نگاهی دیگر به دیسلکسیا: تفکر خلاق در کودکان دیسلکسیا

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بیان مساله: گشویند (۱۹۸۴) دیسلکسیا را موهبتی مطرح می‌کند که حاصل ترشح نامعمول هورمون تستوسترون در دوران جنینی است. براساس نظر او، ترشح بیش از حد هورمون تستوسترون در دوران جنینی رشد نیمکره راست مغز را تسریع و رشد نیمکره چپ را به تاخیر می‌اندازد. تاخیر در رشد نیمکره چپ مغز منجر به اختلالات خاص یادگیری، دیسلکسیا می‌شود، در حالیکه نیمکره راست آنها پیشرفته است. سوال مطرح می‌شود که آیا کودکان دیسلکسیا در فعالیت‌های مربوط به نیمکره راست مغز برتری دارند؟

هدف مطالعه: مطالعه حاضر به بررسی تواناییهای خلاقیت کلامی و شکلی در کودکان دیسلکسیا و غیردیسلکسیا می‌پردازد. توانایی خلاقیت دو زیرریخت از کودکان دیسلکسیا کلامی/شنیداری و دیداری/فضایی نیز با یکدیگر مقایسه شدند. همچنین رابطه برتری جانبی دست و خلاقیت مورد ارزیابی قرار گرفت.

روش تحقیق: ۲۸ کودک دیسلکسیا و ۲۹ کودک غیردیسلکسیا در دامنه سنی ۵ سال و ۱۱ ماه تا ۱۱ سال و ۱ ماه در این مطالعه شرکت جستند. دو گروه در پارامترهای جنسیت، سن، برتری جانبی دست و هوش همتاسازی شدند.

یافته ها: نتایج تفاوتی را بین کودکان دیسلکسیا و غیردیسلکسیا در هیچ یک از نمرات خلاقیت نشان نداد. خلاقیت هر دو گروه با سن در ارتباط بود. خلاقیت شکلی کودکان دیسلکسیای نوع کلامی/شنیداری با دست چپی آنها ارتباط داشت. دیسلکسیای نوع دیداری/فضایی نسبت به کودکان غیردیسلکسیا در تکلیف خلاقیت شکلی ضعیفتر عمل کردند.

نتیجه گیری: نتایج بر اساس تئوری "نیمکره راست پیشرفته" بحث می شوند. توانایی خلاقیت کودکان دیسلکسیا با سن رشد می‌نماید. همچنین در مطالعات مربوط به خلاقیت کودکان دیسلکسیا باید زیرریخت‌های آنها در نظر گرفته شود.

واژگان کلیدی: کودکان دیسلکسیا، خلاقیت کلامی، خلاقیت شکلی، برتری جانبی دست، تئوری نیمکره راست پیشرفته

Another perspective to the dyslexia: creative abilities among dyslexic children

World Federation of Neurology defined dyslexia as "a disorder manifested by difficulty in learning to read, despite conventional instruction, adequate intelligence and socio-cultural opportunity. It is dependent upon fundamental cognitive disabilities which are frequently of constitutional origin" (cited in Singleton, ۱۹۹۱, p. ۱۴۹, Thomson, ۱۹۹۴, p. ۱۱). This definition considers an underlying cognitive deficit for dyslexia and regards it as a congenital phenomenon (Singleton, ۱۹۹۱). It also eliminates other factors (e.g., emotional and behavioural problems) that may cause literacy difficulties, though the co-occurrence of these eliminated factors and the cognitive deficits cannot be ruled out (Rock, Fessler, and Church, ۱۹۹۷).

The study of etiology of dyslexia can be divided into neurological, and clinical studies. Among neurological studies of dyslexia, cerebral dominance gives some explanation for the phenomenon of dyslexia (Miles and Miles, ۱۹۹۰; Thomson, ۱۹۹۴). Orton (۱۹۳۷) suggested a lack of cerebral dominance for language as a cause of dyslexia. He drew attention to the mirror writing of some dyslexics (e.g., confusion between "b" and "d"). Orton (۱۹۳۷) explained this mirror writing of dyslexics as that the word stimulus normally goes to both hemispheres, with the word in the right hemisphere encoded in mirror form of that in the left hemisphere. Dyslexic children's mirror writing was the result of weakness in left hemisphere dominance. So, the mirror-reversed storage would interfere with the left hemisphere processing, and cause confusion and poor reading performance (cited in Miles and Miles, ۱۹۹۰). Other investigators suggested that not all dyslexics write in mirror image, and this kind of confusion may be a function of normal development (Thomson, ۱۹۹۴). However, Orton is criticised for lacking both theoretical depth and empirical support and his assumptions were rejected for many years (Venezky, ۱۹۹۳).

Satz, Taylor, Friel and Fletcher (۱۹۷۸) proposed a delay or maturational lag in cerebral dominance. In such cases, research studies showed that there is a slowness in development of

the basic brain functions that underlie learning to read and spell such as perceptual motor skills (i.e., left-right confusion). Nevertheless, the maturational lag model has been criticised (e.g., Thomson, ۱۹۹۴), to the effect that the two hemispheres of the brain do not develop equally over time; also, all functions of the left hemisphere and not only reading, writing and spelling should be affected (Beaumont and Rugg, ۱۹۷۸).

Geshwind and Galaburda (۱۹۸۵) stated that there is evidence that the language region of the left hemisphere (i.e. Heschl's gyrus, Planum temporal) is different from that of the right hemisphere in terms of structure and size. Furthermore, the examination of some dyslexics' brains showed that the right planum temporal is wider or approximately similar compared to the left one (Geshwind, ۱۹۸۲; Galaburda, Rosen, Sherman, ۱۹۸۹). In addition, William Drak (۱۹۶۸) reported the result of the examination of the brain of a dyslexic boy that had a larger brain with some abnormalities in the subcortical white matter and a thin corpus callusum (cited in Rosen, Sherman, Galaburda, ۱۹۹۳). Since then, a series of brain examinations of male and female dyslexics has revealed two consistent findings: developmental neuropathology and the symmetry of language-related regions of the brain (Galaburda, et al., ۱۹۸۹).

Thomson (۱۹۹۴) put the evidence for maturational lag and the left hemisphere deficit together to interpret the underlying problems of dyslexia. He argued that "an amalgamation of maturational lag and a functional deficit is a more attractive idea. One could argue that during the early stages of development a child develops inappropriate strategies which delays his reading and spelling. The evidence for functional lag/deficit is fairly strong" (p. ۸۲). None of these studies explain the underlying cause of anomalous cerebral dominance. That is, how does maturational lag or left-hemisphere deficit happen? Some argue that some dyslexia is caused by minimal neurological dysfunction due to extensive or severe brain damage at birth (Thomson, ۱۹۹۴). However, the results of the studies are inconsistent and confounded with other variables such as socio-economic ones (Thomson, ۱۹۹۴). Geshwind and Galaburda (۱۹۸۵) gave a plausible explanation for the occurrence of brain symmetry in dyslexia. They

proposed that overproduction of, or oversensitivity to, testosterone in the foetus is the common factor causing dyslexia. This can also explain why boys are more affected by these disorders than girls. According to Geshwind and Galaburda (۱۹۸۵), testosterone delays the migration of neurones in language related regions of the left hemisphere.

Clinical studies used information processing models to explain academic difficulties of children. It has been proposed that the underlying skills necessary in early reading development are verbal abilities (including phonological awareness), visual-perceptual abilities, sequential and memory processing. It seems that dyslexics have difficulty in one or more of these areas (Singleton, ۱۹۹۴).

For the purpose of the current study the visual and verbal deficits associated with dyslexia are discussed. Myklebust and Johnson (۱۹۶۲) indicated two types of dyslexia, namely, visual and auditory dyslexia. They defined visual dyslexia as a deficiency in visual-spatial perception and visual discrimination. The children have problems with recognition of letter clusters, orientation, sequence and discrimination of size and form. The auditory dyslexic category used by Myklebust, et al. (۱۹۶۲) also indicated problems in naming, segmenting words into syllables and syllables into phonemes, sound blending, rhyming and letter-sound association (cited in Thomson, ۱۹۹۴). Obrzat (۱۹۷۹) suggested that dysphonetic dyslexia is due to left hemisphere deficit (cited in Thomson, ۱۹۹۴).

SUPERIOR ABILITIES ASSOCIATED WITH DYSLEXIA

The study of some famous people who showed signs of learning disability such as Leonardo da Vinci, Auguste Rodin and Charles Russell (Aaron and Guillemard, ۱۹۹۳), and the success of many dyslexic students in subjects like art, engineering technology, and architecture which require visual skills have led to investigations of the creative abilities of dyslexics. In this respect, Gardner (۱۹۸۳) linked this highly uneven profile of abilities and deficits of learning disabled individuals to genetic factors, or to specific neural regions. Geshwind's hypothesis of "right hemisphere dominance" attempts to explain this association.

Examinations of the brains of dyslexics (post-mortem examination or brain scanning methods) showed a reversal of cerebral asymmetry or symmetry of the planum temporal (an

area on the posterior superior temporal lobe involved in language processing) (Rosen, Sherman, and Galaburda, ۱۹۹۳; Galaburda, et al., ۱۹۸۹). Studies of symmetrical brain substrates support the idea that the right planum which is smaller than the left planum in the case of asymmetric brains has increased in size (Hugdahl, ۱۹۹۳).

It could be that symmetric and asymmetric brains have *patterns* of connections that are both qualitatively and quantitatively different (Rosen, et al., ۱۹۹۳; Galaburda, et al., ۱۹۸۹), and so are their functional capacity, information processing strategies, and their extent of hemispheric lateralization (Geshwind ۱۹۸۲). Geshwind and Galaburda (۱۹۸۵, p. ۴۳۲) postulated that this is due to "delay migration and/or abnormal neuronal assembly especially in left hemisphere regions," which can be caused by overproduction of or oversensitivity to testosterone. Thus, symmetrical brains and an enhancement of the functions of the right hemisphere are promoted (Tallal and Fitch, ۱۹۹۳).

Geshwind and Galaburda (۱۹۸۵) linked left-handedness and immune disorders with certain giftedness and dyslexia. The link between dyslexia, handedness and giftedness occurs because visual abilities and left-handedness are generally thought to be right hemisphere functions.
The questions now arise: ۱) is there any co-occurrence of creative talent with dyslexia? ۲) Is the talent associated with left-handedness? ۳) Is the talent related to cognitive deficit of dyslexia?

WHAT IS CREATIVITY?

Guilford (۱۹۵۰) suggested two distinguishing processes of thinking, convergent and divergent thinking. He regarded convergent thinking as reproductive thinking; components of intelligence tests measure this kind of thinking. Divergent thinking is productive thinking; creativity tests measure this kind of thinking (cited in Shouksmith, ۱۹۷۰).

He suggested four mental abilities involved in creativity. These are "fluency" (or the ease of producing ideas), "flexibility" (or attacking a problem from a new direction), "originality" (or giving an acceptable response not produced by others to the same problem) and "elaboration" (or amount of details) (Torrance, ۱۹۹۷).

Cognitive psychologists argue that talent in a given domain is associated with exceptional memory for that domain and has a specific kind of information processing and way of development (Gardner, Kornhaber, and Wake, ۱۹۹۶). Torrance tests of creativity are primarily based on the *process* rather than *content* of thinking, and they assess the process of creativity in different domains, two of which are figural and verbal.

Instruments

For the purpose of this study, the following instruments were used:

i) A computerised test to screen and assess the pattern or *profile* of cognitive *strengths* and *weaknesses* (Singleton, ۱۹۹۱) of dyslexic children.

ii) Block Design sub-test of Wechsler Intelligence Scales for Children-Revised (WISC-R, ۱۹۷۶); this sub-test has been used to assess the IQ of children. This sub-test examines the abilities to analyse and synthesise. It is chosen, because it is not dyslexia-laden, which means it would not present special difficulty to a dyslexic subject (Miles, ۱۹۹۳).

iii) Edinburgh Handedness Inventory, (EHI, Oldfield, ۱۹۷۱ see Schachter, ۱۹۹۳); this test consists of ۱۰ items. The subject places a plus sign in the left or right column for each item depending on which hand(s) is usually preferred. Laterality quotient (L.Q.) ranges from -۱۰۰ (complete left-handedness) to +۱۰۰ (complete right-handedness).

iv) Torrance Tests of Creative Thinking, (TTCT, Torrance, ۱۹۷۲); this test is appropriate to use in nursery through to graduate school. It consists of two kinds of tasks, namely, Verbal and Figural creative thinking. According to Torrance (۱۹۷۲) the tasks can be scored with sufficient reliability when the scoring guide is carefully studied and accepted. "Picture Construction" is one of the Figural Creative Thinking activities; form A. "Just Suppose" is one activity from the Verbal Creative Thinking activities; form A. Torrance (۱۹۷۲) reports reliability coefficients for these tests between .۹۴ and .۹۹.

Subjects

Two groups of children participated in the study. The first group (labelled dyslexic group) consisted of ۲۸ children with unexpected literacy difficulty. The age range of the dyslexic group comprising ۶ girls and ۲۲ boys, was ۵ years ۱۱ months to ۱۱ years ۱ month. The second group consisted of children with no apparent literacy difficulty. They were aged ۵ years ۱۱ months to ۱۱ years ۲ months and comprised ۹ girls and ۲۰ boys. This group was labelled "non-dyslexic". The two groups were matched on Block Design scores, age and handedness.

Results

Means and standard deviations (in brackets) of the scores of dyslexic and non-dyslexic children on the Picture Construction, Just Suppose tasks are presented in Table ۱.

Table ۱. Means and standard deviations (in brackets) of the scores of dyslexic and non-dyslexic children on the Picture Construction task and Just Suppose tasks.

	yslexic children	-dyslexic children	t-test
Figural originalit	۰,۵۷ (۰,۵۰)	۰,۷۲ (۰,۴۵)	$t_{(۵۵)}$=-۱,۲۰, p=.۱
Figural elaboratio	۱۰,۲۱ (۶,۹۸)	۱۲,۸۶ (۷,۹۸)	$t_{(۵۵)}$=-۱,۳۳, p=.۰
Verbal originalit	۲,۱۰ (۱,۹۳)	۲,۱۰ (۳,۱۰)	t(۵۵)=.۰۰۵, p=.۹
Verbal elaboratio	۱,۵۷ (۲,۱۶)	.۸۹ (۱,۳۷)	t(۵۵)=۱,۴۱, p=.
Verbal flexibilit	۱,۱۰ (۲,۶۴)	۰,۵۵ (۰,۹۰)	t(۵۵)=۱,۰۶, p=.۲
Verbal fluency	۳,۸۵ (۴,۶۳)	۳,۲۷ (۲,۲۰)	t(۵۵)=.۶۰۸, p=.۰

The results indicate that there were no significant differences between the two groups on the elements of both tasks.

Table ۲. Means and standard deviations (in brackets) of the scores the visual/spatial sub-group and non-dyslexic children on the two creativity tasks.

	Visual/spatia sub-group	non-dyslexi children	t-test (two-tailed)
Figural originality	.۵۳ (.۵۱)	.۷۲ (.۴۵)	$t_{(۴۰)}$=-۱,۱۷, p=.۲۴
Figural elaboration	۶,۵۳ (۵,۲۶)	۱۲,۸۶ (۷,۹۸)	$t_{(۴۰)}$=-۲,۶, p=.۰۱
Verbal originality	۲,۶۱ (۲,۲)	۲,۱۰ (۳,۱۰)	$t_{(۴۰)}$=.۵۳, p=.۵۹
Verbal elaboration	۲,۰۷ (۲,۸۴)	.۸۹ (۱,۳۷)	$t_{(۴۰)}$=۱,۸۲, p=.۰۷۵
Verbal fluency	۴,۷۶ (۵,۶۱)	۳,۲۷ (۲,۲۰)	$t_{(۴۰)}$=۱,۲۴, p=.۲۱۹
Verbal flexibility	۱,۱۵ (۲,۴۷)	.۵۵ (.۹۰)	$t_{(۴۰)}$=۱,۱۵, p=.۲۳

As Table ۲ indicates, the visual/spatial sub-group performed significantly lower than non-dyslexics in Picture Construction, when elaboration was assessed. Their scores were still lower on the originality component, but not significantly so. Regarding verbal creativity, the visual/spatial sub-group scored higher than non-dyslexic children, but the difference was not significant.

Table ۳. Means and standard deviations (in brackets) of the scores of the verbal/auditory sub-group and non-dyslexic children on all measures of the two creativity tasks.

	Verbal/auditory sub-group	Non-dyslexic children	t-test (two-tailed)
Figural originality	.۶۲ (.۵۱)	.۷۲ (.۴۵)	$t_{(۳۵)}$=-.۵۳, p=.۵۹
Figural elaboration	۱۰,۵ (۶,۳۰)	۱۲,۸۶ (۷,۹۸)	$t_{(۳۵)}$=-.۷۷, p=.۴۴
Verbal originality	۲,۰۰ (۱,۸۵)	۲,۱۰ (۳,۱۰)	$t_{(۳۵)}$=-.۰۸, p=.۹۲
Verbal elaboration	۰,۶۲ (۱,۰۶)	۰,۸۹ (۱,۳۷)	$t_{(۳۵)}$=-.۵۱, p=.۶۰
Verbal fluency	۴,۲۵ (۴,۶۵)	۳,۲۷ (۲,۲۰)	$t_{(۳۵)}$=.۸۵, p=.۴
Verbal flexibility	۱,۸۷ (۳,۸۳)	۰,۵۵ (.۹۰)	$t_{(۳۵)}$=۱,۷۴, p=.۰۹

There were no significant differences between the two groups on the scores of originality and elaboration indices of Picture Construction. The verbal/auditory sub-group scored slightly lower on originality, and slightly higher on elaboration aspects of the Picture Construction task. Comparing their performance on the verbal creativity task, the verbal/auditory sub-group scored slightly lower on the originality and elaboration aspects of the Just Suppose activity, but not significantly. They scored higher than non-dyslexic on fluency and flexibility indexes of verbal creativity task.

Table ۴. Pearson correlation coefficient of handedness and indices of the two creativity tasks among the four groups.

	Handedness		
	Visual/spatial sub-group	Verbal/auditory sub-group	Non-dyslexic children [a]
Figural origina	.۰۳	-.۴۹	.۱۴
Figural elaborat	.۱۲	-.۸۳*	-.۱۲
Verbal elaborat	.۱۹	-.۶۹	-.۱۹
Verbal flexibil	.۱۴	-.۴۳	.۲۹
Verbal fluenc	.۱۵	-.۶۵	.۰۳
Verbal original	.۳۶	-.۷۰	.۰۱

*. Correlation is significant at the ۰,۰۵ level (two-tailed)

a. The correlation coefficient of this group has been processed by Spearman.

The results demonstrate that there were no correlations between handedness and the originality and elaboration aspects of the figural creativity task and the originality, elaboration, flexibility and fluency aspects of the verbal creativity task, among the dyslexic children. This was also the case for the visual/spatial sub-group. However, in the verbal/auditory sub-group, there was a significant correlation between their handedness and the elaboration aspect of the figural creativity task. There was no significant correlation between the handedness of non-dyslexic and their creativity scores.

Table ۵. Pearson correlation coefficient of age and all measures of the two creativity tasks among the dyslexic and non-dyslexic groups.

	dyslexic children	Non-dyslexic children
Figural elaboration	.۶۰**	.۵۷**
Figural originality	.۲۸	.۱۹
Verbal elaboration	.۲۴	.۱۷
Verbal flexibility	.۱۰	.۲۲
Verbal originality	.۱۴	.۲۷
Verbal fluency	.۰۹	.۴۵*

**.Correlation is significant at the ۰,۰۱ level (۲-tailed)

*.Correlation is significant at the ۰,۰۵ level (۲-tailed)

Since figural elaboration had a significant correlation with age, it was assumed that age may have affected the correlation between figural elaboration and handedness of verbal/auditory sub-group. For this reason, a partial correlation between handedness and figural elaboration of verbal/auditory sub-group in which age was controlled was processed. Even after controlling the age of the verbal/auditory sub-group, there was a significant correlation between left-handedness and figural elaboration ($r = -.۷۷$, $p < ۰,۰۵$).

Discussion

This study found no significant differences between children with and without dyslexia in terms of creative abilities. This means that the hypothesis which suggested that dyslexic children perform higher than their non-dyslexic counterparts on creative thinking tasks was not supported. The result was consistent with Everatt et al. (۱۹۹۹) and LaFrance's (۱۹۹۷)

studies. Based on these studies, dyslexic children had the same strength as their non-dyslexic counterparts in producing novel ideas.

However, when comparing the visual/spatial sub-group with the non-dyslexic group, the visual/spatial sub-group showed a significantly lower performance on the figural creativity task. Considering the literature about the comparisons between non-dyslexic and dyslexic children in terms of figural creative abilities, it could be seen that there was a high level of contradiction among the findings of the various studies, in particular when the elaboration aspect of figural creative thinking ability was accounted for. The study of Tarver, et al. (۱۹۸۰), exhibited lesser ability ofdyslexic children in comparison with their non-dyslexic counterparts. On the other hand, the studies of LaFrance (۱۹۹۷), and Everatt, et al. (۱۹۹۹) consistently showed no discrepancy between dyslexics and non-dyslexic children. In the current study the performance of this sub-group of dyslexics did not support Geshwind and Galaburda's (۱۹۸۵) hypothesis. These children showed significantly less talent in related right hemisphere functions than non-dyslexic children did. They might have right hemisphere deficit or maturational lag.

Furthermore, the figural creativity of the verbal/auditory sub-group was found to be highly correlated to left-handedness. Geshwind and Galaburda (۱۹۸۵) postulated a three-way relationship between dyslexia, handedness and creativity. Thus, the creative talent of dyslexics should be related to their left-handedness. As the current study showed, there was no correlation between these two factors in the dyslexic and non-dyslexic groups. So, the mixed group of dyslexics could not be used to support the hypothesis of "enhanced right hemisphere". Regarding the visual/spatial sub-group of children with dyslexic, there was, once again, no correlation between handedness and creativity. Nonetheless, there were high correlations between handedness and all the creativity measures among the verbal/auditory sub-group. From which the correlation between handedness and figural elaboration was significant even when age was controlled. Stronger left handedness was significantly associated with higher figural creative thinking ability, both of which are strongly right hemisphere functions.

Correlation was observed between age and figural elaboration in the case of the dyslexic group and age and figural elaboration and verbal fluency in the case of non-dyslexic children.

The result of correlation between all measures of the two creativity tasks and age of dyslexic and non-dyslexic groups indicated that the only significant age correlation for the dyslexic group was figural elaboration, in which ability increased with age. There was no correlation between verbal creativity and age for dyslexic children. In reference to non-dyslexic group, there was a correlation between age and figural elaboration as well as verbal fluency, in which with increasing age these abilities were also increased. With respect to figural elaboration, the result was consistent with the study of Tarver, et al. (۱۹۸۰). They found significant grade differences for both groups. With regard to verbal fluency, the result was also consistent with Tarver, et al. (۱۹۸۰); they found an increase in verbal ability for non-dyslexic children and not dyslexics. They suggested that the lack of enhancement of verbal ability for dyslexics might be due to the negative effect of society on dyslexic children. Others (e.g., Eisen, ۱۹۸۹), however, argued it is due to the effect of language disabilities associated with these children.

In conclusion, the study demonstrated that children with no learning difficulties as much as children with learning difficulties exhibited creative capabilities. In addition, the study indicated the existence of a sub-group of dyslexic children with visual/spatial deficit and no verbal/auditory deficit who did not function very well when using non-verbal skills, but had adequate verbal skills. However, their verbal creative functions were not associated with their handedness. Hence, the correspondent talent was not related to the enhanced right hemisphere. Moreover, the presence of an enhanced right hemisphere among the verbal/auditory sub-group with no visual/spatial deficit might be justified. The figural creativity of verbal/auditory sub-group was associated with left-handedness, both of which are strongly indicated to be right hemisphere functions. The existence of this phenomenon merely among the verbal/auditory sub-group can meet and support one of the facts that the hypothesis of "enhanced right hemisphere" has predicted. Neither the whole group of dyslexic children nor the visual/spatial sub-group displayed this pattern. The verbal/auditory sub-group might be the critical group that Geshwind et al. (۱۹۸۵) noticed. In addition, the low performance of visual/spatial sub-group of dyslexic children in comparison with non-dyslexic children on elaboration aspect of figural creativity may explain the equivocal results from previous studies on this aspect of creativity among dyslexics and non-dyslexics.

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