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**Lecture - 39**  
**Learning Disorders**

Hello and welcome back to this lecture series of Cognition and Computation. In this week, we are covering Learning and Memory. And so far you know you have studied about what is learning, and what is memory, what are the different theories of learning and memory.

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## **Learning Disorders**

**Dyslexia Dysgraphia and Dyscalculia**



Today, we are going to talk about a specific kind of learning disability which is a very common phenomenon in today's world. And many of us are familiar with it thanks to the movie [FL]. So, today as you can well understand we are going to talk about specific learning disabilities.

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## What is a Specific Learning Disorder?

- Specific learning disorders are neurodevelopmental disorders that are typically diagnosed in early school-aged children, although may not be recognized until adulthood. They are characterized by a persistent impairment in at least one of three major areas: reading, written expression, and/or math
- 5-15% of school-age children struggle with a learning disability
- Approx 80% with learning disorders have an impairment in reading in particular (commonly referred to as dyslexia). Dyslexia affects male and females equally
- Specific skills that may be affected include word reading accuracy, spelling, grammar, or calculation. In addition, fluency in reading and mathematics may be noted. Difficulties with these skills often cause problems in learning subjects such as history, math, science and social studies and may impact everyday activities and social interactions
- Learning disorders are categorized as mild, moderate and severe. Accommodation and support services align with the severity to facilitate a person's most effective functioning



Now, this has been a problem and its one of the common problem among students and more than 3 to 10 percent of students are affected by learning disorders or I should call it a specific learning disorder. And it is the most common form of neurodevelopmental disorders.

There have been many definitions that have been proposed for this disorder neurodevelopmental disorder, but there is no common consensus on the diagnostic criteria and definitions of ND.

Samuel Kirk in the 1960s defined dyslexia as and it most commonly known as dyslexia. So, this is this implies or rather they are characterized by persistent impairment in at least one of the 3 areas.

So, what are they? Reading expression, reading writing expression and for math. So, mostly we are familiar with this lecture that is people or students or children having problems with reading. And we have seen that approximately 80 percent with learning disorders have an impairment in reading in particular and it affects males and females equally.

So, as I was just talking about it, Samuel Kirk in the 60 defined dyslexia as a kind of learning disability. And define learning disability as an unexpected difficulty in learning,

one or more of the instrumental school abilities. And as you can well understand instrumental school abilities would require reading, writing and doing math.

So, Kirk describe learning disability as a process issue which can affect language and academic performance of people of all ages. This is a misconception that only children have learning disabilities. Many a time actually, because when we go to school and we have to perform on the specific areas, the learning disability becomes highlighted. But there are many adults moving around amongst ourselves with specific learning disabilities.

Now, we have to understand that there is a discrepancy between the estimated between the individual, the students his estimated intellectual potential, and actual level of performance. That this is very very clearly seen in specific learning that.

That means, that when the individual is talking and interacting with others, he might not show a persistent problem in his intellectual ability. But when it comes to academic performance, there is a stark difference between him or her and the colleague and the peers of the same academic group.

And this deficiency, this must be understood that this discrepancy or this deficiency is not secondary to mental retardation; educational or cultural deprivation, severe emotional disturbance or sensory loss. So, the discrepancy that you get to see in the academic performance with the peers is not because of these specific factors.

Now, so coming back to what other specific skills that may be affected. So, you are in dyslexia or in dysgraphia and dyscalculia, what we generally see is a disturbance with word reading accuracy, spelling, grammar or calculation. And in addition fluency in reading and mathematics needs to be noted.

Difficulties with these skills often calls problem as you can well understand specifically in language related areas and mathematical expressions. So, math is a problem area. And we generally in India we see that mathematics becomes a problem once the child starts learning complex functions.

But before that also the it is quite evident even before class 5, but because in India we are till class 5, it is not the restrictions are not as much for you know clearing to the next

grade. It might not, it might go unnoticed as an attention in attention problem and so on and so forth. But generally these children have a problem with understanding the relationship between numbers in mathematics.

Further, problems happen in reading in language related subjects like history and social studies. And also these these academic problems may have an impact on the social interaction with others.

Now, please understand that is not, I repeat not specifically because of intellectual deficiency. Otherwise, the intellectual standard of the student is or the intellectual capacity or ability of the student is equivalent to his theorem. But because of problem because of problems in academics, there may be some developments in the social sphere. Like disturbances in social interactions, problem behaviour, that follows academic issues and so on.

Learning disorders are categorized as mild, moderate, sever. We are going to talk about this a little in detail later.

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### The ICD 10 diagnostic criteria for SLD

The ICD 10 refers to Specific developmental disorders of scholastic skills:

- Conceptually they are disorders of disturbance in the normal pattern of skill acquisition. Not simply a consequence of lack of neither opportunity to learn nor any acquired brain trauma or disease
- Abnormalities in cognitive processing that derive from biological dysfunction
- Clinically significant degree of impairment in specified scholastic skill. Severity can be judged by scholastic terms or developmental precursors (scholastic difficulties were preceded by developmental delays or deviance, most often in speech or language in preschool years) or qualitative abnormalities
- Response– scholastic difficulties do not rapidly and readily remit with increased help at home/school
- Impairment must be specific– not solely explained by mental retardation/lesser impairment to general intelligence
- Impairment must be developmental– early years of schooling and not acquire educational process



So, there as I mentioned the diagnostic criteria is a little confusing. So, or rather I should say that there was no diagnostic criteria priory. But, now we have a criteria that is mentioned in both the diagnostic manuals that we follow generally, one is the international classification of diseases, and I will just show you share with you the 10

how SLDs are seen in the 10th provision of international classification of diseases or ICD detail. And then, we will also see the diagnostic and statistical manual for mental disorders the 5th edition, DSM 5, that is generally followed by America.

So, now coming to the diagnostic criteria, ICD 10 refers to specific developmental disorders of scholastic skills. When it talks about learning disability it, it specifies on this.

And conceptually it says that the disorders of disturbance is a normal pattern of skill acquisition. Not simply a consequence of lack of either neither of lack neither opportunity to learn nor any acquired brain trauma or disease. I just mentioned about this a little before saying that this has this is in no way related to a lack of opportunity or a brain disorder or because of any other nutritional deficiency and cultural lay back or backwardness and so on.

But so, this is a disturbance in the normal pattern of skill acquisition, this is what ICD 10 highlights on. And it says that abnormalities and cognitive processing derive from, they are derived from a biological dysfunction.

Now, it does not very specifically talk about the biological dysfunction in this criteria. Clinically significant degree of impairment in specified scholastic skill. Again, we are coming back to academic specifically.

And severity, thus the impairment severity can be judged by developmental precursors, like earlier what kind of scholastic difficulty was faced by the students, whether there was any developmental delay or deviance from the norm and mostly what I have seen is the how the speech and language development was in the preschool years.

We also look into the milestones, but in this case again we are not looking into the intellectual development. If the if rather I should say if it can be explained via in via intellectual development then that would then we would rule out a specific learning disability.

Now, response in scholastic difficulties do not rapidly and readily relate with increased health at home and school. So, this is again an important point to remember especially when we are talking to patients to family members of students suffering from SLD. If

you are a teacher or if you are a clinician, you must explain this because mostly parents look out for immediate solutions or short ways to you know help the children.

Now, it does not you know remit easily and impairment has to be specific not solely explained by mental retardation lesser impairments of general intelligence. We have already talked about this point. And impairment must be developmental early years of schooling and not acquired later in the educational process.

Now, that if that is that happens, then we will have to look into emotional issues for one of the causes or some sensory deprivation or perhaps brain trauma could be a reason. But if the development of dyslexia or development of any specific learning disabilities at a later age in life, there could be other explanations for it. But for SLD specifically, the development or I should say the impairment in scholastic development should be scholastic skills, should be evident from early childhood.

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### Characterization of impairments:

- The impairments are characterized by Specific reading disorder: Characterized by specific and significant impairment in the developmental of reading skills which are not accounted for mental age, visual acuity problems or inadequate schooling
- Deficits in reading comprehension
- Specific spelling disorder: Characterized by specific and significant impairment in the developmental of spelling skills in the absence of a history of specific reading disorder which is not solely accounted for by low mental age, visual acuity problems or inadequate schooling
- Specific disorder of arithmetic skills: Characterized by specific impairment in arithmetic skills which is not solely explicable because of general retardation or of grossly inadequate schooling
- Mixed disorder of scholastic skills: Characterized ill-defined/inadequately conceptualised but necessary residual category of disorders in which both arithmetical and reading or spelling skills are significantly impaired but in which the disorder is not solely explicable in terms of general mental retardation or inadequate schooling
- Other developmental disorders of scholastic skills: Developmental expressive writing disorder
- Developmental disorder of scholastic skills: Unspecified disorders in which significant learning that cannot be solely accounted for by mental retardation, visual acuity, or inadequate schooling
- Includes: Knowledge acquisition disability NOS; LD NOS; learning disorder NOS.



So, now, ICD in case speaks about the characterization of impairment and here it speaks about impairments as you know specific and significant impairment in the development of reading skills, which are not accounted for by mental aid, visual acuity or inadequate school schooling.

I forgot to mention, we spoke about backwardness, we spoke about inadequate schooling, nutritional issues and so on and so forth, emotion emotional problems. The

visual acuity is another factor. Many times a child develops visual problems in school and cannot see the blackboard.

Many more often than not; and because of a range with specific learning disabilities, students families tend to think and often more often than not even teachers insist that they may be a language, maybe a learning problem with the child. But before diagnosing a child as having SLD we must rule out visual acuity and the other problems that I have spoken about.

So, deficits in the child shows deficits in reading comprehension, child might show deficit in a spelling. So, a specific spelling disorder is generally characterized by significant impairments in spelling skills in the absence of a reading disorder, and which is not again you know accounted for by mental age, low mental age, visual acuity or inadequate schooling.

The child may also show a deficit in arithmetic skill. Now, when we are often talking about deficits in arithmetic, skills deficits in mathematics, as I mentioned, children with this difficulty have a problem with identifying the relationship with the numbers.

So, if they a classic example is even if they learn how to add two numbers together, but you know subtraction is a problem. If they learn multiplication as a form of addition, again division becomes a problem. So, they do not understand and the relationship between the symbols, numbers are symbols.

So, if you can if you teach them with pen as to you know addition with pens or addition with objects, transferring it to the numbers again became becomes a problem. This is a very common feature that we see in young children with dyscalculia.

There is there may be a mixed disorder of scholastic skills which implies inadequately conceptualized you know development in both math arithmetic, reading or spelling skills, and they may be overall impaired. So, it need not be a specific area, but it can be a combination of many areas. And other; they may have a an problem with an expressive writing disorder, it is known as developmental expressive writing disorder. And there may be, it may be unspecified also.

So, where significant disability of learning cannot be fully accounted by any of the other exclusive factors. So, this; so, when we are talking of impairment, the specific areas of impairments are reading comprehension, spelling disorder, arithmetic disorders or a mixed disorder of all the 3 combined. But that cannot be explained by mental retardation, sensory deprivation, visual acuity loss or any other inadequate schooling.

Now, so this is the characterization of impairments as given by ICD. DSM 5 the diagnostic and physical manual for mental disorders by American psychiatric association, specifically uses the term SLD for learning disability. So, it calls it as a specific learning disorder.

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#### DIAGNOSTIC AND STATISTICAL MANUAL OF MENTAL DISORDERS 5 EDITION

- Term used "SLD"
- Difficulties learning and using academic skills indicated by presence of one of the following that have persisted for at least 6 months, despite the provision of interventions that target those difficulties:
  - Slow/inaccurate/effortful reading
  - Difficulty understanding what has been read
  - Difficulty in spelling
  - Difficulty in written expression
  - Difficulty in mastering number sense, number facts, calculations
  - Difficulty with Math reasoning
- The affected academic skills are substantially and quantifiably below those expected for the individual's chronological age (at least 1.5 standard deviation below the population mean for age). Significant interference with academic or occupational performance or with activities of daily living is observed.
- LD is confirmed by means of standardized achievement measures and comprehensive assessment. Learning difficulties start at school years. However, they may not manifest if academics exceed individual capacities.



And it expresses that there are, so the diagnostic criteria tells that if an individual or if a student has difficulties learning and using academic skills indicated by presence of one of the following that have persisted for at least 6 months.

Please understand that this time period is very important for the diagnosis because many times a child, because of some emotional disturbance may show a difficulty in reading or in math or in writing behaviour at an early age of life. But that would not be accounted by specific learning disability.

A change in a class teacher, a teacher with whom I loved to you know interacting and I love learning from, the change in the teacher, may bring about a problem with you know



any specific academic skill like mathematics, but that is not because of dyscalculia. So, we must understand that to control these emotional factors, we need to see that it has followed at least a time period. The problem has persisted for more than 6 months or so.

The affected academic skills are substantially and quantifiably below those expected for the individual chronological age. And this what exactly do we mean by lower than the chronological age? It is at least 1.5 standard deviations below the population mean for that age.

So, the academic performance is substantially below by you know as compared to the chronological age. Along with there should be a significant interference with academic or occupational performance or with activities of daily living and LD is confirmed by means of standard achievement measures and comprehensive clinical assessment. This is required for a diagnosis of LD, and we need to see that these difficulties have started in the early school years.

And however, they may not be manifested you know explicitly before a certain class is reached. As I said, in India, we often do not diagnose, you know SLD before a child has crossed class 2 or class 3. And many times after class 5, we get to see the problems being very very specifically manifested in different areas. Now, when we talk of severity, the diagnostic criteria DSM speaks about severity.

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Current severity:

- **Mild:** some difficulties in one or two academic domains; mild enough and can be compensated or functions well with accommodations/support service especially during school years
- **Moderate:** Marked difficulties one or more academic skills; unlikely to become proficient without intensive teaching during school years, accommodations/supportive services at school/home to complete activities accurately
- **Severe:** Severe difficulties, several academic skills; unlikely to become proficient without ongoing intensive teaching for most of the school years, despite accommodations/supportive services at school/home may not complete activities accurately



Here it talks about mild, moderate, and severe. There could be an individual could be diagnosed with either of these 3 conditions, severity conditions. And mild indicates that there are some difficulties in one or two academic domain, but mild enough and can be compensated or the individual can function well with support, especially remedial classes and so on.

Moderate indicates marked difficulties in one or more academic skills, and unlikely to become proficient without intensive teaching during school years. And it requires accommodations and supportive services, and both school and home situations to for the activities means scholastic activities to be completed accurately.

Severe would imply severe difficulties in several academic skills. In the previous two, it can be one or more, but in severe SLDs you get to see the problem persisting in most of the academic skills. And the individual is unlikely to become sufficient without intensive ongoing continuous intensive teaching for most of the school years, and despite accommodation and support services in school and home.

Now, when we talk of school and home support services, especially the accommodation part, it is important to understand that what we mean by it. So, for management this is very important. For management of the deficits of these disorders. Interventions focus on one accommodation that is to facilitate the students to access educational material.

And this you know maybe provided in different multiple forms through recording through larger font to colour font or maybe on an instructional design platform. And this helps to decrease the cognitive load of the child. This content itself has a load, a cognitive load that may increase the problem of reading. So, this for phonemic reconstruction.

So, the objective is to reduce that complexity for the child. And these as I just mentioned may include pens, highlighter pens, you know gripper, highlighting a text or increasing the font, providing tactile feedback. So, you know the instructional systems that are being used now specifically with assistive technology takes care of tactile stimulation. When a child is writing a letter on a touchpad, if the construction of the letter is wrong, there is a tactile feedback to it.

In fact, I work on a project under, we had a project under the DST, Ministry of Education and we worked on creating an automated device learning for intervention strategies for learning disorders. So, there we tried to use tactile stimulation feedback with tactile stimulation, other than among other things.

The other is for management, what we focus on is modification. And the task and academic expectations from the child are changed. Not as per the scholastic academic demand in school, but there is a change in the delivery content or instructional level of subject matter or test.

So, the child may be allowed to give the test at you know at intervals or you know may focus may be allowed to give a short test. Not look at the question paper in the form that is available to all the other peers, normal subjects, normal students in school, but they may be allowed to speak out loud, you know phonetically express loudly or be given adequate time. So, this is the modification that is followed or you know in the specific learning disabilities.

And remedial education this may is a way to you know assist the child with age appropriate skills in the foundation areas. So, as we have seen that these children are intellectually around 1.5 sd, the below their chronological age group as per the normal age group. So, you know the objective here through remedial education is to bring them up in those skills. So, that they can you know that does not add as a another additional load for the child during comprehension of academic material.

And this intervention especially in remedial education needs to be systematic, well-structured and multi-sensory. So, as I was telling you, that we use tactile stimulation, the more number of sensors you use, the better is the comprehensive as well as the encoding process. So, this helps with the consolidation process.

So, coming back to the e to severity, here we were talking about the accommodation, remedial service, and the modifications that need to be assessed before we give a category of, before we identify the severity. So, these that is why I spoke about the different kinds of management techniques. And now, let get take a look at the psychometric test that I use for SLD.

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## Psychometric testing

Psychometric testing helps in confirmation of diagnosis and in planning the intervention. The psychometric testing usually includes testing for cognitive abilities and testing for academic abilities. Assessment of the child's level of Intelligence by measuring IQ can be done using Standardized IQ tests.

The tests that can be used include

- Binet-Kamat Test
- Malin's Intelligence Scale for Indian Children (MISIC), Wechsler's Intelligence Scale for Children-4 Edition etc.

## Indian Tests:

NIMHANS Index for SLD is the most commonly used battery in the Indian context. Reliability and validity of this tool has been established. It includes the tests in two levels. Level I is for 5-7 years age group and Level II for 8-12 years

Tests in Level I are:	
1. Visuo-motor skills (copying of three geometrical figures)	13. Auditory memory
2. Writing of capital letters	14. Speech/language (both receptive and expressive)
3. Writing of small letters	
4. Writing of an alphabet preceding a specified alphabet	
5. Writing of an alphabet succeeding the specified alphabet	<b>The tests in Level II are:</b>
6. Writing of numbers serially	1. Number cancellation
7. Writing of numbers preceding a specified number	2. Reading of English passages
8. Writing of numbers succeeding a specified number	3. Spelling of English words (including Schonell's 15 words list)
9. Color cancellation test	4. Reading comprehension of English passages
10. Visual discrimination	5.
11. Visual memory	6.
12. Auditory discrimination	



Now, most of the times we need to do an intellect intelligence test. And the tests that are used are generally Binet-Kamat test, Malin's intelligence scale for Indian children; this is mostly for Indian students that I am talking about and Wechsler's scale for intelligence, the Wechsler's intelligence scale for children with.

So, we generally, use this scale for screening that the problem is not you know subserved by intellectual deficiency. The in NIMHANS has come up with an SLD index for SLD and a for the Indian context and reliability of this tool has been established already. So, we can also use this test for an assessment and this test of binding hands includes two levels. So, one is for the 5 to 7 years and age group, and the other is for level two is for 8 to 12 years.

So, understandably, that this if somebody has a learning disability that would be evident by these age group. So, in level 1 that is for the age of 5 to 7 years, what is tested in the NIMHANS test battery is visuo-motor skills writing of capital letters, small letters, alphabets, writing of an alphabet, writing of an alphabet preceding the specified alphabet, letter, or the preceding series of the letter. The writing the numbers serially, writing numbers preceding a specified number, and succeeding a specified number, colour cancellation, visual discrimination, visual memory, auditory discrimination, auditory memory and speech and language both receptive and expressive language.

Now, as you can well understand what we are trying to capture through these test is the area where the problem focus lies. So, whether there is a specific problem in language expression or in reception or in the visuo-motor skills. So, if there is a graphical problem, there may be some problems with visuo-motor skills.

The sequence, whether there is a problem with sequence, SLDs generally have a problem with sequence and relations as I told you. So, you know what is the previous letter, what is the letter for following it, preceding it, similarly with numbers.

So, identifying whether it is restricted to a language or is it also spreading across to mathematics because again these areas are very specific within the brain. So, it may not be the problem, may be incapacitating both these areas or maybe individualized and unique to a specific area.

Colour cancellation because it whether the individual has any problem with colour discrimination, and we look at visual discrimination and visual memory, also auditory discrimination and auditory memory to see, if the impairment is restricted to a modality. This is actually helpful for the management techniques. So, whichever is the stronger ground, we would provide management, you know we will try and explain them that ground and look at the limitations in the weaker area.

For test in level 2, that is for the age group of 8 to 12 years, it is the NIMHANS test package, generally has number cancellation, reading of English passages, spellings of English words, the Schonell's word list of 15 words. The reading comprehension of English passages, arithmetic sub test and BGT or bender gestalt test for visual spatial ability.

Now, so these are generally the psychometric test that I use. But we also need to do a differential diagnosis when we are looking at SLD.

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### DIFFERENTIAL DIAGNOSIS

Prior to diagnosis of SLD, the evaluation should rule out the following conditions as primary causes of poor academic performance:

1. Borderline intelligence
2. Intellectual disability
3. Attention deficit hyperactivity disorder
4. Autism spectrum disorder
5. School absenteeism due to general medical conditions
6. Psychiatric disorders including mood disorders, anxiety disorders, and psychosis
7. Discrepancy between mother tongue and medium of schooling
8. Inadequate facilities for schooling
9. First-generation learners with poor social support
10. Hearing impairment
11. Visual impairment
12. Neurological disorders, for example, myopathy and writer's cramp



Now, if you are a teacher or you are seeing somebody you know in your environment with SLD, with a features of learning disability, please see that you know these could be the other twelve reasons for the individual problem rather than SLD. So, these all need to be ruled out before, actually diagnosing somebody with SLD.

And these include borderline intelligence, intellectual disability, ADHD or attention deficit hyperactivity disorder. This is most prevalent with students having learning disabilities. And it may add to a, it may be comorbid and adding to the problem or it may be the reason for the problem, rather than the learning disability.

Autism spectrum disorder again. School absentees and due to general medical conditions, so if the child has fallen back in comparison to his classmates. Psychiatric disorders including mood disorders, anxiety disorders and psychosis. Very often childhood depression can be a cause for poor scholastic achievement in class and if a child is not disturbing, if a child is not shouting or talking a lot, many times it gets unnoticed.

But the performance the first evidence that something is wrong comes from scholastic performance. And this may be not because of a learning disability, but because of a mood prevalent, mood disorder.

The way we could identify is if whether the problems in academic achievements were they were present even earlier before you know from early childhood, so or it has just develop suddenly. So, this is one feature that we look into.

Discrepancy between mother tongue and medium of schooling. This is a very very common feature. These days especially when parents have to travel because of this global world today, a lot of parents keep transfer getting transferable jobs, keep shifting to different places.

And I have come across personally with many children who do not talk in school. There is an elective mutism in school or the academic performance in the new school suddenly dropped because of the unfamiliarity with the peers, with the teachers, and unfamiliarity with the language even in India also.

So, it is not only that the language spoken is different, but it can also be that the dialect is different. Somebody travelling from the north northern part of India to a southern part of India going towards in English school, the pronunciation and the dialect English dialect is different. And many children have problems with adjustment.

Especially, think about this, we are talking about we are talking of early childhood to late childhood. So, these are children who are very sensitive and they are their familiarity with the teacher, familiarity with the peers, familiarity with the dialects are very important conditions in their learning environment.

We have not spoken about the learning environment per se. If the classroom has changed, it might, just the child might not just wish to study. So, we need to look at these before getting to a diagnosis of SLD.

Inadequate facilities for schooling, first-generation learners with poor social support hearing impairment, visual impairment, and other neurological disorders like myopathy and writer's cramp.

Children many times are not able to express that they cannot write because of the problem of with their muscular movement. So, that may be identified or misidentified as a problem of you know not being able to hold the pen properly or the speed may reduce, the pace of writing may be much lesser as compared.

So, you see when we are dealing with children and when we are dealing with children issues, we need to be very very careful before coming to a diagnosis.

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## SPECIFIC EDUCATIONAL STRATEGIES

For management of SLDs intervention may be classified as:

- Accommodations
- Modification
- Remedial Education

### Reading

**Reading** - In problems of decoding, phonological awareness needs to be increased. Emphasis is paid on phonemes, which is the smallest unit of speech, e.g., k in kit, b in bat. Phonemic awareness includes ability to hear and manipulate individual phonemes.

#### **Phonemic awareness includes activities such as:**

1. **Isolation** - the training is in recognizing the individual sounds in words. (tell me the first sound in the letter hat)
2. **Phoneme identity**: The ability to distinguish the common sound in differing words (tell me the sound that is same in pod and pan)
3. **Phonemic substitution**: Replacing one phoneme for another to create a new word (cat-mat, bad-bat)
4. **Oral segmenting** - able to break the word into c b/a/n)
5. **Oral blending** - joining the sounds to form word



Now, if you look at specific educational strategies for management and intervention, I spoken a lot about diagnosis, but let us come to management. And as I spoke about accommodations, modification, and remedial education earlier, but getting to the specific areas. So, if you look at reading with problems of decoding, phonological awareness, these need to be looked upon.

And emphasis is paid on phonemes which is the smallest unit of speech. So, [FL] so in fact, students are taught to learn to train by phonemes. In fact, many schools today teach spelling through the use of phonemes. So, that you know there are no errors in spelling.

So, phonemic awareness to increase phonemic awareness, the activities that are included are isolation that is training in recognizing the individual sounds of the word. So, what is the sound of h in hat? Ha. So, what is the sound of h in ba or pa? So, ha at the end. So, you know the positioning the of the words, the also the function the expression of the word is taught to the child in isolation.

Phoneme identity, to, ability to distinguish the common sound in different words like you know pa may come as pod in pod and span is the same sound. So, you identify the letter pa. So, you know; so, after identity through the phoneme it comes to later identification.



Phonemic substitution, a very good way of doing this is we did it for our intervention tool that we made. We you know, what you do is you put cat, say c a t you ask the child to say it and then you switch the letter c changes to h, the child says then you change again to m to p to r, so f. And you know, so identifying that the change in the phoneme brings about the change in the way, the word is said and meant.

Similarly, again you change the letter at the beginning, then you change the letter at the end. So, instead of mat, it may you change the word t and make it man. Then, the you know phonemic substitution is also done by changing the vowels. So, oral segmenting, able to break the word into different sounds, and oral blending, joining the sounds to form different words. So, separate letters are given, and we you know we use this you click in those letters together and form a word.

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### SPECIFIC EDUCATIONAL STRATEGIES

#### Writing

- Writing is more complex skill than reading and it may co-occur with reading disorder or independently.
- Eye hand coordination and ability to segment phonemes is essential
- The basic motor functioning is enhanced using hand exercises such as working with clay, beading and finger tapping
- To improve spelling, phonics instruction and teaching of letter writing is used (following numbered arrow cues, hiding letter and visualizing writing letter, utilizing the numbered cues to write letter and finally checking the letter as compared to sample)

#### Mathematics

- Number sense is deficient in children with dyscalculia.
- Educational strategies include practicing number syntax (linking numbers to related digits; e.g., 1234, one corresponds to thousand, two to hundreds, three to tens and 4 to units).
- Repeated additions help in internalizing the number line.
- Drill and practice also help to remember number facts.
- Verbalization of arithmetic concepts, procedures and operation explicit instruction



So, for writing, this is more complex. And it is a writing problem may co-occur with a reading problem or may happen independently. So, hand eye coordination, visuo-motor coordination is very very important. And the ability to segment phoneme specifically.

So, this is taught and many times you know especially in the learning systems that we use today, you know individualized learning systems. They try and use you know touch pads where there is a as a there is a tactile stimulation telling you.

One good exercise for enhancing basic motor functioning is using hand exercises by clay, you know clay modelling beading and finger tapping. Finger tapping is a very common exercise that is done for hand eye coordination, hand you know motor control.

To improve spellings and phonemic instruction and teaching of letter writing is used and you know following arrowed cues. So, ok this is the next one that you write, hiding the letter and visualizing, right the writing letter to be written.

And you know then training the child to write parts of a letter, and then you know completing the letter fully, then being able to see what was written earlier. So, writing is a little more complex. It requires more of remedial education and assistance both at home and school premises.

Mathematics, for mathematics again students with dyscalculia have a problem in this area as I said that, you know identifying the relations is a problem with such children. So, you know positioning is a very important training that is done.

So, you know when 4 is say in 1, 2 3, 4, 4 is in the unit position. If it is 4, 1, 2, 3, 4, 4 is again in the 10000 position. So, you know positioning we start by looking into whether the child can see, understand the positioning, and then train children in positioning.

This is as you will see this is one skill that is taught in a foundational level in school. So, but this is again highlighted as a training principle. So, the objective is to bring is to strengthen the child's fundamentals, to bring him up to a certain level. So, that thereafter he can you know use his skills to further explore.

The catch here is because the intellectual ability of the child is like any other child of his age. So, that is why we try and work on the academic skills, trying to loosen the complexity of the content representation and presentation, rather than trying to work on the intellect, work on the intellectual processing.

Now, again as we say for every mathematical skill practice is very very important drill and practice. And another thing that is followed is verbalization of arithmetic concepts. So, procedures you know to read out understand, you know express it through words when we are trying to understand a relational concept.

The reason being that as I said you know numbers as symbols are tough to grasp for these children. So, you know if they understand it through languages, they understand it in their own terms instead of those symbols, it is easier for them. So, they are trained to verbalize the arithmetic concepts and operations and this generally works as helpful.

So, this area is a recently developing concern. I would not say recently developing concern, but at least we are conscious of this concern at this point in time. Thanks to media as well as you know the community awareness programs. And the schools are now aware that well there may be children having problems with SLDs, having problems with attention deficit, and these need to be addressed.

Now, today we get a disability certificate because of SLD, if somebody is suffering from SLD in India. And as per the act disability act, right of person with disability at 2016. And but instead of just talking about the certification, we must also look at the prediction, prevention and prediction of SLD.

If we are to reduce this you know impairment for students for children to work efficiently through their lives. And we have actually seen many individuals with SLDs who have done very well in their, you know careers.

So, well, that is what I have to share in today's lecture.

Thank you.