Module 10 – AT for Cognitive and Learning Difficulties

This course entitled "Foundation in Assistive Technology " was prepared and designed by Mada Center, Qatar.

Course Outline

- Learning Objectives / Outcomes
- Introduction to Cognitive and Learning Difficulties
- Types of Learning Disabilities
- AT Support for Reading and Writing Difficulties
- AT support for Reading
- AT support for Writing
- AT support for Math
- AT support for study and Organization
- AT Assessment for Learning Difficulties
- Universal Design for Learning
- Universal Design in Education UDE
- Learning activities/ Instructional strategies
- Resources and additional materials

Learning Objectives / Outcomes

- Be familiar with Cognitive and Learning Difficulties
- Be familiar with the AT assessment for learning difficulties.
- Learn about AT support for literacy, Dyslexia, Math or STEM and Study and Organization
- Know how to support students' access to their curriculum.
- Be familiar with the Universal Design for Learning

Introduction to Cognitive and Learning Difficulties

Cognitive disability (also known as intellectual disability) is a term describing a person who has greater difficulty with mental tasks than the average person. Cognitive disabilities are by far the most common type of disability.

Most cognitive disabilities are rooted in biology or physiology. The connection between biology and mental processes is most apparent in cases of traumatic brain injury and genetic disorders. Still, even the more subtle cognitive disabilities stem from brain structure or chemistry. This can happen before a child is born or during childhood. For many children, the cause of their intellectual disability is not known.

The level of impairment ranges in severity for each person. Some of the early signs can include:

- Delays in reaching or failure to achieve milestones in motor skills development (sitting, crawling, walking)
- Slowness in learning to talk or continued difficulties with speech and language skills after starting to talk.
- Difficulty with self-help and self-care skills (e.g., getting dressed, washing, and feeding themselves)
- Poor planning or problem-solving abilities
- Behavioral and social problems
- Failure to grow intellectually or continued infant childlike behavior.
- Problems keeping up in school.
- Failure to adapt or adjust to new situations.
- Difficulty understanding and following social rules.

People with profound cognitive disabilities need assistance with nearly every aspect of daily living. Someone with a minor cognitive disability, however, may be able to function adequately, even to the extent that the disability is never diagnosed.

Cognitive disabilities can be thought of in functional or clinical terms. Clinical diagnoses include autism, Down syndrome, traumatic brain injury (TBI), and

dementia. Less severe cognitive conditions include attention deficit disorder (ADD), dyslexia (difficulty reading), dyscalculia (difficulty with math), and learning disabilities in general.

1.1 How will this affect the child?

Children with intellectual disabilities may take longer to learn to speak, walk, and care for personal needs such as dressing or eating. They are likely to have trouble learning in school. They will know, but it will take them longer.

Students with intellectual disabilities are often eligible for special education support. A child with a cognitive impairment can do well in school but will likely need supplementary aids and services. Students with intellectual disabilities must be involved in the general education curriculum. It's the same curriculum learned by those without disabilities but with some accommodations and modifications.

Learning disabilities are due to genetic and/or neurobiological factors that alter brain functioning in a manner which affects one or more cognitive processes related to learning. These processing problems can interfere with learning basic skills such as reading, writing and/or math. They can also interfere with higher-level skills such as organization, time planning, abstract reasoning, long or short-term memory and attention. It is essential to realize that learning disabilities can affect an individual's life beyond academics and can impact relationships with family, friends and in the workplace.

Since difficulties with reading, writing and/or math are recognizable problems during the school years, the signs and symptoms of learning disabilities are most often diagnosed. However, some individuals do not receive an evaluation until they are in post-secondary education or adults in the workforce. Other individuals with learning disabilities may never receive an evaluation and go through life, never knowing why they have difficulties with academics and why they may be having problems in their jobs or relationships with family and friends.

Learning disabilities should not be confused with learning problems, which are primarily the result of visual, hearing, or motor handicaps; intellectual disability; emotional disturbance; or environmental, cultural, or economic disadvantages.

Generally speaking, people with learning disabilities have average or above-average intelligence. There often appears to be a gap between the individual's potential and actual achievement. This is why learning disabilities are referred to as "hidden disabilities": the person looks perfectly "normal" and seems to be a very bright and intelligent person yet may be unable to demonstrate the skill level expected from someone of a similar age.

A learning disability cannot be cured or fixed; it is a lifelong challenge. However, with appropriate support and intervention, people with learning disabilities can achieve success in school, at work, in relationships, and the community.

Types of Learning Disabilities

Specific Learning Difficulties (SpLD)

Specific Learning Difficulties (SpLD) is an umbrella term which emphasizes the differences that students display across their learning. Students with SpLD may have difficulty learning to read, write, spell, or manipulate numbers, so their performance in these areas is below that in other areas. Students may also have difficulties with short-term memory, organizational skills, visual processing, and coordination. Students with SpLD cover the whole ability range, and the severity of their impairment varies widely. The difference between 'Learning Difficulties' and 'Specific Learning Difficulties' is that the term 'Learning Difficulties' is generally applied to people with global (as opposed to specific) difficulties, indicating an overall impairment of intellect and function. Examples of specific learning difficulties are Dyslexia, Dyspraxia/DCD, and Dyscalculia.

Dyslexia

Dyslexia is manifested in a continuum of specific learning difficulties. It is a learning difficulty that primarily affects the skills involved in accurate and fluent word reading and spelling.

• Characteristic features of dyslexia are difficulties in phonological awareness, verbal memory, and verbal processing speed.

• Dyslexia occurs across the range of intellectual abilities.

• It is best considered a continuum, not a distinct category, with no clear cut-off points.

• Co-occurring difficulties may be seen in aspects of language, motor coordination, mental calculation, concentration, and personal organization, but these are not, by themselves, markers of dyslexia.

• A good indication of the severity and persistence of dyslexic difficulties can be gained by examining how the individual responds or has responded to well-founded intervention.' In addition to these characteristics, the BDA acknowledges the visual and auditory processing difficulties that some individuals with dyslexia can experience and points out that dyslexic readers can show a combination of abilities and challenges that affect the learning process. Some also have strengths in other areas, such as design, problem-solving, creative skills, interactive skills, and oral skills. Students may have difficulties in concentration and organization and in remembering sequences of words. They may mispronounce common words or reverse letters and sounds in words.

Dyscalculia

Dyscalculia: is a difficulty understanding math concepts and symbols. It is characterized by an inability to understand simple number concepts and to master basic numeracy skills. There are likely to be difficulties dealing with numbers at elementary levels; this includes learning number facts and

procedures, telling the time, timekeeping, and understanding quantity, prices, and money.

Dysgraphia:

Dysgraphia is a learning disability which involves impaired ability to produce legible and automatic letter writing and often numeral writing, the latter of which may interfere with math. Dysgraphia is rooted in difficulty with storing and automatically retrieving letters and numerals. Individuals with dysgraphia often have problems with Executive Functions (e.g., planning and organizing).

Attention Deficit and Hyperactivity Disorder

A disorder that includes difficulty staying focused and paying attention, difficulty controlling behavior and hyperactivity. Although ADHD is not considered a learning disability, research indicates that 30–50 per cent of children with ADHD also have a specific learning disability and that the two conditions can interact to make learning extremely challenging.

Attention Deficit Hyperactivity Disorder is a condition that becomes apparent in some children in the preschool and early school years. It is hard for these children to control their behavior and/or pay attention.

Dyspraxia

Dyspraxia, a form of developmental coordination disorder (DCD), is a common disorder affecting fine and/or gross motor coordination in children and adults. While DCD is often regarded as an umbrella term to cover motor coordination difficulties, dyspraxia refers to those people who have additional problems planning, organizing, and carrying out movements in the correct order in everyday situations. Dyspraxia can also affect articulation and speech, perception and thought. Although Dyspraxia may occur in isolation, it frequently coexists with other conditions such as Attention Deficit Hyperactive Disorder

(ADHD), Dyslexia, language disorders and social, emotional, and behavioral impairments.

Executive Functioning

An inefficiency in the cognitive management systems of the brain that affects a variety of neuropsychological processes such as planning, organization, strategizing, paying attention to and remembering details, and managing time and space. Although not a learning disability, different patterns of weakness in executive functioning are almost always seen in the learning profiles of individuals who have specific learning disabilities or ADHD.

AT Support for Reading and Writing Difficulties

Dyslexia and other learning difficulties conditions do not cover all the reasons why a person may have difficulty with reading and writing.
There are many reasons students do not acquire the learned skills of reading and writing, due to difficulties accessing schools and curriculums and having other disabilities that impact their ability to learn.

Assistive technology can provide support in many ways. If a student has a general learning difficulty in acquiring the skills required for reading and writing, they will need a way to access information in an alternative format. Some of the solutions suggested are:
- text readers with highlighting
- the use of a thesaurus and dictionary helps check meaning and alternative words
- the use of symbols to give pictorial support to extracting information from text
- for students who are non-verbal, the use of a communication device with a keyboard and labels on all pictures
- Exposure to eBooks and audiobooks

AT support for Reading:

<u>Using a Keyboard:</u>
- Touch Typing: Motor plans for certain words can be learnt, and finding letters on the keyboard can be assisted by using options such as keyboard stickers.
- Easier to read: Text is legible, consistent and looks good. Size, color, and font can be changed and personalized to the user's requirements. Some software can assist with readback, such as using screen tinting to focus on the current line of text being read and text readers, which will read aloud text. Usually with highlighting.
- Easier to write: Using a word processor will reduce the need to focus on lower-level skills such as page orientation.
- Easier editing: Using a computer or tablet means that text can be more easily edited. Spellings can be easily corrected using spellcheckers and specialist software. Words can be changed without having to rub and rewrite, and sentences and paragraphs can be moved easily.
- Forming letters: It is physically easier to press a key than to write a letter using a pen or pencil. When using a computer, a letter key is pressed, taking away some fine motor skills involved, using recognition rather than recall finding the letter and reducing the need to focus on letter size, orientation, etc.…
- Recognition rather than recall: It is much easier to recognize a letter on the keyboard than have to recall its size, shape and orientation to handwrite it. Learning to touch type can also help. Evidence suggests that learning a pattern of letters can be useful (learning a finger pattern to distinguish "saw" from "was" or the letters "P, B, Q, D."

<u>Using Word Processing:</u>

- Fonts-Serif: Using sans-serifed fonts is usually recommended, as these are seen as being clearer (Comic Sans, Arial, Helvetica...)
- Fonts-Proportional Typefaces: Portion fonts are usually considered more straightforward to read. For some people, nonproportional fonts may make it difficult to determine where one-word starts and ends, as space between letters can vary widely.
- Spacing within Text: Using double spacing routinely instead of single spacing within paragraphs can help people with literacy difficulties as it makes it easier to track where they are on a page.
- Increasing text size: Text size can be increased by simply using the feature within the font tabs. Accessibility guides recommend at least a 12-point font.

Inbuilt supports:
- Spellcheckers and Grammar Checkers: Most word processors will assist in helping the user choose the correct word, such as producing a list of alternatives when the word is highlighted.
- Autocorrect: Some word processors will also include the feature of Autocorrect. This allows for the automatic changing of frequently misspelt words. Autocorrect dictionaries can be personalized for individual needs and can also be used for abbreviation expansion.
- Color schemes: High contrast color schemes can also help in text readback.
- Audio recording Speech: This is a quick way to make notes without writing.

Specialized Software:
They provide additional features to support people with Dyslexia.
- Spellcheckers: They have additional features within specialist software not found within the built-in word-processing packages (Grammarly)
- Thesaurus: They provide variety to language used as well as finding more words or vocabulary and looking for opposites of words.
- Word Prediction: To assist with spelling and to increase typing speed. Words are predicted after the first letter or two have been typed and will have suggestions based on the history of the words used in the past or on

the topic being written or predicting words based on the context of the sentence (text help)
- Word banks: They provide vocabulary to be used within the written task arranged by alphabetical order or by topic (Clicker)

Speech Recognition:

It is suggested to overcome difficulties in written language expression for dyslexic students. But it should not be a stand-alone solution for someone with dyslexia, and they may require support on ensuring that what is transcribed is what they intended, but saving the audio file may also be a good backup so that the teacher or lecturer can hear what was intended rather than what ended up on paper.

Reading Support:
- Text to speech Reader: It can be used to read aloud text for individuals who can understand what they hear but have difficulty reading it. Most software will allow you to choose a different voice, select the speech rate, and highlight words as they are being read.
- Talking Dictionaries: As well as being used to look up the spelling of words, dictionaries can give understanding to language read. Words can be looked up, the definition read aloud, or picture support can be used.
- Screen tinting: The whole screen can be tinted in color, or alternatively, the line of text being read can be tinted solely. This may help track the current line being read, as well as prevent losing the current place in the document.
- Scanning pens: A scanning pen or reading pen is a device about the size of a highlighter. It uses optical character recognition or OCR (Optical Character Recognition) technology to take pictures of written text and turn it into digital text. Users can edit, translate, or have the text read aloud based on the scanner software behind the pen.

When choosing a software package for a person with literacy difficulties, it is essential to know where problems lie. This information is a requirement when selecting the most appropriate solutions. For some, it may be a simple text

reader; others may need more support. Most students will be aware of their difficulties and, with trials, can tell if a solution will work or not for their needs.

AT support for Writing:

- Alternative Pencils: Designed for students who cannot hold a traditional pencil or physically manipulate a keyboard.
- Adaptive keyboard
- Keyboard size, hand/finger space, key size, color coding
- Slant boards, positioning supports, magnetic letters, and pointers.
- Pencil grips, stylus, adapted stylus.
- Dictation
- Word prediction
- Spell check
- Grammar check
- Dictionary
- Thesaurus

AT support for Math

- Talking calculators: To make it accessible, two modifications have been made: large keys and talking options.
- Simple Maths (Excel, Twinkl, Panther...)
- Maths Drill Software (Numbershark, Splash!, SushiMonster, IXL.com...)
- Maths Notations software can benefit students who have difficulty with fine motor skills or those with visual perceptual and spatial awareness difficulties (MathMAgic, MathType, Maple, MathJax, LaTex...)
- Graphic tools to output graphs in 2D and 3D formats (Geogebra, Desmos, Math42...)

AT support for study and Organization

- Notetaking: OneNote/Evernote allows one to type or handwrite notes on pages, ensuring that all messages can be filed in a manner that suits the student. Tagging notes to make them easier to find. Notices can be made in several formats (Tables, Images, screen clippings, photos, audio, and videos). Also, the possibility to underline, highlight and draw.
- Live scribe pen: allowing audio recording of a class or lecture synchronized to written notes.
- Audio NoteTaker: to audio record and visually represent the sound as blocks that can be color-coded, moved, deleted, etc....
- MindMapping: it is a diagram to represent ideas, tasks, words, and items and then link them and arrange them. It can also help to summarize large amounts of information in a single page using color, imagery, and arrows to support visual learners (XMind, MindMeister, FreeMind, Coggle. it, Mindomo, Mind42...)
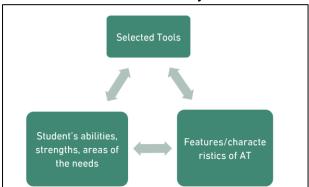
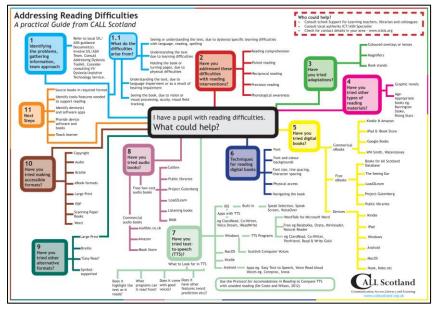# AT Assessment for Learning Difficulties

AT Evaluation Process:
1. Initiate the AT Decision-Making process.
   - AT Consideration
   - Simply discuss the needs of AT
2. Identify the Team
   - Student
   - Family
   - Teacher
   - Related Service Professional
   - Physician, nurse
   - School Administration
   - School tech coordinators
   - AT specialist
3. Identify students' needs and abilities, environment, and tasks.

Use SETT (Student Environment Task Tools) and WATI (Wisconsin Assistive Technology Initiative) models of assessment discussed in previous modules to identify the student's needs, abilities, environments, and tasks.

4. Feature-match to identify tools.

5. AT Trials and Recommendation

6. Implementation and ongoing assessment support
   - Set short-term and long-term goals
   - Share the responsibilities – i.e., who will facilitate the use of the device, data collection, training, etc.
   - Periodic review
   - Reassessment if necessary

AT Evaluation Protocol & Guide for Reading
- The Bridge Assessment
- Checklist: Developmental Stages of Reading (You for Youth)
- Par Protocol (Denice DeCoste)

Writing Evaluation Protocol & Guide

- Denise DeCoste Writing Protocol
- CTE Adapted pencils to the computer.
- Speech Recognition as AT for writing
- BVSD Assistive Technology Writing Evaluation

Universal Design for Learning

Universal Design Principles

→ **Equitable use.** The design does not disadvantage or stigmatize any group of users.

→ **Flexibility in use.** The design accommodates a wide range of individual preferences and abilities.

→ **Simple and intuitive use.** The use of the design is easy to understand, regardless of the user's experience, knowledge, language skills, or current concentration level.

→ **Perceptible information.** The design communicates necessary information effectively to the user, regardless of ambient conditions or the user's sensory abilities.

→ **Tolerance for error.** The design minimizes hazards and the adverse consequences of accidental or unintended actions.

→ **Low physical effort.** The design can be used efficiently and comfortably and with a minimum of fatigue.

→ **Size and space for approach and use.** Appropriate size and space are provided for approach, reach, manipulation, and use, regardless of the user's body size, posture, or mobility

Universal Design Goals

- **Body Fit** Accommodating a wide range of body sizes and abilities
- **Comfort** Keeping demands within desirable limits of body function and perception
- **Awareness** Ensuring that critical information for use is easily perceived
- **Understanding** Making methods of operation and use intuitive, clear, and unambiguous
- **Wellness** Contributing to health promotion, avoidance of disease, and protection from hazards
- **Wellness** Contributing to health promotion, avoidance of disease, and protection from hazards
- **Social Integration** Treating all groups with dignity and respect
- **Personalization** Incorporating opportunities for choice and the expression of individual preferences
- **Cultural Appropriateness** Respecting and reinforcing cultural values, and the social and environmental contexts of any design project
- The design of products and environments to be Usable by all people, to the greatest extent possible, without the need for adaptation or specialized design.   Ron Mace, 1985)
- Enables and empowers a diverse population by improving human performance, health and wellness, and social participation. (Steinfeld and Maisel, 2012)

Accessible, Usable, and Universal Design

Accessible, usable, and universal design are all approaches to design that can result in products that are easier for everyone to use, including people with disabilities.

Apply to the design of the built environment, customer services, and other products and environments, including information technologies such as hardware, software, multimedia, distance learning courses, websites, curriculum, and instruction.

→ Accessible Design is a design process in which the needs of people with disabilities are specifically considered.
→ Accessibility standards are developed for software, hardware, websites, videos, and other information technology (e.g., the Web Accessibility Initiative)
→ "Effectiveness, efficiency, and satisfaction with which a specified set of users can achieve a specified set of tasks in a particular environment. "(the International Organization for Standardization)
→ Usable Design serves to create products that are easy and efficient to use.
→ Universal Design refers to the design of products and environments to be usable by all people, to the greatest extent possible, without needing adaptation or specialized design. (https://www.washington.edu/doit)
→ Sidewalks with curb cuts and doors that automatically open when a person moves near them are examples of universally designed products.
→ People with disabilities, parents with baby strollers, delivery workers, and others can primarily benefit from such products.
→ Human characteristics considered in universal designs may include age, gender, stature, race/ethnicity, culture, native language and learning preference.

Universal Design in Education UDE

"Universal design for learning (UDL) is a framework to improve and optimize teaching and learning for all people based on scientific insights into how humans learn."

− Considers people's diverse characteristics in the design of all educational products and environments at all education levels. These include:
  ↘ computers, educational software.
  ↘ websites, educational content, textbooks, assessment.
  ↘ curriculum and instruction.

      ↘ Educational technologies, teaching as learning services

      ↘ computer and science labs.

      ↘ Classrooms, libraries, and other student services.

− Three sets of principles for UDE: UD, WCAG (Web Content Accessibility Guidelines) and UDL.

Universal Design for Learning:

→ Classrooms are highly diverse, and curriculum needs to be designed from the start to meet this diversity. Research shows that the way people learn is as unique as their fingerprints.

→ Universal Design for Learning is an approach to curriculum that minimizes barriers and maximizes learning for all students.

→ By "Universal", we mean a curriculum that can be used and understood by everyone. Each learner in a classroom brings their own background, strengths, needs, and interests.

→ The curriculum should provide genuine learning opportunities for every student.

Universal Design for **Learning**:

→ Learning is not one thing.

→ Neuroscience tells us that our brains have three broad networks,

→ one for recognition (The "What" of learning),

→ one for skills and strategies (The "How" of learning)

→ and one for caring and prioritizing (The "Why" of education).

→ Students need to gain knowledge, skills, and enthusiasm for learning, and a curriculum needs to help them do all three. But every learner is unique, and one size does not fit all. So how do we make a curriculum that challenges and engages diverse learners?

Universal **Design** for Learning:

→ This is where the word "Design" comes in.

→ A "Universally designed" building is planned to be flexible and to accommodate all kinds of users - with and without disabilities.

→ It turns out that if you design for those "in the margins," your building works better for everyone. e.g., Curb cuts and ramps are used by people in wheelchairs, people with strollers, and people on bikes.

→ Captioning on TV serves people who are deaf, people learning English, people in gyms etc.

UDL Goals

→ UDL is a framework to guide the design of learning environments that are accessible and challenging for all.

→ The goal of UDL is to support learners to become "expert learners" who are, each in their own way, purposeful and motivated, resourceful, and knowledgeable, and strategic and goal driven.

→ UDL aims to change the design of the environment rather than to change the learner. When environments are intentionally designed to reduce barriers, all learners can engage in rigorous, meaningful learning. ⌶

UDL Guidelines

The Framework:

→ Learning environments should be designed with a deep understanding and appreciation for individual variability. That is a fundamental premise of universal design for learning and the educational systems made with UDL principles in mind.

→ A key element to achieve transformation in education is to personalize it considering:

→ Learner variability is systematic and, to a large degree, predictable.

→ Context, Learner capacities are context dependent.

Misconceptions:

→ Flawed approaches:

– Categorizing learners: kinds of learners belonging to distinct groups (labelling). It distorts learners' experiences, and it implies that learners in categories are different

– Treating every learner as an individual case, addressing each learner on the fly as a unique case is impractical

- Treating learners as separate from their contexts or environments
→ Two primary features to be considered:
- The predictable and systematic variability, and
- The context dependency of learners' characteristics

Meeting the learner variability:
→ Predict specific types and ranges of variability in learners enables us to build corresponding kinds of flexibility into learning tools and experiences
→ In UDL, we build upon the model of the learning brain wherein we consider the learner variability across affective, recognition and strategic networks and design flexibility into the curriculum to meet this variability.
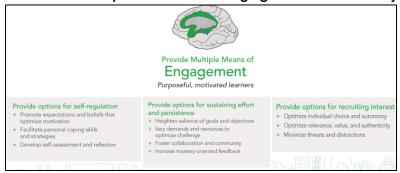
The UDL principles:
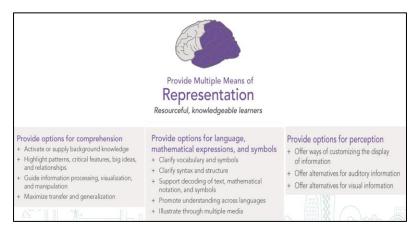The UDL framework benefits from:
- Research into how the brain learners
- Educational research
- Digital technologies

Three UDL principles guide the design, selection, and application of learning tools, methods, and environments:
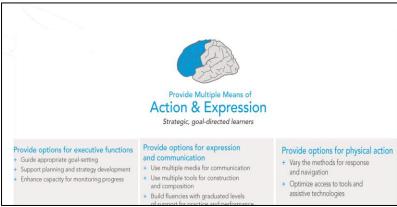→ Provide multiple means of engagement: the "why" of learning:

→ Provide various means of representation: the "what" of learning

→ Provide multiple means of action and expression: the "how" of learning

Means of action and expression

Benefits of UDL:

→ Reduces barriers to learning

→ Providing full access to content to everyone

→ Enable different abilities and learning styles

→ Allow compatibility with a wide range of technologies

→ Increases student engagement

→ Empowers students to be self-directed

→ Helps students to 'show you what they know.'

→ Helps meet Accessibility

→ For all students

Learning activities/ Instructional strategies

- Cases
- Guest speakers
- Readings
- Lecture
- Interactive discussion
- Discussion Board
- Presentations

Assessment Methods

- Reflective Journal
- application cards
- online polling
- dynamic questions

Resources and additional materials

- Center on Technology and Disability (CTD (Center On Technology and Disability)) (ctdinstitute.org)
- http://www.bdadyslexia.org.uk/
- http://www.bridgewater.nhs.uk/haltonsthelens/childrensoccupational therapyservice/
- http://www.dyspraxiafoundation.org.uk/
- http://www.bdadyslexia.org.uk/about-dyslexia/schools-colleges-and-universities/dyscalculia.html
- Enable Ireland