Assistive Technology: 3D-Printing for Special Schools - Possibilities with linking to Transition Year Projects or community organisations

Assistive Technology Switches

In Assistive Technology (AT) terms, a switch usually refers to an object that can be touched or activated by a body part in order to give commands to a computer by a person with restricted motor control.

With related software, a single body movement can operate a computer via a switch.
This requires a training and learning period, and pupils' expectations should not be raised too much as it is very slow in operation.

A switch makes an electrical connection between two contacts, such as a light switch. The button on a mouse and a key on a keyboard are switches. In AT terms, a switch usually refers to an object that can be touched or activated by a body part, in order to give computer commands. This usually refers to touch, but puff (blow) and suck switches are other examples. Switches are, therefore, useful to pupils who are limited to gross motor movement and can only touch a single, fixed target. They are also useful to those with very fine, but limited, motor movement, such as those restricted to head control. With the use of appropriate software, input by switch can manipulate a computer.

Air-link Infra-Red

Jelly Bean Switch

Most switches are contact switches - they operate by touch or grip, and give feedback, such as a click, or spring return. This audio and tactile response is important for users who cannot easily tell what their limbs are doing. For pupils who cannot speak, switches such as

the BigMac will play a pre-recorded message. Switches are also available to operate toys. Multiple switches are also available, where a variety of functions need to be performed by different switches. The Wafer Switch is an example. These do not give audio or tactile responses.

Potential for Community Links

AT is evolving and diverging rapidly, and the benefits of 3D printing in/for special education environments is growing. The adoption of this 3D printing technology in special education requires time commitments, due to the learning curve to develop the skills needed, to encouraging in-house assistive device design. Internationally, some special schools have recently made successful connections with Post–Primary Schools and STEM Clubs to switch adapt toys and produce switches. Possible links in Ireland could include developing links with Transition Year(TY) coordinators/students, Men's Sheds, STEM clubs etc.

There seems to be a real possibility for a school's Transition Year Coordinator to link with special schools and develop switches and or adapting toys for switches.

> http://atmakers.org/
> ATMakers.org introduces makers and Assistive Technology (AT) users and give these two communities the tools they need to collaborate. High School STEM and Robotics students, hobbyists & DIY electronics enthusiasts have the skills necessary to create innovative solutions today. We hope to provide descriptions and instructions that allow a community of Makers (for example a high-school robotics club or regulars at a MakerSpace) to build customized technology solutions for Assistive Technology Professionals and individuals whose lives would be enriched by them.

3D Printed Switches

Commercially available switches can have huge mark-ups and sometimes prohibitively expensive. Also these may not very customisable or ultimately suit the needs of their users. With the advent of consumer 3D printing and adaptive open-source designs, switches can be printed on 3D printers for little money and some have very high recommendations.

You can download the SDL Code for the 3D Printed Switches and easily assemble. Step by step video instructions are available here: http://atmakers.org/2017/03/3d-printed-at-switches-mark-i/#more-501

Two other open-source 3D printed switch designs can be seen here:

- The Accessible Push Button Switch, widely used in the field of disability. https://www.thingiverse.com/thing:3086823
- The Raindrop is small, simple DIY assistive switch. https://www.thingiverse.com/thing:3635665

If you want more of a challenge you can learn how to design and print your customized switch here: https://www.instructables.com/id/Create-Adaptive-Switches-With-TinkerCAD-and-3D-Pri/

Mounts and Positioning

Positioning switches is critical for folks with severe and profound physical challenges. Getting the AT Switch "just right" reduces fatigue, increases accuracy, and makes communication and environmental control much more successful.

- Easy AT Switch Positioning with free 3D Printed Camera Mounts http://atmakers.org/2017/02/at-switch-adapters/

Toy Switch Adaptation of Battery Operated Toys

Why are switch-adapted toys important?

- Encourages independent play
- Teaches cause and effect relationship skills
- Teaches switch access, which is a gateway to communication device access, computer access, and environmental access

https://www.jerichoadaptstoys.org/
The Jericho Adapts Toys Team: we are a group of Jericho High School students volunteering our time outside of school to adapt toys for children with physical disabilities. Michael Dicpinigaitis is the founder and CEO of the Jericho Adapts Toys Team. Other students helping with this initiative include: Eric Li, Sohil Dharia, Jai Joshi, and Corinne Dicpinigaitis.

It is a real possibility for TY to link with special schools regarding adapting toys for switches; there are some useful videos online that demonstrate how battery operated toys can be made switch accessible. It is necessary to find the single on-off switch - you turn it on and it does something, you turn it off and it stops doing it. You then modify this by adding a switch socket. For example, see the following videos for examples of adaptation of a toy.

- Switch Adapting a Child's Toy
  http://atmakers.org/2018/09/switch-adapting-a-childs-toy/
- Switch Adapting a toy
  https://www.youtube.com/watch?v=nxNtdBfaoW8

Individual Toys that have instructions on how to add a switch/socket

- Taking ABC Elm0 – Switch Adaption
  http://atmakers.org/2017/11/talking-abc-elmo-switch-adaptation/#more-676
- My bubble Machine - Switch Adaption
  http://atmakers.org/2017/11/my-bubble-machine-switch-adaptation/#more-1018
- Clubhouse Fun Minnie – Switch Adaption
  http://atmakers.org/2017/11/clubhouse-fun-minnie-switch-adaptation/#more-1004
- Minion Stuart Interacts with Guitar – Switch Adaption
  http://atmakers.org/2017/11/minion-stuart-interacts-with-guitar-switch-adaptation/#more-953

Perhaps for older child:

- switch adapted scissors: https://www.youtube.com/watch?v=r8Ys-wzmPCs
- switch adapted zoom tube: http://atmakers.org/2019/01/zoom-tube-switch-adaptation/ and https://www.youtube.com/watch?v=z7BF4IChNc8

Further Reading:

- ABC and 3D: Opportunities and Obstacles to 3D Printing in Special Schools
  https://dl.acm.org/doi/pdf/10.1145/2661334.2661365?download=true
- Volks-Devices: links to devices that are designed for individuals with disabilities and freely available to build and customize.
  https://volksswitch.org/index.php/volks-devices/
- Enable Ireland's National Assistive Technology Training Service Accessible Apps, Games and Toys

https://www.enableireland.ie/sites/default/files/publication/Enable%20Ireland%27s%20Guide%20to%20Accessible%20Apps%20Games%20and%20Toys.pdf

- NCSE Assistive Technology Research Report

  http://ncse.ie/wp-content/uploads/2016/07/NCSE-Assistive-Technology-Research-Report-No22.pdf