrect activations are a very important part of te learning process. Opportunities to activate switches and observe results are essential. For children who are just learning switch access, incorrect switch activations should not be considered an indication of the lack cognitive understanding by the child. They may instead show the child’s active engagement in problem solving, indicate a need for more practice in controlling motor movements and shifting between two controlled movements or a sign of boredom and fatigue (Burkhart, 2015).

Learning takes place when students are actively engaged and there is intent, purpose and variation included in the teacher’s strategies. Teachers that emphasize active engagement help students process and retain information. Active engagement leads to more self-questioning, deeper thinking, and problem solving. Engagement strategies like repetition, trial and error, and posing questions move the brain into active and constructive learning. And such activities can lead to higher student achievement (Lorain, n.d.)

The first step in successfully adapting is to choose age appropriate toys or devices. Whereas younger students may like fuzzy toys, older students may need a tape deck, radio or CD player to work with. The type of switch and the toy/device is determined by the individual desires of the child or adolescent. The best way to determine which toy/device would work best is to observe the student during play and see what he or she enjoys. The easiest toys/devices to modify are ones that move in only one direction or use sound and lights as an activity. Toys with multiple movements like spinning or flipping are more challenging to use with a switch because the wire has a tendency to become tangled and the battery interrupter can easily be pulled out (http://www.smasupport.com/making_a_switchadapted_toy.htm).

Battery Interrupters can be used to adapt most devices, toys, or radios that have an on/off switch to work with a capability switch. Educational uses of battery interrupters include making toys and electronic devices, switch-capable. Simply insert the battery interrupter between the positive end of the battery and make most items switch activated. This is a great option if there is have a favorite toy or vocational-related device that needs to be adapted. These interrupters generally don't work with devices that are squeezed or use remote control to activate them. Gently slide the disk between the battery and the metal bump on the compartment. Sometimes it is easiest to slide the battery interrupter disk and the battery in at the same time.

This is usually done for the purpose of allowing a person to use that device, by using an enabling ability switch, which can be anything from a plastic button to a muscle twitch sensor. They are used with mostly anything that has a battery power source.

An adapted switch is usually a 3.5mm jack, with each of the two wires connected to an input device, such as a pushlight or doorbell. These jacks are inserted into the matching jack input on the device, redirecting the electrical circuit through the 3.5mm jack, so that it can be opened and closed with a switch. These switches are particularly useful for programs that require physical student input to scan options.

Building a battery interrupter

Step One: Select your tools:

1. Some of the tools we used are a soldering iron, insulated wire, a wire splitter, solder and a metal conductor. In this case, the metal conductor was a piece of copper sheeting which we had to insulate using electrical tape.

Step Two: Insulate the conductor:

2. Cut a piece of conductor (copper plating works best, but any metal that will conduct electricity will do). Cut the conductor small enough to fit into the battery compartment. Using electrical tape, put a strip of tape down the center of one on the conductors. Make sure the entire surface is covered, as the sides of the conductors cannot make contact with each other.

Step Three: Cut a piece of insulated wire to the desired length:

3. Depending on where the student will need the switch to be located depends on the length of the wire. Some students may not be able to activate a switch with their hand and may need to have a switch that will fit between their knees, be mounted on a headrest or even on a foot rest on a wheelchair.

Step Four: Split the piece of wire on both ends:

4. This is easily done by using a knife or scissors to separate the wire about 2" down. Simply place the blade between the two strands of wire and pull the wire to split. Make sure you split the wire on both sides.

Step Five: Strip the insulation:

5. Now that you have split the wire, strip about ¼ to ½ inch from the insulation. This is easily done using a quality wire stripper. It can also be done with a knife/pair of scissors, but the wire stripper is well worth the cost at this point.

Step Six: Solder one piece of the wire to one side of the copper conductor:

6. Using a quality solder, solder the stripped wire to one of the strips of conductor you cut in Step Two. Make sure the conductors do not contact each other and make sure the wires you soldered don't contact each other.

Step Seven: Solder the other wire to the other side of the copper strip.

7. Solder the stripped wire to one of the strips of conductor you cut in Step Two. Again, make sure the conductors do not contact each other and make sure the wires you soldered don't contact each other.

Step Eight: Bend the metal conductor so that it will fit in the battery compartment, but not stick out too much.

8. If the device you are using has a battery compartment across the bottom, the conductor should be bent to lie across the bottom of the device you are trying to interrupt. If the interrupter is too tall, the device, if it is supposed to move, will not be able to function properly.

Step Nine: Insert the interrupter conductors between the "+" lead of the battery and the device.

9. This works better than trying to interrupt the electrical flow at the negative end of the battery. It is also much easier to insert the interrupter at the positive end.

Step Ten: Pressing the switch should now activate the device we used with the battery interrupter.

10. Some students will not have mastered the 'cause and effect" relationship between switch activation (cause) and something happening (effect) to the device.

If developing a switch for computer jack input, after step five,

Step Six: Wire your connector plug so that the switch can be connected to the computer jack. The male component of the connector plug has two separate connectors. Solder one of the wires to one part of the connector and solder the other wire to the other end of the connector. Make sure the wires do not touch.

Step Seven: Wire your connector plug so that the switch can be connected to the computer jack.

10. The female component of the connector plug has two separate connectors. Solder one of the wires to one part of the connector and solder the other wire to the other end of the connector. Again, make sure the wires do not touch.

Step Eleven: Wire your plug so that the male connector of the switch interface fits into the female plug of the computer jack input.

11. Plug the male adapter you just made into the female connector of the switch you are going to use to activate the device. Make sure there is a "snug' connection.

Step Twelve: Pressing the switch should now activate the computer/tablet so the student can effect device input.

Again, some students will not have mastered the 'cause and effect" relationship between switch activation (cause) and something happening (effect) to the device.

Helping students develop the skills to effectively and correctly utilize a battery interrupter and/or switch will help students become much more actively engaged in their own learning than having students passively sit back and have no real active involvement. Switch access is one effective way to allow students with significant disabilities to have a more active role and make their learning more meaningful and personal.

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