WILL DYSCALCULICS BE BENEFITTED BY DINT OF VISUAL LEARNING?

By

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ABSTRACT

Not all children are made the same. Learning disabilities like dyslexia, dysgraphia or dyscalculia are either not understood or ignored in schools. As a result, the schoolchildren suffer for no fault of theirs and they lag behind in their course of learning. They may find it difficult to achieve the basic skills of learning such as reading, writing, reasoning or doing arithmetic calculations.

Dyscalculia, a learning disorder in which a student faces severe difficulties in mathematical computations, includes all types of difficulties in learning mathematics ranging from inability in understanding numbers to inability in applying mathematical principles to solve problems. Since understanding and working with numbers require mental skills, children who have trouble in visualizing concepts struggle with computation. A number of learning styles can be incorporated for the dyscalculic children who face severe problems.

Visual learning is a learning style which involves learning through seeing things. It involves the use of charts, graphs, pictures, diagrams, videos, transparencies, flipcharts, hand-outs etc in the learning process. Activities in practical Mathematics help students immensely in visualization. Innovative use of technology may help dyscalculic learners to overcome their disability to a large extent. Technology can greatly aid the process of mathematical exploration and clever use of such technology can help engage such students with learning disorders. As mathematics learning requires visual patterns to fully grasp the number concepts or computations, it is very essential for the schools to adopt visual learning strategies to meet the needs of dyscalculic learners.

Keywords: Learning Disabilities, Dyslexia, Dysgraphia, Dyscalculia, Learning Style, Technology and Visual Learning.

INTRODUCTION

Many children, low performers in academic activities, face difficulties in the acquisition of basic academic skills such as reading, writing and arithmetic which might be the result of the prevalence of certain learning disabilities. Learning disabilities manifest themselves as disorders that interfere with the development of these basic academic skills in which a child's achievement is substantially below what one might expect for the child. Learning disability is a general term that refers to a heterogeneous group of disorders manifested in significant difficulties in the acquisition and use of listening, speaking, reading, writing, reasoning or mathematical abilities. In addition to these primary characteristics of learning disabilities, there are also secondary consequences of learning disabilities such as poor motivation, self-esteem, self-efficacy and metacognition.

Children with learning disabilities face many academic and non-academic difficulties. Non-academic difficulties include motor problems, perceptual problems, phonological processing difficulties and language problems. Academic difficulties include problems in reading, spelling, writing, and numeracy. Learning-disabled children may have average or above average intelligence and may be slow learners, average learners or even gifted children. But they apparently cannot use information transmitted by the senses to the brain as accurately as most other children. Therefore they may do poorly in school or not as well as they can.

Learning disabilities exhibit disorders in one or more of the psychological processes involving understanding and in using spoken/written language or numbers. These

deficiencies damage a child's ability to learn. Most often they fall into three broad categories such as dyslexia (reading disorder), dysgraphia (writing disorder), and dyscalculia (arithmetic disorder).

Dyscalculic Learners

Dyscalculia is a broad term that refers to a wide range of life-long learning disabilities involving mathematics or simply, severe difficulties in mathematics. It is a condition that affects the ability to acquire mathematical skills. According to Rao, dyscalculia is the inability to develop mathematical concepts, difficulty in implementing calculation procedures or to reason with numbers (Karanth & Rozario, 2003). It includes all types of mathematics problems including inability to understand the meaning of numbers and quantities and to apply mathematical principles to solve problems.

Dyscalculia can occur developmentally as a genetically linked learning disability which affects a person's ability to understand, remember or manipulate numbers or numerical facts. It occurs in pupils across the whole IQ range and the sufferers often have difficulties with time, measurement or spatial reasoning (Kumar & Raja, 2008). However it is a lesser known of all the learning disorders and is often not recognized.

Dyscalculic learners may have difficulty in understanding simple number concepts, lack an intuitive grasp of numbers, and have problems in learning number facts and procedures. A student with any degree of mathematical difficulty may be considered to have "dyscalculia" by some educational specialists. There is no single form of mathematical disability and difficulties vary from person to person and affect people differently in school and throughout life (Kumar & Raja, 2009).

There are a range of warning signs that a dyscalculic learner may have in his/her mathematical difficulty. These include slowness in giving answers to mathematics questions in comparison with other learners, difficulties in mental calculations, using fingers to count simple totals, mistakes in interpreting word problems, difficulty to remember basic mathematics facts, losing track when counting or saying multiplication tables, difficulty in remembering the steps in a multistage process, difficulties with position and spatial organization etc (Hannell, 2005).

It has been estimated that lack of competence in the four computational skills such as addition, subtraction, multiplication and division account for ninety percent of the difficulties experienced by dyscalculic learners (Jeya & Geetha, 2004). In order to be functional in these skills, students need a great deal of rehearsal, repeated teaching and learning to ensure that they internalize these skills. Counting is a necessary skill for addition and multiplication and many dyscalculic learners may lag behind even in the skill of counting.

Much less research has been done in the area of mathematical disorders compared to other learning disorders. Research in the analysis and remediation of problems related to mathematics has been rather neglected. Large numbers of schoolchildren continue to experience failure in this subject. It has been reported that 88 percent referred to the learning disabled programme are much below the expected grade level in arithmetic computation (Nakra, 1996).

As mathematics learning continues, school children with mathematical learning disabilities may have difficulty in solving basic mathematical problems. They may struggle to remember and retain basic mathematical facts and could have trouble figuring out how to apply their knowledge and skills to solve mathematical problems. If basic mathematical skills are not mastered, many teenagers and adults with dyscalculia may have difficulty in moving on to advanced mathematical applications.

Visual Perceptual Difficulties of Dyscalculic Learners

As with other types of learning disabilities, dyscalculia is said to involve the language and visual processing centers of the brain. A mathematical difficulty may be related to visual spatial confusion. Researches show that visuospatial functions and right hemisphere functioning affect the numerical information and skill in interpreting information. The tactile perceptual, visual spatial organization and psychomotor skills are the building blocks of higher order formation and problem solving

abilities in children (Karanth & Rozario, 2003).

Visual processing disorder is a condition that affects the ability to learn mathematics. Pupils with visual spatial difficulties may understand the essential mathematical facts but may have difficulty in putting them down on paper in an organized way. Visual spatial difficulties can also make it difficult to understand what is written on a board or in a textbook challenging (http://www. ldonline/org/article/Dyscalculia).

The most noticeable difficulty faced by the dyscalculic children involves the inability to visualize and identify numbers and mathematical situations. Young children with mathematics learning disabilities can have difficulty in number sense, in sorting objects by size or shape, and in comparing and contrasting certain mathematical concepts. Students with dyscalculia have a difficult time in visualizing numbers and often mentally mix up the numbers, resulting in what appear to be "stupid mistakes". Also they may have spatial problems and difficulty in aligning numbers to proper columns. They may have poor ability to picture mechanical processes such as the location of numbers on the face of a clock (http://www.as.wvu.edu/~scidis/dyscalcula.html).

In order to solve mathematical problems, a child has to learn the foundation skills of mathematics like visual perception and visual memory. Visual perceptual difficulties include identification of similar signs and symbols, identification of similar geometric shapes etc (http://www.dyscovery.co.uk/……). Children who confuse the signs +, -, x etc may have a problem of visual discrimination of forms or visual discrimination of position in space. A child who has a poor sense of direction (i.e. north, south, east and west) or the directional confusion such as remembering or differentiating right and left may have a problem with visual discrimination of position in space (http://www.learninginfo.org/dyscalculia.htm).

What is Visual Learning?

Visual learning is a kind of learning style. A style is a preferred way of using one's abilities. Learning styles are preferred ways of studying and learning such as using pictures or text, working alone or with other people, learning in structured or unstructured situations and so on. According to Curry, an individual's learning style is a distinctive and habitual manner of acquiring knowledge, skill or attitude through study or experience (Bhardwaj & Gupta, 2006). There are three main types of learning styles namely auditory, tactile/kinesthetic and visual.

Auditory learners are those who learn through hearing things. They learn best through lectures, discussions, talking things through, listening to what others have to say and using a tape recorder. Tactile or kinesthetic learners are those who learn through experiencing or doing things. They learn best through a hands-on approach by moving, doing and touching. Visual learners are those who learn through seeing things. They learn best by looking at graphics, watching a demonstration or reading. Most people learn best through a combination of the three learning styles, but learners are different (http://www.learningrx.com/types-of-learning-styles-faq.htm).

Visual learning is the type of learning style in which learning certain facts and concepts occur through seeing or observing things. Visual learners often tend to keep an eye on the teaching done in the class and watching the lecture or demonstration or lecture closely. They understand or like instruction done through charts and are good with sign language. Learning techniques for the visual learners include using charts and flashcards, using diagrams for teaching, taking notes or making lists, watching videos etc (http://www.homeworktips.about.com/od/homeworkhelp/a/visual.htm).

The visual learners need to see the teacher's body language and facial expression to fully understand the content of a lesson. They tend to sit at the front of the classroom to avoid visual obstructions. They may think in terms of pictures and learn best from visual displays such as diagrams, illustrated textbooks, overhead transparencies, videos, flipcharts and handouts. During a lecture or classroom discussion, the visual learners often prefer to take detailed notes to absorb the information (http://www.ldpride.net/learningstyles.MI.htm). For them, it is easy to look at charts and graphs, but they may have difficulty focusing while listening to an explanation.

Visual Learning for Dyscalculic Learners

Visual learning may prove to be very much useful for dyscalculic learners to get rid of their difficulties in learning. It involves the use of charts, graphs, pictures, diagrams, videos, transparencies, flipcharts, hand-outs etc in the learning process. Visual learning fosters better understanding, organization and imagination. A student when given visual scope for learning remembers pictures, diagrams, symbols, formulae etc. Pupils with dyscalculia display a range of individual learning styles. For visual learners, mathematics that allows them to learn through pictures, diagrams etc will be more appealing and hold their interest much more effectively. Sung & Lung-Yeh (1999) on analyzing the learning style preferences of students in a junior high school found that the students had two or more learning style preferences and the visual numerical style was preferred to all the other styles. On studying a sample of college students enrolled in first and second semester calculus classes, it was found that the majority of visual learners learned through the website the aspect that contributed to most of their learning (Husch & Sharon, 2001).

Data handling, graphical representation and visualization are important mathematical skills which can be taught productively for children with learning disabilities like dyscalculia. Data handling can be suitably introduced as a tool to understand the process and represent and interpret day-to-day data. Use of graphical representations of data can be encouraged among students for effective learning. Activities in practical Mathematics help students immensely in visualization. The spatial reasoning and visualization skills of students should be enhanced.

Innovative use of technology may help dyscalculic learners to overcome their disability to a large extent. A study conducted by Lugo (2004) explores how multimedia computer technology could be a potential supplemental teaching aid that teachers use in addition to traditional classroom instruction. Technology can greatly aid the process of mathematical exploration and clever use of such technology can help to engage such students with learning disorders. Calculators are typically seen as an aid for the calculations regarding arithmetical operations. If ordinary calculators can offer possibilities such as doing arithmetical operations, calculating squares, square root etc, the potential of using computers for mathematical exploration is far higher (NCERT, 2005).

It must be understood that there is a spectrum of technology use in mathematics education and calculators or computers are at one end of the spectrum. The use of pictures, blackboards etc are at the other end and the use of graph paper, geo boards, abacus, geometry boxes etc is crucial. Innovations in the design and use of such material must be encouraged so that their use makes school mathematics enjoyable and meaningful. Michaelson & Thomas (2007) suggests that certain practical methods and instructional designs can be implemented in the classroom to address the specific learning needs of dyscalculic learners.

Dyscalculia can be detected at a young age and measures can be taken to overcome the problems faced by younger students. An awareness that there are certain teaching methods and practical approaches which are effective with such children is essential for class teachers particularly of elementary schools. The use of technology like multimedia instructional strategy or computer-assisted instruction may facilitate the process of mathematical exploration for dyscalculic learners. By these specialized approaches to teaching, most dyscalculic learners can be helped to learn normally. It is therefore imperative for dyscalculic learners to receive the highest quality of Mathematics education possible.

Educational Implications

Awareness about learning disability like dyscalculia is very much essential for the minimization of difficulties in learning mathematics. Visual learning helps to improve the arithmetic skills of dyscalculics to a great extent. Mathematics teachers need to adopt visual learning strategies in the classroom for the benefit of dyscalculic learners.

Introducing mathematics laboratories in schools may go a long way in helping the arithmetic-disabled children to overcome their problems in learning. Students can

benefit greatly through the use of different visual media for learning mathematics. These media can stimulate their interest to learn through the creation of a congenial environment for learning.

Dyscalculic problems can be minimized through visual representations such as pictures, diagrams, charts, handouts etc in the learning process. Video representations too may help to overcome the problems faced by the dyscalculic children. The use of videos and transparencies may help such learners immensely in visualization.

Adoption of innovative teaching strategies like computer-assisted instruction or multimedia instructional strategy can help to engage such mathematically disabled children which help them to learn mathematics in an enjoyable and meaningful way. So it is becoming imperative for school teachers to adopt such instructional strategies to help these academically weak learners cope up with their peers and hence to improve in academics.

Conclusion

Dyscalculia is thus a specific learning disability and it requires diagnosis as well as support at the initial stage. It is highly essential for school teachers to adopt innovative methods of teaching to meet the needs of dyscalculic learners. Research has shown that visual perception, visual memory and logical thinking are the most important foundational skills needed for learning mathematics. These fundamental skills have to be mastered by means of adequate training and practice. Visual perception and visual memory are important mathematical skills to master visual spatial relationships. To be really competent in acquiring mathematical skills, one needs to visualize clearly numbers and mathematical situations.

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