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The Role of Nonverbal IQ in Screening Batteries for Reading Deficits

Ammara Farukh * Syed Shujaat Ali † Muhammad Shahid ‡

Abstract: *The study tried to establish the role of non-verbal IQ tasks to screen the children for reading deficits including dyslexia at initial stages of their schooling. The participants of the study were 66 children screened from a bigger sample of a prior study (Farukh & Vulchanova, 2014). The participants were 9 years old, and studying in public and private sector schools of a developing district in Punjab, Pakistan. They were tested on 7 standard IQ tasks (WISC III & Raven's matrices). No significant difference on IQ scores was observed between the reading deficit group and the control group except the digit coding task. High Socio-economic status (SES) and better educational opportunities were shown to act as a positive factor for better performance on IQ tasks.*

Keywords: Reading deficits, screening batteries for dyslexia, nonverbal IQ, digit coding task, Raven's Matrices, WISC III.

Introduction

The role of intelligence in dyslexia and general reading disabilities requires discussion. Individuals with dyslexia are characterized with abnormal (atypical) activation of the brain circuits that support reading (Morken, Helland, Hugdahl, & Specht, 2014), whereas garden variety poor readers have under-developed reading circuits as a result of insufficient instruction and developmental delay. Traditionally, the term dyslexia has been thought of as an inability to acquire reading skills despite adequate intelligence and educational opportunities. Garden variety poor readers are not considered to have dyslexia if they have lower intelligence or have missed educational opportunities, as dyslexia is usually defined by a discrepancy between good score on a test of IQ (intelligence quotient) and a low score on a standard reading test (according to discrepancy definition of dyslexia). Furthermore, the central mechanism of poor reading is reported to be similar in all children with dyslexia (independent of the IQ score that appears on a wide continuum for different individuals). They are also observed to be benefitted from the same treatment as poor readers (Stanovich, 2005).

Overall, intelligence, as measured on standardized IQ tests, contributes significantly in the teaching-learning process. IQ test is a summary of performance on all tests of ability

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and its results can help diagnose for individuals whose failure in literacy, in the presence of appropriate teaching, might imply intellectual deficit. It may also act as a guide for establishing expectations in teaching (Turner, 1997). It confirms if the failure in literacy is caused by an intellectual deficit or not.

As a diagnostic tool, the scores on IQ tests are used to rule out the possibility of any intellectual deficit which might be the cause of a reading deficit other than dyslexia. Despite the evidence that the reduced pattern of brain activation during phonological processing, typical of dyslexia, is similar in both discrepant and non-discrepant poor readers (Tanaka et al., 2011), IQ tests are routinely used in test batteries used for assessing dyslexia (reading deficit).

Dyslexia and Giftedness

Following the discrepancy definition of dyslexia, intelligence is assumed to be within the normal range for children with dyslexia, and as such, is not expected to impact on the condition. At the same time, it has been observed that some children with dyslexia develop into extraordinarily successful adults (van Viersen, de Bree, Kroesbergen, Slot, & de Jong, 2015).

Problems in Measuring IQ in individuals with Dyslexia

It can therefore be concluded that the IQ discrepancy diagnosis of dyslexia places great weight on IQ scores, although exceptions may also be attested (Miles, 1996b). Nevertheless, IQ tests may not be a valid measure of intelligence for individuals with dyslexia given these individuals are often slow at processing information and following instructions, and IQ tests typically place time constraints.

Despite all these concerns, IQ discrepancy provides an effective means of screening out garden-variety poor readers compared with children with a reading deficit. To make the intelligence tests more valid for measuring intelligence among children with dyslexia, some recommendations in administrating the tests have been suggested and quoted by (Miles, 1996a). He emphasizes that one should attempt to find global patterns in dyslexic performance in the subtests of the intelligence tests, and use these as guidelines.

Some studies report cases of language-related deficits against special talents in other cognitive domains, such as high intelligence, mainly in the nonverbal areas (Winner & Casey, 1992; West, 1991; Craggs, Sanchez, Kibby, Gilger, & Hynd, 2006). At the same time, there is evidence that such "giftedness" is more often present in readers with dyslexia than in normal readers (Winner & Casey, 1992). It has been suggested to be theoretically possible for "some combination of neurodevelopmental events" to create the co-occurrence of dyslexia and nonverbal advantages in some people. Therefore, a shared etiology for both conditions could be imagined, the actual causes of which (i.e. genes, hormones, etc.) are unknown (Craggs et al., 2006). It has been proposed that the developmental processes and neurology causing dyslexia allow the dyslexic brain to be more skilled at particular (nonverbal) skills than the non-dyslexic brains (Geschwind & Behan, 1982).

Coming again to the point of giftedness, it is believed to have nothing to do with dyslexia, but to compensatory activities using other faculties. Although, contrary to this belief, recent research (van Viersen et al., 2015) has claimed that in a sample of 73 Dutch primary school children including a dyslexic group, a gifted-dyslexic group, and a borderline-dyslexic group i.e., gifted children with literacy problems. Children were assessed on literacy, phonology, language, and working memory. The results exhibited no sign of compensation of dyslexia-related deficits by giftedness-related advantages in gifted children having dyslexia. There was no proof for compensation by peculiar strengths more relevant to development of literacy in the third (borderline) group.

In sequence of the previous research, this study tried to compare non-verbal IQ between typical readers and poor readers studying together in grade 3. The children (both groups) were selected both from Urdu and English medium schools, and were tested on 7 non-verbal IQ measures.

The findings were that both (typical & poor reader) groups performed similarly on all tasks in both types of schools, except the digit coding task. Furthermore, the score of both groups in English medium schools was better than their counterparts at Urdu medium schools. The finding of the study can contribute to the data for setting universal patterns of dyslexic performance on nonverbal IQ tasks. Furthermore, this is the first study of its nature conducted in Pakistan which adapted nonverbal IQ tasks, and used international standard tasks for screening dyslexia.

Predictions

As the children are exposed to same educational opportunities (studying together in same school and same grade), and given the discrepancy definition of dyslexia, the children should exhibit similar scores on non-verbal IQ tasks. The 2 groups from English medium schools might score a little better due to their exposure to similar extracurricular activities, better educational opportunities, and relatively higher SES.

Materials and Method

Participants and Preliminary Procedure

The participants of the study were 66 children selected from among 150 third graders (96 boys and 54 girls) in a prior study (Farukh & Vulchanova, 2014). The participants were studying at public and private schools in a developing district in Punjab, Pakistan. They were screened for reading skills and potential reading deficit in a test involving a non-word repetition task (in Urdu) and a classical RAN battery (Farukh & Vulchanova, 2014).

Scores for reading speed; rapid automatized naming of colours, objects, letters, and numbers, and errors at repeating 4-syllable non-words, were used to further distribute the children into groups. The children with a score below the 25th percentile on 3 or more tasks were considered as having a reading deficit (RD), while the children with a score

between the 25th and 75th percentile on 3 or more tasks were included in the control groups.

Urdu is the national language of Pakistan, and the medium of instruction in all public sector schools and most of the private sector schools. The schools that were chosen to select the children from were Urdu medium (both public and private sector) schools, as well as English medium private sector schools, where, typically, children from high SES families get admission.

The term "reading deficit group" is used in this paper to identify participating children who might present with a reading disorder. However, in the absence of any standard tests for diagnosing dyslexia in Urdu, we cannot state with any degree of certainty that such a deficit is present in those children.

66 participants were selected for the second phase of testing out of the original sample. Both types of schools (Urdu & English medium schools) contributed 2 groups of participants, a Reading Deficit (RD) Urdu group (20), an RD English group (14), a control Urdu group (18) and a control English group (14).

The tasks administered in the Second Phase are listed below:

WISC-III (1991) & Raven's Matrices

The participants in the second phase went through a battery of tests to check nonverbal IQ including some standard sub-tests from WISC-III (1991), such as digit coding, picture completion, block design, arithmetic, picture assembly, and picture arrangement. In addition, Raven's coloured progressive matrices (Raven & Raven, 1998) were administered. Performance on IQ tasks is not language-, status- and culture-free (Gunderson & Siegel, 2001); thus we properly translated all instructions into Urdu to confirm that the children from both schools were able to understand them equally. Independent samples t-tests for equality of means were applied for IQ (Appendix A and B) after splitting the files for school type to ensure that there was minimum effect of SES.

Results

Results from the t-tests showed that the reading deficit groups and control groups in both types of schools did not differ significantly on any of the IQ measures except for digit coding speed. The t-test results from English medium schools were as follows: for digit/symbol coding t =.12, df = 26, p= .01, for picture completion t =-1.37, df = 26, p=.18, for block design t =-.61, df = 26, p=.55, for arithmetic t =-1.24, df = 26, p=.225, for picture assembly t =-.08, df = 26, p=.94, for picture arrangement t =-.89, df = 26, p=.38, and for Raven's coloured progressive matrices t =-2.04, df = 26, p=.05.The t-test results from Urdu medium schools were, respectively: for symbol coding t=-2.83, df = 36, p= .01, for picture completion t =-1.05, df = 36, p=.30, for block design t =-1.26, df = 36, p=.22, for arithmetic t =-2.52, df = 36, p= .02, for picture assembly t =-.87, df = 36, p=.39, for picture arrangement t =-2.01, df =36, p=.05, and for Raven's coloured progressive matrices t =-2.08, df = 36, p=.05.

The results from both t-tests show that the main significant difference between the performance of the children from the control group and the RD group in both types of schools is on the digit/symbol coding task. At this task the reading deficit groups are significantly behind the controls at both schools (p= .01 for both schools) according to the p-value that was adjusted to .007(.01), using Bonferroni correction formula for a comparison with 7 variables. Secondly, the group statistics in Appendices (table 1 & 2) show that both groups at English medium schools scored higher than their counterparts at Urdu medium schools. In addition, there is seen a tendency towards significant differences between the RD children and controls at the Urdu medium schools in arithmetic, picture arrangement and on Raven's matrices.

Discussion

Although interventions for children with reading problems (including poor readers and children with dyslexia) are similar (Stanovich, 2005), intelligence scores have an additional value from the point of view of remediation. They provide a clearer picture of a range of abilities, which could be improved to compensate for the impaired reading skills.

The relationship of dyslexia and IQ is still controversial despite contradictory evidence both supporting the presence of extraordinary IQ abilities (Craggs et al., 2006) and of the absence thereof in individuals with dyslexia (van Viersen et al., 2015). The present study revealed largely similar intelligence levels in the control and the reading deficit groups at both types of schools. After providing equal/similar educational opportunities, and following the discrepancy concept, the largely similar IQ scores of children may suggest that the children from the reading deficit group are not poor readers, but might present with dyslexia. Furthermore, the main significant difference between the RD groups and controls at both types of school was in the domain of digit coding speed. This difference is indicative of a deficit in dyslexia in processing speed, potentially leading to the well-attested phonological processing deficit (Turner, 1997). It should be noted, however, that the RD children from the Urdu medium schools displayed additional problems, in comparison to controls. The tendency towards a significant difference in picture arrangement and matrices can be further related to processing deficits and thus related to dyslexia. The trend towards a significant difference on arithmetic can be indicative of co-morbid dyscalculia. Alternatively, these differences may reside in cultural and social (SES) factors, as the children from the Urdu medium schools are less likely to have been exposed to matrices tasks or tasks involving picture arrangement. In addition, both groups (control and the RD group) at English medium schools scored higher than the two counterpart groups at Urdu medium schools, which shows the advantage of exposure to similar tasks through extracurricular activities both at school and at home (Gunderson & Siegel, 2001). These results are in need of further investigation with more carefully controlled environmental factors.

The findings of the present study highlight the relevance of intelligence skills in the identification of reading deficit, and are largely consistent with a discrepancy/exclusionary

criteria view of dyslexia. They also suggest an effect of SES/ medium of instruction, opportunities and exposure to perform extra-curricular activities on performance on IQ tests. Yet, further study with a bigger sample is required to validate the results and to make more realistic pedagogical implementations.

Appendices

Table 1
Summary of Group Statistics showing scores of the RD group and the control group at English medium schools

	Group	Mean	Std. Dev	Std. Error Mean
DigitCodingPoint	RDG	90.93	2.37	0.63
	CG	90.79	1.48	0.40
PictureCompletion	RDG	3.57	3.92	1.05
	CG	5.64	4.09	1.09
Blockdesign	RDG	9.71	4.16	1.11
	CG	10.5	2.41	0.64
Arithmetic	RDG	9.29	2.23	0.60
	CG	10.14	1.29	0.35
PictureAssembly	RDG	4.00	2.57	0.69
	CG	4.07	2.27	0.61
PictureArrangement	RDG	6.71	3.60	0.97
	CG	7.79	2.72	0.73
Ravensmatrices	RDG	16.86	5.26	1.41
	CG	20.71	4.73	1.26

Note: RDG= Reading Deficit Group, CG= Control Group, N= 14 (for both groups).

Table 2
Summary of Group Statistics showing scores of the RD group and the control group at Urdu medium schools

	Group	Mean	Std. Dev	Std. Error Mean
DigitCodingPoint	RDG	87.3	5.34	1.20
	CG	88.39	5.14	1.20
PictureCompletion	RDG	2.45	3.07	0.69
	CG	3.72	4.38	1.03
Blockdesign	RDG	6.85	2.89	0.65
	CG	8.06	3.02	0.71
Arithmetic	RDG	8.90	1.65	0.37
	CG	10.17	1.43	0.34
PictureAssembly	RDG	2.55	2.24	0.50
	CG	3.22	2.53	0.60
PictureArrangement	RDG	2.85	2.35	0.53
	CG	4.61	3.05	0.72
Ravensmatrices	RDG	12.1	4.05	0.91
	CG	15.22	5.20	1.23

Note: RDG= Reading Deficit Group, CG= Control Group, N= 20 (for RDG), N=18 (for CG).

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