Adaptive Technology (AT)

This document has been created to help you describe the role that adaptive technology can play in the lives of people with special needs (LCCS LO1.17).

Assistive and adaptive technologies can help some people with disabilities ‘work around’ their limitations. Although the terms are often used interchangeably, there is a slight difference in the definitions of assistive technology and adaptive technology. Assistive technology is any item, system, or product used to improve the functional capabilities of individuals with disabilities. Adaptive technology is a subcategory of assistive technology; it refers to something specifically designed for people with disabilities. [2]

Adaptive Technology Categories

There are many ways that technology can improve the functional capabilities of individuals with disabilities. Due to the broad spectrum of ways lives can be improved, there are numerous categories of Adaptive Technologies including [3]:

- Aids for Daily Living
- Environmental Controls
- Mobility
- Seating and Positioning
- Communication Aids
- Computer Access
- Blindness and Visual Impairment (VI)
- Deafness and Hearing Impairment (HI)
- Telecare/Telehealth
- Cognition and Learning Disabilities
- Recreation and Leisure
- Prosthetics and Orthotics
- Vehicle Modifications
- Architecture and Universal/Inclusive Design

For the purpose of this document, we will limit our scope to Adaptive Technologies (AT) that are applicable to Education and Care. In particular we will focus on Adaptive Technologies that we need to consider in designing Computer Science Solutions.

Adaptive Technology in Education

Computers and adaptive technologies are playing an increasingly important role in the education of pupils with unique needs. Computer-based AT applications can help overcome some of the functional barriers created by disability and can allow pupils to read, write and communicate more effectively. Used in conjunction with special software, pupils with associated learning difficulties have new educational opportunities.

Benefits of AT in Education

The availability of assistive technologies can help to 'level the playing field', in terms of academic achievement. Along with the increasing use of computers in the workplace, these technologies have opened new independent-living and employment opportunities and can enhance the pupils' perception of their potential development and role in life.

Examples of Adaptive Technology Solutions for Students:

Adapted Keyboard: The standard keyboard and mouse are the main input devices and represent the chief barriers to pupils with restricted motor control. However optional settings available within the standard computer operating systems, such as Microsoft Windows, can improve the usability of the standard keyboard and mouse in some cases. The keyboard will be the main input device for visually impaired pupils. A larger than normal keyboard with high contrast letters may help, and coloured stickers for standard keys are available.

Onscreen keyboard: An on-screen keyboard can perform all the functions of a standard keyboard, but without the need to physically use the hardware keyboard. The on-screen keyboard is a software application that stays on the monitor with whatever application is being used and can be used in conjunction with alternative mice or switches.

Mouse: The standard mouse requires fine motor control and is often difficult to operate initially, even for non-disabled people. The mouse properties in the Windows Control Panel can significantly help by reducing the double-click speed, the motion of the pointer and the pointer size. Also, by using the MouseKeys function, the numeric keypad on the standard keyboard can control the mouse.

Touchpads: These have become popular on laptops, but standalone touchpads are available as a mouse alternative. The monitor pointer is operated by limb movement across a touch pad, and the clicking function by tapping on buttons or on the pad. Touchpads are useful for people that might have fine finger control but lack gross hand movement.

Voice Recognition Apps & Programs: Voice Recognition (VR) technology allows the user to use and control a computer through voice. While this may be useful for pupils with special needs, it is a relatively advanced technology and its potential success depends on a range of factors including the suitability of the environment (e.g. noisy background)

Touchscreens: With a touchscreen, options can be chosen by directly touching the monitor (screen) as distinct from using a mouse. Integrated touchscreen monitors are available, or 'clip-on' units can be used with standard monitors.

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 commands to a computer by a person with restricted motor control.

Screen Magnifiers: Software, such as ZoomText, allows portions of the monitor to be enlarged to varying degrees of magnification. Also, the Microsoft Accessibility Options offer some variation of Display Settings.

Screen Readers: Allow for Speech to be generated from a computer. Screen-reading software with speech synthesisers is readily available and will provide supplementary speech support to standard software applications. TextHelp and Write: OutLoud are examples.

Braille Output: Output options for the visually impaired students may include tactile material using Braille.

Website Accessibility: Web access for people with visual impairment has become more difficult as the development of screen-readers tries to keep pace with the growing complexity of web-page design. The increasing use of graphics compounds this. There is now a standard for accessible web-pages - the Web Accessibility Initiative (WAI) has produced guidelines for the development of accessible websites. User-friendly webpages have graphics kept to a minimum and include

alternative explanations or headings (i.e. ALT tags in images). Software to make Internet browsers more readable is available. Examples are BETSIE and Webspeak.

Loops: Loop systems are especially designed to cut out background noise for people with hearing difficulties. The 'loop' is a wire that picks up sound from a microphone and transmits it to an earpiece, or hearing aid, within the loop. The size of the loop will vary. A cinema may have a very large loop, while a pupil in a classroom may wear a neck loop that will pick up the teacher's voice, transmitted from a microphone. There are also Microsoft Accessibility Options that provide SoundSentry and ShowSounds features for people with hearing impairment using a PC, and these give visual signals instead of the usual computer bleeps which indicate error messages.

Computer Generated Speech: This may allow non-verbal pupil or a pupil with a speech impairment to become an active participant rather than a passive listener. Where pupils have reasonable hand function, computer generated speech can be used and there are many software options available for this (e.g. TextHelp and Write:OutLoud). Also specialised literacy software, such as Clicker, will have voice output. Also LightWriter range of devices are small, portable appliance that pupils can carry with them to give messages. The message is typed in by the user and displayed on a small monitor. Voice output is also available. Where the pupil with speech difficulty also has significant physical impairment, more advanced communication technologies will have to be used, such as DEC TALK, Cameleon and DynaVox.

Adaptive Technology for Care

An ageing population means increased demands for elder care, which can range from extensive medical needs to day-to-day assistance. There are a range of AT solutions that can provide an improvement in the quality of life of the elderly. AT solutions such as Artificial Intelligence and Robots have recently started to appear. A vision of robotic helpers in this space is no longer seen as a futuristic remove as it becomes a present-day reality [4].

Artificial Intelligence and Robots: Currently, the social robots that are beyond trials and prototyping are little more than simplistic companion devices, such as Paro, the fluffy, therapeutic robot seal. Also, “Stevie the AI Robot” made fame recently by helping residents stay socially connected with family & friends. Stevie also aims to keep residents cognitively stimulated with quizzes and games and he enables staff to respond faster and make better decisions [5].

Smart Devices with Social Media: Furthermore, Facebook has worked with the health providers to provide Portal smart camera devices to thousands of aged care residents as a means to keep them connected to family and friends amid the COVID-19 pandemic [6].

In addition to these high profile and advanced solutions there are some “low scale” AT solutions that can have great benefits in health care [7]. For example, in the case of Dementia and Alzheimer’s the following AT solutions can have benefits:

Stand Alone Devices: Stand Alone devices can be bought off the shelf. They can be something simple like a clock or something more complicated like an automatic pill dispenser that will send a text to a carer if medication is not taken. These products are not linked up to a monitoring centre.

Telecare devices: Telecare devices can only be used as part of the Telecare system. There are various companies providing Telecare in Ireland. They charge a fee for providing a base unit and sensors and a monthly monitoring fee. Telecare sensors are placed around the home depending on each individual’s needs. When a sensor is triggered it sends a signal to the base unit (which is connected to a landline or mobile telephone) which in turn goes to the monitoring centre or a carer.

Case Study for Student with Visual Impairment in a Leaving Cert Computer Science Class:

Samantha is a 6th year student who is taking Computer Science as one of her option subjects. The school is a one-to-one iPad school which meant that students were already comfortable with Technology Enhanced Learning. However, Samantha has a visual impairment which can affect her ability to see small text in print and on screen. Her school designed a solution involving Adaptive Technology and streamlined processes and procedures. The Adaptive Technology Solution was put in place to allow Samantha to successfully participate in the LCCS class.

- The student was given a high spec laptop (via the NCB) with SSD and 8GB RAM that boots up quickly
- A Screen magnifier tool was installed - the laptop has the Zoomtext package – it was expensive but good
- Procedures were put in place to take care of the laptop and bring it to and from class
- Where possible, all slides were pre-prepared and exported as pdf and distributed prior to the class
- An Online Learning Environment was used (such as Google classroom) for all assignments and the expected deliverables/homework were clearly state
- PC management software was used (Veyon) that allows the teacher to mirror their PC to everyone's screen. This avoided the need to use the projector.
- Consistency of tools/programs is important. So the class used Thonny for all programming python. Glitch.com for html, CSS, etc. Replits were coding homework.
- An online system was used for coding homework (e.g. Replits). The self-correcting exercises where practical.
- All handouts/exams scripts were copied to A3 size (where possible).
- Careful consideration was put into pairing up people into project teams for practical work. This often brought benefits to the whole team due to the student’s unique skills and insight.

Ethical Consideration of Adaptive Technologies

It is important to think carefully about the pros and cons of any potential solution whether it be technological or otherwise. For example, you need to consider the following questions.

- How does it affect the privacy or freedom of the person?
- Is the person involved in the consent process?
- Is it being considered as an option to cut back on costs and therefore “more economical?”
- Does it disempower the person by fear or misunderstanding?
- Does it only consider the risk and difficulties of other people rather than the needs of the person with special needs?

Reference Information

[1] examples of AT from : https://www.sess.ie/resources/assistive-technology-overview

[2] definition of AT from : https://hiehelpcenter.org/treatment/assistive-adaptive-technologies/

[3] categories of AT from: http://www.assistivetechnologyguide.co.uk/guides/definitions-and-categories-of-at/?LMCL=QJTRDf

[4] Care Homes from : https://www.siliconrepublic.com/machines/stevie-robot-elder-care-niamh-donnelly

[5] Stevie the Robot: https://stevietherobot.com/

[6] FB in Care Homes; https://www.wired.co.uk/article/facebook-portals-in-uk-carehomes

[7] Living with Dementia: http://livingwellwithdementia.ie/assistive-technology/

Sample Exam Questions:

(1) Explain what Adaptive Technologies could be put in place for a student with special needs .

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(2) Describe 2 adaptive technologies that can improve the lives of elderly people with special needs.

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(3) What Ethical Considerations are important when considering using Adaptive Technologies?

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