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Comprehensive Study of Child Programmers and Dyslexia

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ABSTRACT

This paper examines how and why dyslexics are good computer programmers. The most common of the strategies that dyslexics develop to survive are outlined. Major issues confronted by dyslexics are considered. In this paper huge IQ ranges and extraordinary abilities possessed by the dyslexics are discussed. Mind mapping method and different strategies adapted by dyslexics to decode the blobs (alphanumeric characters unidentified by dyslexics) are inscribed. Introductory evidence, from each the broader dyslexia body with computer programming experience and a few early interview consequences are presented to support the dyslexics and recognize the problems faced by them as well as acknowledge their genetic endowments and developmental trajectories.

Keywords: Programming and Dyslexia, Dyslexia in Programming, Disability in Education, Accessibility in Programming

I. INTRODUCTION

In this study we shall investigate the complexities of dyslexic students who are studying in the computer programming curriculum. We shall see such topics where student having dyslexia can excel and perform better. This paper begins with outlining the causes and common symptoms of dyslexics. Specific issues associated with computer programming and dyslexia are then outlined. With focus on doing this, first the features of dyslexia are presented. After that, a model of the computer programming processes is proposed.

1.1 What is Dyslexia?

Dyslexia can be explained as a general term for disorders that involve difficulty in learning to read or to interpret words, letters, and other symbols, but do not affect general intelligence. Dyslexia is a condition that affects around 20% of the global population. It is the most common of all the neurocognitive disorders in the world. Dyslexia is a common condition that makes it difficult to work with language. Some experts believe that between 5 and 10% of people have this condition. Others say that as many as 17% of people show signs of dyslexia.

1.2 What are its causes?

Dyslexia generally tends to run in families. It is perceived to be related to certain genes that affect how the brain processes reading and language, as well as risk factors in the environment.

Risk factors for dyslexia include:

- Dyslexia or other learning disabilities in the family
- Premature or low birth weight
- Exposure to nicotine, drugs, alcohol, or infections during pregnancy can inhibit foetal brain development
- Individual differences in the brain regions that enable reading

1.3 What are the symptoms of dyslexia?

- Student having it are often diligent and brilliant.
- Students with dyslexia have a difficult time connecting letters to sounds they make and then blending those sounds into words. So, to someone with dyslexia, the word "saw" might read as "was" or “how” as “who”.
- Reading can be a slow and difficult task as a result of these mix-ups.
- Dyslexia can vary from one-to-one.
- Some people have a mild form of the disease that they learn to manage over time.
- Others have a harder time getting over it.

Signs of dyslexia may be hard to apprehend earlier than your baby enters faculty, however a few early clues may also suggest a problem. Once your baby reaches faculty age, your baby`s trainer can be the primary to be aware a problem. Severity highly varies; however, the circumstance will regularly become obvious as a baby begins off evolved getting to know to read.

Signs that a younger baby can be susceptible to dyslexia include:

i. Late talking
ii. Learning new phrases slowly
iii. Problems forming phrases correctly, inclusive of reversing sounds in phrases or perplexing phrases that sound alike
iv. Problems remembering or naming letters, numbers and colors
v. Difficulty getting to know nursery rhymes or gambling rhyming games

School age:

Once your baby is in faculty, dyslexia symptoms and symptoms and signs may also turn out to be greater obvious, which include:

i. Reading nicely beneath the predicted stage for age
ii. Problems processing and information what she/he hears
iii. Difficulty locating the proper phrase or forming solutions to questions
iv. Problems remembering the series of things
v. Difficulty seeing (and every so often hearing) similarities and variations in letters and phrases
vi. Inability to sound out the pronunciation of an strange phrase
vii. Difficulty spelling
viii. Spending a strangely long term finishing responsibilities that contain studying or writing
ix. Avoiding sports that contain studying

Teens and adults:

Dyslexia symptoms and symptoms in teenagers and adults are just like the ones in youngsters. Some not unusual place dyslexia symptoms and symptoms and signs in teenagers and adults include:

i. Difficulty studying, which include studying aloud

ii. Slow and labour-in depth studying and writing
iii. Problems spelling
iv. Avoiding sports that contain studying
v. Mispronouncing names or phrases, or troubles retrieving phrases
vi. Trouble information jokes or expressions which have a that means now no longer effortlessly understood from the particular phrases (idioms), inclusive of "piece of cake" that means "easy"
vii. Spending an strangely long term finishing responsibilities that contain studying or writing
viii. Difficulty summarizing a story
ix. Trouble getting to know a overseas language
x. Difficulty memorizing
xi. Difficulty doing math troubles.

Dyslexia can cause to a variety of issues, including:

- **Difficulty in learning:** Reading being the foundational skill for most other school subjects, a child with dyslexia will be at a disadvantage compared to his peers in most grades and may have trouble keeping up with his competitors.
- **Social Issues:** If left untreated, dyslexia can gradually lead to low self-esteem, behaviour problems, anxiety, aggression, and withdrawal from friends, parents, and teachers.
- **Problems in adulthood:** An inability to read and understand can prevent a child from reaching its true potential as they grow up. This can have long-term educational, social as well as economic consequences. Children with dyslexia are most likely to develop Attention Deficit Hyperactivity Disorder (ADHD) and vice versa. ADHD can lead to difficulty sustaining attention as well as hyperactivity and impulsive behaviour, which can make dyslexia even more difficult to treat.

1.4 How common dyslexia is?

Dyslexia is a common learning disability that causes difficulty with language processing. About 1 in 10 people have dyslexia. In “decoding” letters and words people with dyslexia face difficulty.

What percentage of the global population has dyslexia?

Dyslexia affects 20% of the global population which accounts for 80-90% of all people with learning disabilities. In neurocognitive disorders, it is the most common.

1.5 Who is most affected by dyslexia?

Dyslexia affects people from all economic and ethnic backgrounds. It is estimated that 10% of Indian children are affected, with approximately 35 million children worldwide suffering from this learning difficulty. About 2 million children, receive special education services for people with reading disabilities. In reading, writing, and spelling difficulties dyslexia is the most common cause.

1.6 What are strengths of Dyslexics?

- Puzzles are something that dyslexics enjoy and excel at.
- Dyslexics have a high level of comprehension when it comes to stories that are read to them or narrated to them.
- Most dyslexics have a superior awareness of spatial relationships and use their right brain more effectively.

- Dyslexics excel at conceptualization, reasoning, imagination, and abstraction, among other things.
- Dyslexics have a good ability to see the larger picture when it comes to concepts.
- Dyslexics flourish in areas that are not dependent on reading.
- For their age, dyslexics usually have a big verbal vocabulary.
- Dyslexics are more inquisitive, imaginative, and intuitive than the ordinary person.
- The gift of mastery comes naturally to dyslexics because of their unique way of thinking.

II. DYSLEXIA AND EDUCATION:

The term "dyslexia" refers to a mismatch between IQ and language skills. Dyslexic students have several complications in education like:
poor handwriting;
poor spelling;
poor reading;
poor composition and writing skills;
poor short-term memory;
poor organization.
Due to this, dyslexic students experience substantial educational and legal stigma, and there is a lack of information about their and their families' health situation during this health crisis.
But there are some measures which could be taken by teachers to support and encourage dyslexic students in school:

i. **Multi-Sensory Techniques:** As a sort of active learning in which students actively participate in their education, kinesthetics exercises will assist dyslexic students to employ their strongest learning channels in the classroom.
ii. **Overlearning:** To compensate for poor retention, students should have the chance to overlearn through a variety of different and complementary learning strategies.
iii. **Metacognition:** Students should be encouraged to be aware of the learning process so that they can set personal goals and effectively self-regulate their learning. The dyslexic student will be actively encouraged to map prior knowledge through discovery learning.
iv. **Personal Motivation:** Students will be more engaged and motivated if they are presented with a real-world scenario that can be applied outside of the classroom.
v. **Short Concentration Span:** Lessons should be compartmentalised into manageable portions that allow dyslexic pupils to concentrate for short periods of time, as they can lose concentration fast.

III. DYSLEXIA AND PROGRAMMING:

3.1 What is Computer Programming?

Computer programming is the process of designing/building an executable computer programme to execute a given computation (or, more broadly, to get a specified computing result). Programming entails duties such as analysis, algorithm generation, algorithm accuracy and resource use profiling, and algorithm implementation (usually in a chosen programming language, commonly referred to as coding). A program's source code is written

in one or more languages that are intelligible by programmers, rather than machine code, which is immediately executed by the central processing unit. The purpose of programming is to create a set of instructions that will automate the execution of a task (as complex as an operating system) on a computer, aiming to problem-solving. As a result, effective programming frequently necessitates knowledge of a variety of areas, such as the application domain, specialised algorithms, and formal logic.

The paradigm for the design or problem-solving cycle can be summarised in the following steps when designing a computer program:

- Recognition of a Need
- Problem Definition
- Synthesis
- Analysis
- Implementation
- Evaluation

Individuals must meet specific prerequisites when programming in general, which include:

- Concept Acquisition
- Underlying System Knowledge
- Abstract Thought

3.2 Advantages of Dyslexics in computer Programming

i. Dyslexics have the ability to see connections between different components of the system that others do not, and this ability can considerably simplify and optimise the system's operations, which leads to effective code.

ii. The syntax and notation of computer code is completely predictable, which makes coding easier.

iii. Because of their genetic endowment and developmental paths, many dyslexics go on to develop exceptionally talented brains, they make excellent software designers and programmers.

iv. They excel at static holistic analysis in particular, visualising the entire system in their heads, spotting patterns that others miss, spotting possibly cost-effective short cuts in their 3D mental maps of the proposed code, and avoiding inconsistencies.

v. Dyslexics are right-brained, therefore can figure out what the full programme, class, or method needs to do at various levels of abstraction. (Synthesis)

3.3 Disadvantages of Dyslexics in computer Programming

i) Analysis	Dyslexics may have difficulty breaking down the system into component pieces and perceiving these parts in a logical manner, because these are predominantly left-brained activities
ii) Implementation	Dyslexics may have problem with coding, testing and correction of syntax or spelling until the program both compiles and functions in the expected manner.

iii) Evaluation	Dyslexics are at a disadvantage when it comes to determining the source of erroneous behaviour in a program or even re-conceptualizing the problem.
iv) Concept Acquisition	Students' capacity to learn new concepts will be hampered because they lack implicit learning skills.
v) Underlying System Knowledge	Due to their restricted working memory, dyslexic children will struggle to retain information of more than one language or system without becoming confused.
vi) Abstract Thought	Due to their short working memory, dyslexic students may struggle to manage complicated activities.

IV. COMPUTER PROGRAMMING ACCESSIBILITY GUIDELINES FOR DYSLEXICS:

Many acts, law and guidelines have been made for better experience of dyslexics in Computer Programming. Some of them are mentioned below:

- The Special Education Needs and Disability Act (SENDA, 2011)
- IMS Global Learning Consortium (IMS, 2002)
- The W3C's Web Accessibility Initiative (WAI)
- Section 508 of United States accessibility law Section 508
- DDA, (1995), Disability Discrimination Act.
- CITA, (1998), Section 508 Standards, Center for IT Accommodation.

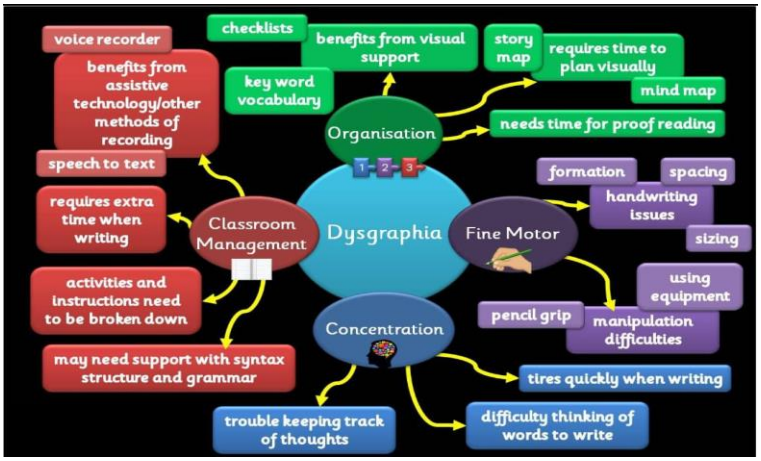
In addition to these standard-setters, a number of organisations, such as WebCT and TechDis, have endorsed the aforementioned providers' standards.

The following guidelines were chosen from generic accessibility guidelines and connected with dyslexia symptoms:

- The dyslexic coder should have flexibility over font sizes, styles, and background and text colours.
- Contrasting colours can help students read text more easily, while particular fonts can be challenging for dyslexics.
- Cascading style sheets enable students to customize a webpage to their preferred visual learning style.
- Active Avoidance is the opposite of passive avoidance. The dyslexic coder may be distracted by a brightly coloured or patterned background, which can conceal text.
- Structuring for the dyslexic programming learner, left justified paragraphs will provide a clear framework.
- Linguistics language used should be clear and succinct, and the graphics should be simple to understand.
- Web pages should be made to function with assistive devices such as screen readers.
- The learner will be able to compensate for his or her lack of reading abilities by receiving knowledge through a more accessible medium.
- Turning Off the Lights Distractions like moving or timed components, blinking or scrolling text may be challenging for dyslexic students who have trouble reading text.
- Consistency Students' cognitive burden will be reduced by consistent layouts and formats, allowing them to focus their attention

- To offer a foundation of knowledge for the dyslexic student, information should be contextualised and orientated
- On the page, the text should not be cluttered.
- Hyperlink sentences should include a brief summary of the page to which they lead and why it is significant.

Supplementary Information:



V. RESULTS AND DISCUSSION

This is the result of measuring the cognitive abilities of students with dyslexia before and after brain training, with particular attention to the cognitive abilities associated with auditory processing.

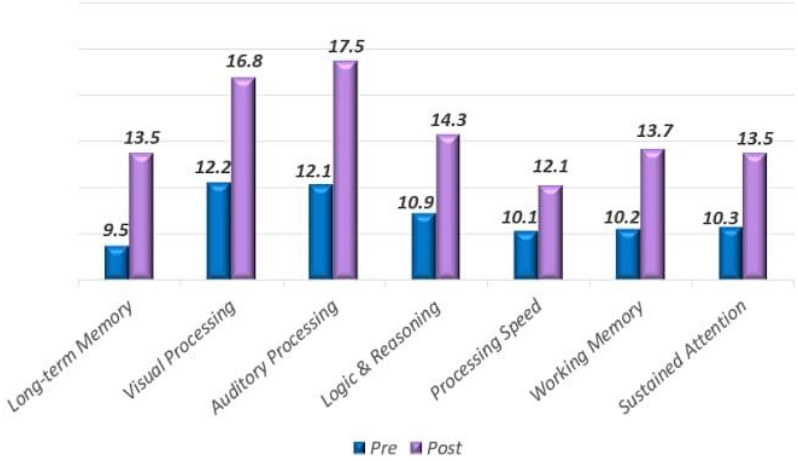
After results we have learned that:

i. The greatest benefits after brain training have been seen in processing auditory, long-term memory, and broad attention.

ii. After only 6 months of training, age-equivalent cognitive ability improved by an average of 3.7 years.

iii. The IQ score after brain training also improved.

These improvements are as follows on the graph.



VI. CONCLUSION

The accessibility standards discussed in this paper should assist both dyslexic and non-dyslexic users by boosting intelligibility of page and allowing users to concentrate on the material's content. The research implies that dyslexic students bring their visualization and creative problem-solving skills to programming, as well as their more generally recognized spelling, organisation, and short-term memory challenges. Until now, no attention has been paid to the auxiliary skills needed to learn how to program in various languages, algorithms, or concepts. These abilities should be taken into account in future work. The delivery of teaching materials was a key concern, as evidenced above. The whole motto of this research is to imply that rather than being viewed as a hindrance in this sector, dyslexia could possibly be useful. Indeed, making dyslexic computer science students aware of these positive viewpoints may be useful. This may provide additional motivation to overcome initial difficulties when learning to program. Programming appears to be a place where persons with dyslexia may use their talents, work around their deficiencies, and even design their own Assistive Technologies.

VII. FUTURE WORK

In the future, we will extend this work by reducing the limitations and improving this model as well.

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