ICT use with MDVI learners:

special considerations

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Types of ICT implemented in the education of MDVI pupils

Assistive technologies for pupils with MDVI can be divided into three categories:

1. INPUT devices (adapted and alternative keyboards, track-ball mice, touch-screens, overlay keyboards and switches): Methods of giving the computer commands and inputting information.

2. OUTPUT devices (speech and audio output, tactile displays, monitors and Braille embossers): Methods of relaying the computer's response to the user in an accessible format.

3. SPECIAL SOFTWARE: Educational and recreational activities that can be accessed using input and output devices.

A further important distinction can be made between the mediums of technology i.e. a desktop computer, a portable device and new innovative alternatives. Lastly, it is important to give consideration to the ergonomics of the classroom setting.

1. INPUT DEVICES

Alternative Keyboards and Mice

There are various reasons why a standard keyboard and mouse might be inaccessible to a child with complex needs: the child's motor skills, visual impairment and underlying learning disability are all factors to be considered when deciding whether an alternative keyboard and mouse might be appropriate.

If it is possible for the pupil to use a keyboard as opposed to switches or a touch-screen the benefit is access to a wider range of computer input. The majority of children with moderate to severe learning difficulties are unable to make use of the full key-range on a keyboard, although with the use of tactile markers, a given number of keys can be learned and used, such as the SPACE, TAB, ENTER and ARROW keys.

Children with some level of residual vision might benefit from a high-contrast keyboard or a standard keyboard adapted with high contrast stickers. Keyboards with larger keys can also be helpful to learners with poor motor skills. A keyboard can be chosen with the QWERTY key configuration or an alphabetic configuration to make it easier for the pupil to find and remember the key layout.

The computer can also be configured to aid keyboard use. Pupils who tend to press too hard and too long on a given key can benefit from the filterkey setting whereby sustained presses only result in a single key input. The stickeykeys setting can be beneficial to those who are only able to press one key at a time as it enables sequential key presses to serve as simultaneous inputs.

Although computer mice are inappropriate for non-screen users, we find that many pupils with low vision enjoy the freedom of movement provided by a mouse interface. Adapted track-ball mice with large high contrast buttons, such as the BIGtrack, have been used successfully by our partially sighted learners.

The computer can be configured to improve the visibility of the mouse cursor on the screen. Most operating systems enable the customisation of cursor size and colour, toggling on/off of cursor trail, and adapting the speed and sensitivity of mouse movements. Separate software is also available to further customise the cursor (for an extra-large cursor size) and to help the user to keep track of the cursor on the screen.

Overlay keyboards

Another alternative to standard keyboards are overlay keyboards, such as Intellikeys. The keyboard is in the form of a touch-sensitive 'tablet' onto which a tactile-visual overlay can be attached. The tablet is connected directly to the computer and different key functions are assigned to specific regions of the surface. The entire surface is divided into a grid and any area of the grid can be programmed to trigger specific keystrokes, key combinations or complex computer operations, such as the playing of a media file. The overlays can be produced using a Braille embosser, swell paper or with the use of other tactile materials, such as foam and cloth. The tactile markings identify to the user the regions of the surface that activate the various key functions. Different overlays can be produced for different learners and different computer activities, ranging from simple two- or three-button overlays to complex arrangements of buttons and functions.

The specific benefits of overlay keyboards include child-centred customisability and a richly tactile user-interface. Tactile materials can be chosen that the individual child feels

comfortable touching. Some learners with autistic spectrum disorders have particular problems with tactile hypersensitivity and prefer to touch soft materials. Overlays provide a valuable alternative when the surfaces of a standard keyboard and mouse are intolerable for the child.

Touch-screens

When residual vision is sufficient, a touch-screen interface provides the most intuitive form of computer-input. The child can interact directly with objects on the screen by reaching out and touching them. The obvious pre-cursors for effective touch-screen use are good hand-to-eye co-ordination and sufficient sight to accurately locate objects visually on the screen. The computer can be configured so that a single-press to the screen triggers a double mouse-click.

A useful alternative to the standard monitor-sized touch-screens is a large multi-touch plasma screen, which can be adjusted in height for wheel-chair users and young children and is large enough to be used in group activities. Graphics are presented in a far larger format while maintaining a high quality image.

Switches

Switch access is a method used by many of our pupils, both partially sighted and blind. Switches come in all shapes and sizes, from those operated through the press of a hand or finger to foot, eye and head operated switches. The switch method selected and the number of switches to be used for a given child will depend on her level of mobility and co-ordination as well as her underlying learning difficulties. The mounting of the switch in relation to the learner also needs careful consideration, especially when the individual has impaired motor skills such as cerebral palsy.

Switches can be used to directly replace the left and/or right mouse-click button or they can be programmed to carry out other computer actions. Switch actions can be programmed using generic interface control software, which is installed on the computer before the switch-operated software is installed. Few switches will connect directly into the sockets on the back of the computer. You will first need to plug the switches into an interface device, which in turn is connected to the computer.

Switch Colour and Texture

With partially sighted users it is important that there is a good level of contrast between the switch and the surface onto which it is placed. Some switches have detachable transparent covers. Different tactile materials can be attached to these covers to distinguish one switch from another for multiple-switch users. Attaching an adapted switch cover can be a quick way of setting up a switch for the sensory needs of a given user, such as those with tactile hypersensitivity.

Switch positioning and push-click sensitivity

A number of devices are available to aid in the positioning of switches. Switches can be placed on a table top or can be held in position by a flexible ‘arm’ or stand. Velcro is a good way of keeping switches in place, particularly when the child has problems with involuntary movement and could accidentally knock the switch out of position. Switches range in their level of sensitivity. Some switches can be adjusted for different users i.e. the button-click sensitivity can be reduced or increased.

Switch Tapping and Banging

A problem sometimes encountered with switch use is the tendency for the child to repeatedly and indiscriminately press or hit the switch. This problem can have several causes.

It is possible that he does not fully understand the function of the switch i.e. that his pressing of the switch is causing an on-screen or auditory effect from the computer. Before the switch can be used effectively in activities, the pupil needs to grasp the relationship between a switch-press and the resulting effect. Different switch skill development software as well as non-computer based activities can be used to help the individual grasp the cause-and-effect relationship.

Using a two-switch set-up (if possible), it is easy to ascertain whether the child has grasped the concept of cause-and-effect. One switch is set up to trigger a reaction (reward) while the other switch is unplugged and causes no response when pressed. If the child repeatedly presses the unplugged switch, we can infer that they have not yet made the connection.

Another possibility is that the learner is unmotivated or uninterested in the activity. A change of activity can help. A good option is to try software which allows you to use material personal to the client e.g. where the switch triggers a film or audio file of him or his family or of a personal interest.

Finally, a common problem is that the child is reacting to the tactile and auditory feedback from pressing the switch itself. Using a touch-sensitive pad in place of a click-press switch can help to solve this problem. Another option is to explore software where the switch has to be held down for a given length of time to achieve the desired response.

Children with Restricted Movement

Some children with MDVI have the additional challenge of severely restricted movement and/or poor motor control. With these pupils special provisions need to be made when assessing the best form of input device. The key to a successful assessment is identifying a reliable, repeatable and consistent movement that the child can make comfortably to activate an input. Repeated assessments might be necessary to accommodate the changing needs of individuals with fluctuating conditions or progressive illness.

2. OUTPUT DEVICES

Speakers and Headsets

Before beginning a computer activity with a learner it is important to check that the volume of the speakers or headset is comfortable. Some children are particularly sensitive to loud and sudden sounds.

From our experience many of our pupils are uncomfortable using headsets and favour a pair of speakers. Obviously, in a room with several workstations the sound level can soon escalate. Ensuring ample room between each pupil and limiting the number of individuals per session will minimise the amount of distraction.

When headsets are used, it can be helpful, via a headset splitter, to connect a second headset so that the teacher or therapist can follow the activity. This is especially pertinent when the child is using software without a graphical interface.

Monitors

As already mentioned in relation to touch-screens, the positioning of the screen is crucial. A partially sighted child needs to be able to use his or her remaining vision optimally to access the screen. Pupils should be seated comfortably without having to strain to see what is on the screen. Adjustable screens and height-adjustable computer desks can be used to adapt the workstation. Software should be screen-filling (maximised) when in use and the screen resolution can be reduced. Screen-enlargement software is rarely an option for pupils with an MDVI because they have difficulty understanding that only part of the screen is visible at any given moment. We therefore make use of the low vision options integrated into the special software itself (where available) and adjust resolution, contrast and brightness settings on the monitor and computer.

CLASSROOM ERGONOMICS

In the classroom situation there are several areas that need to be carefully considered. There should be ample space between each learner, so that teachers and teaching assistants can sit and work with each child individually and so that one child does not distract another. The lighting level in the room should be customisable to the child's needs (i.e. good overhead lighting and blinds to block out bright sun-light). Each learner should be positioned comfortably behind the computer, with good posture and comfortable access to input and output devices. Mounting input devices, adjustable desks and computer screens attached to extending arms can be used to aid access to wheel-chair users and children with impaired mobility.

3. SPECIAL SOFTWARE

Types of software

Special software used with children with MDVI can be grouped as followed:

- Adaptive/assistive software: Software used to adapt an interface so that it is suitable for a user with special requirements.
- Educational software for children with intellectual disabilities: Software specifically developed for learners with a range of learning disabilities, such as
    - Mouse skill development
    - Switch skill development
    - Cause and effect association
    - Decision-making
    - Language and numeracy competence
- Visual training: Software to encourage visually impaired children to develop and use their residual vision.
- Computer games: Visual or audio based games accessible via multiple input devices and appropriate to learners with intellectual disabilities.
- E-books: Sound and picture books activated by a switch or touch-screen.
- E-community interfaces: On-line communities for users with MDVI where information can be accessed/shared and users can communicate on-line.
- Customised desktop interface: Simplified customised desktop interfaces where the child can easily access the software she uses.
- Communication aids: Software used to aid communication (digital symbol systems and on-line accessible e-mail and chat clients).
- Software for teachers to develop learning materials for children with MDVI: Content management systems where the teachers themselves can create content (e-books or learning exercises) for their pupils.
- Software to aid communication between teachers and parents of children with MDVI: Information-sharing platforms where various professionals working with the child can post and access information on the child's progress and communicate learning goals effectively with the parents.

General guidelines for software accessibility

Before considering each type of special software in more detail, some basic general guidelines apply to all types of software used directly with pupils with MDVI.

1. The software has to be compatible with the accessibility settings on the computer i.e. it should run at the chosen screen resolution and with the selected mouse cursor settings. It should also run in full-screen (maximised) mode.

2. The following factors may be important when assessing the suitability of the programme for students with MDVI:

    - Can the colours/contrast be customised? Is there good contrast of colours?
    - Are the graphics clear and large? Do they have a clear outline? Are groups of images clearly set apart from one another?
    - How busy is the visual layout? Is the information well spaced and is there consistency in the layout from the one screen to the next?
    - When images are used, is it possible to customise them (for example to replace pictures with photographs, if these are more easily recognised by the learner)?
    - When an activity is time-limited, is it possible to adjust the time in which the activity has to be completed?
    - Are images supported by audio instructions and feedback? Is it possible to use the software without using the screen? To what extent is the visual content essential?
    - Are there a lot of moving graphics? Unnecessary movement could be distracting for the user.
    - Is written information supported with graphics and audio instruction?
    - How complicated are the instructions? Is it possible to adapt the complexity/difficulty of the activities?
    - Which forms of user input does the software support, i.e. switch-access, touch-screen, keyboard etc.
    - To what extent will the pupil be able to access the program independently? How much assistance will he need?
    - Is there background music? If so, can this be toggled on/off?
    - Can the pupil progress be logged and saved from the one session to the next?
    - Can the teacher created customised settings for individual pupils which can be quickly loaded when the program is started up?
    - How user-friendly is the software for the teacher i.e. how complicated is it to customise the software for the target group?

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