

A Review on Learning Disabilities and Technologies determining the severity of Learning Disabilities

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Abstract— Learning disabilities is defined as disorders that have an effect on one’s ability to know or use spoken or communication, do mathematical calculations, coordinate movements, or direct attention. In this review paper we are going to discuss what learning disability mean and its types, different types of techniques that are currently available for determining the severity of various learning disabilities.

Keywords—learning disabilities; dyslexia; dyscalculia; dysgraphia, dyspraxia; fuzzy systems; neurocognitive program; computer based screening.

I. INTRODUCTION [1-7]

Learning disability, or learning disorders, is an umbrella term for a large type of learning issues. A disorder isn't a tangle with intelligence or motivation. Children with learning disabilities aren't lazy or dumb. In fact, most are even as good as everybody else. Their brains are merely wired differently. This distinction affects how they receive and method information. Simply put, kids and adults with learning disabilities see, hear, and perceive things differently. this could result in hassle with learning new info and skills, and putting them to use. The foremost common varieties of learning disabilities involve issues with reading, writing, math, reasoning, listening, and speaking[5].

Learning disabilities have an effect on one's ability to interpret what one sees and hears or to link information from totally different components of the brain. These limitations will show up as specific difficulties with spoken and communication, coordination, self-control, or attention. Such difficulties reach school assignment and may impede learning to scan or write or to try and do science. Learning disabilities don't replicate I.Q. (intelligence quotient), or how good someone is[5].

Learning disabilities is womb-to-tomb conditions that, in some cases, have an effect on several elements of an individual's existence: faculty or work, daily routines, family things, and, sometimes, even friendships and play. In some folks, several overlapping learning disabilities is also apparent. Others might have one, isolated learning drawback that has very little impact on alternative areas of their lives. Not all learning issues constitute the class of learning disabilities. Several youngsters area unit merely slower in developing sure skills. As a result of youngsters

show natural variations in their rate of development, typically what appears to be a disorder might merely be a delay in maturation[5].

II. SIGNS AND SYMPTOMS OF LEARNING DISABILITIES[1-7]

Different types of learning disabilities at different age are as follows[6, 7]:

Age	Symptoms
Preschool Age	<ol style="list-style-type: none"> 1. Difficulty in finding the correct word 2. Problems with learning alphabets numbers, colors, daily habits, etc. 3. Problems with learning an understanding directions. 4. Problems with dealing with days of the week, month, shapes, etc.
Age group 5-9 years	<ol style="list-style-type: none"> 1. Problem while dealing with letter and sounds 2. Difficult to mix sounds and form words 3. Unable to deal with new skills 4. Problems while telling time and cognitive process orders 5. Confusion while reading basic words
Age group 10-13 years	<ol style="list-style-type: none"> 1. Problems with reading sentences comprehension, etc. 2. Does not like reading or writing and mostly avoids to do so. 3. Bad Handwriting 4. Poor structural organization

TABLE 1. Signs and symptoms of learning disabilities

III. COMMON TYPES OF LEARNING DISABILITIES [1-7]

It is not compulsory that each and every child will face from the same learning disability. There are various learning disabilities such as dyslexia, dyscalculia, dysgraphia, etc. Following table shows different types of learning disabilities with its respective difficulties and problems faced:

TABLE 2. Common types of Learning Disabilities

Type	Difficulty with	Problem with
Dyslexia	Reading	Reading, writing, spelling, speaking.
Dyscalculia	Maths.	Doing math problems, understanding time, using money
Dysgraphia	Writing	Handwriting, spelling, organizing ideas
Dyspraxia	Fine motor skills	Hand-eye coordination, balance
Dysphasia	Language	Understanding spoken language, poor reading comprehension
Auditory Processing Disorder	Hearing differences between sounds	Reading comprehension, language
Visual Processing Disorder	Interpreting visual information	Reading math, maps, charts, symbols, picture

It is not necessary that a child can suffer from only one learning disability. For example, if a child is suffering from dyslexia might also suffer from dysgraphia as well. But a child suffering from dysgraphia might no suffer from dyslexia.

IV. TECHNOLOGIES FOR DETERMINING THE SEVERITY OF LEARNING DISABILITIES [1-7]

Different types of techniques that determine the severities of learning disabilities are discussed are as follows:

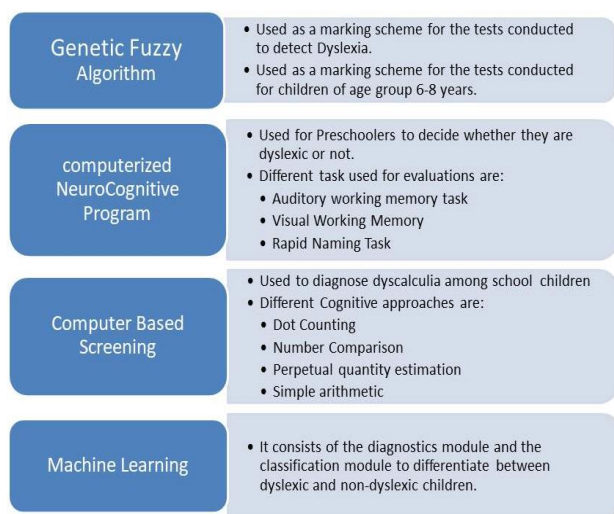


Fig.1: Techniques for determining severity of Learning Disabilities.

A. Diagnosis of dyslexia using genetic fuzzy systems:

Artificial intelligence is used to determine the severity of dyslexia in children of age 6-8 [1]. It is used as a marking scheme for the tests conducted to detect dyslexia. There are lots of disorders whose symptoms coincide with dyslexia and thus tests conducted must separate those children from dyslexic children. Fuzzy systems imply blurring the boundaries between right and wrong. Their values range in between 0 and 1. Genetic algorithms imply choosing the fittest candidates from the

population. This system contains a rule based system whose knowledge base is identified by using genetic algorithms[1].It classifies children into classes like dyslexia, no dyslexia, control and revision, and others like hyperactivity, inattention. It focuses on a fact that input data is never crisp in the practical world. In machine learning context fuzzy sets are used to represent a nested family of sets, each of them will contain the true value with a probability[1].

B. Designing a computerized neurocognitive program for early diagnosing children at risk of dyslexia:

This system was designed for preschoolers in a game format to decide whether they are dyslexic or not. This study is longitudinal descriptive research in which a total of 259 kids with an average age of 6 years were selected. A program was designed using their unskilled data and diagnostic tests were automated to test for dyslexia in these kids over a span of 2 years. A program for visual and auditory working memories and rapid naming were selected[2]. C language was used to build this system and design focused on neuro cognitive impairments due to neural circuits' dysfunctions and alterations in dyslexia[2].Separate tasks designed to evaluate visual and auditory working memory are:

1. Auditory working memory task:

Children were made to hear a set of objects and see similar images on the monitor and were asked to point to the objects in the same order as they heard it. This was to check their memory state and score was calculated by the correct order of pictures.

2. Visual working memory :

Children were subjected to remember the places and directions that were displayed on the monitor for a short time and then they were asked to point the place of one of them. The numbers of items heard and seen initially were two and increased subsequently until 2 failures consecutively. The performance was calculated on basis of correct clicks and response time.

3. Rapid naming task:

A page full of fruits was displayed to the children and for sake of clarity their names were identified for them. This task included naming the maximum fruits in 30 seconds. Subsequently time was reduced and speed was increased. Score was measured by correct number of fruits in the stipulated time.

The degree of reliability of system for visual and auditory processing memories ,and rapid naming were obtained as 0.89,0.92 and 0.88 n respectively. The **degree of reliability** of system for visual and auditory processing memories and rapid naming between

dyslexic kids. Kids with scores less than or equal to 20.7% were classified as dyslexic. The accuracy of system was **0.87, 0.67 and 0.8**. The accuracy of system was **90.65%**

C. Computer based screening for dyscalculia:

Developmental dyscalculia (DD) affects about 3 to 6 % of school age children in various countries[3]. It is a genetic disorder. This system approaches to diagnose dyscalculia by using basic cognition of the human brain. Human brains can attend only 3-4 separately moving objects[3]. Different computerized tasks used for cognitive screening are:

1. Dot counting:

In this task, numbers of dots are arranged randomly and canonically. The difference in the counting speed of both the patterns is measured. The cognitive functions identified here knowledge of number, attention, visual memory.

2. Number Comparison:

In this task two numbers were given and a numerically larger number was supposed to be selected given two incongruent physical numbers. This was done to test their working memory and executive functions.

3. Perpetual quantity estimation:

In this task, an image with a number of items was displayed on the screen for 3000 milliseconds and students were asked to estimate the approximate number of objects in the image. It checks their working memory, attention and abstraction capabilities.

4. Simple arithmetic:

In this task children were given basic math questions and performance was measured on the basis of the correct answer. It measured the knowledge of number.

D. Diagnosis and classification system for kids with dyslexia with the help of machine learning:

In this technique a test was conducted which included 857 school going kids and their scores were used to train the system to predict if a child has dyslexia or not[4]. Twenty fifth percentile was used as a threshold value, score less than or equal to the threshold value indicated child was dyslexic whereas scores above the threshold value indicated child not having dyslexia [4]. This is basically a diagnostic module[4]. The second module is the classification module which segregated non dyslexic students from dyslexic students. The third module is the analysis tool which classified which basically indicated that **out of 857 students 20.7 % students were dyslexic** [4].

1. Algorithm and technology used for designing the system:

For classification purpose. The algorithm used is k- nearest neighbor which checks for k number of nearest neighbors corresponding to a particular data point which needs to be classified and then the data point belongs to that class which consists maximum number of neighbors with respect to that data point.

2. Methodology:

The system forms a knowledge base with the help of training data then based on the information in the knowledge base it can predict the results for any new user. Then it can classify if the child is dyslexic or non-dyslexic. The test included reading and writing modules.

V. EVALUATION[1-7]

After meta analysis of these papers which use genetic fuzzy,(names of all methods) we are able to reach the following broad conclusions

1. Categorizing a child into definitely dyslexic border line or some other disorder having similar symptoms.E.g.: ADHD(Attention Deficit Hyperactivity Disorder)
2. Sub classifying dyslexia into types like auditory cognitive disorder ,visual cognitive disorder or dyscalculia and analyzing the degree of disorder (whether mild ,moderate or severe).
3. Use of machine learning by setting a threshold to identify whether a child is actually dyslexic or not.
4. These diagnostic and classifying methods are already being used by neuro physicians all over the world.As we know this disorder is no treatable but can be improved upon by therapeutic techniques such as machine learning ,artificial intelligence and computerized therapeutic methods.

VI. CONCLUSION

A learning disorder is a neurological disorder. In straightforward terms, a disorder results from a distinction within the approach an individual's brain is "wired." kids with learning disabilities are not as sensible as or smarter than their peers. However they will have issue reading, writing, spelling, reasoning, recalling and/or organizing info if left to work things out by themselves or if educated in standard ways that. A disorder cannot be cured or fixed; it's a long issue. With the proper support and intervention, however, kids with learning disabilities will achieve school/college and become successful in life. Parents will facilitate kids with learning disabilities accomplish such success by encouraging their strengths, knowing their weaknesses, understanding the academic system, operating with professionals and learning regarding methods for handling specific difficulties.

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