



## The Effectiveness of the Barton Intervention Programme on Reading Skills of Dyslexic Students

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### ABSTRACT

The purpose of this study was to determine the effectiveness of the Barton intervention programme on reading skills of dyslexic students. This study used an experimental design. The population included 138 fourth and fifth graders of male and female dyslexic students in Ilam, Iran. A total of 64 dyslexic students were randomly selected and assigned into two groups, namely; the control group and the experimental group. The experimental group received three months of treatment. Pre-test and post-test for the reading skills (i.e. reading recognition, reading fluency and reading comprehension) were carried out on the students to measure their reading skills. The reliability of the reading skills was also confirmed. In addition, the content validity of the scales was investigated using the judgments of 10 psychology experts, whose expert knowledge also confirmed the scales. The analysis of the findings using the Multi-variate Analysis of Variance and the Analysis of Variance showed a significant difference between the control and experimental groups after the treatment of Barton intervention programme, i.e. at  $p < .000$ .

*Keywords:* Intervention, reading, fluency, comprehension, reading recognition, dyslexia

### INTRODUCTION

Dyslexia is a specific learning disability that is neurological in origin. It is characterized by the difficulties with accurate and/or fluent word recognition and decoding abilities. These difficulties typically result from a deficit in the phonological component

of language that is often unexpected in relation to other cognitive abilities and the provision of effective classroom instruction. Secondary consequences may include problems in reading comprehension and reduced reading experience that can impede growth of vocabulary and background knowledge (Hennessy, 2003). Byrne and Fielding-Barnsley (1995) carried out a 12-week intervention in which the kindergarteners were taught the principle of phoneme identity, such as the words that can begin and end with the same sound. At the

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end of the training period, the children from the experimental group outperformed those from the control group. Two years later, at the end of the first grade, the experimental group performed better than the control group in reading and they showed a marginal advantage when reading regular words. At the end of the second grade, i.e. three years after the intervention, the experimental group remained ahead of the control group in decoding skills and they also did better in reading comprehension.

For dyslexic students, there are specific and significant difficulties with fluent reading and the phonological components of language, which are related to the left hemispheric language functions of the brain. Many prominent researchers have linked dyslexia to cortical anomalies and neurophysiological dysfunctions, particularly to the areas of the brain impacting language functions (e.g. Duane, 1991; Galaburda, 1999; Ojemann, 1991). According to Shaywitz (2003), the automatic detector in the left occipitotemporal area of the brain breaks down in children with dyslexia. A neurological anomaly prevents their brains from gaining automatic access to the word analyzer and phoneme producer areas of the brain. A microscopic examination of dyslexic brains conducted by Galaburda (1994) revealed several abnormalities in the brains involving ectopias and dysplasisas (a kind of scarring) of the neurons. These cortical lesions were taken to suggest atypical patterns of neuronal circuitry. An associated finding was symmetry of the planum temporal.

Rather than finding the left planum to be larger than the right in these dyslexic brains, they were equivalent in size, with the right larger than normal. Taken together, these findings suggest that the differences in the brain structure in dyslexic children date back to prenatal brain differentiation, i.e. a process that is under genetic control.

According to Shaywitz *et al.* (2004), phonologically reading intervention will improve reading and development of the neural systems serving reading. The experimental intervention was structured to help students increase phonological knowledge, and at the same time, develop their understanding of how the orthography represents the phonology. Students who received the experimental intervention programme not only improved their reading but also demonstrated an increase in activation in the anterior system as well as in the parietotemporal and occipitotemporal system, as compared to their preintervention brain activations. A study by Temple *et al.* (2003) showed that intervention programme resulted in improvement in reading accuracy and increased brain activation in the posterior reading systems as well as in right hemisphere and cingulated cortex.

## READING

The National Reading Panel Report recommended integration across all three areas, namely; alphabetic, fluency and comprehension – in order to create a complete reading programme (Daly *et al.*, 2005). Research indicates that phonological

coding ability is the primary determinant of a child's success in mastering the alphabetic code and learning to attach names to printed words, whereby both are essential components in learning to read (Vellutino, 1991). Dyslexic students experience severe phonological processing problems (Lovett & Steinbach, 1997). Since success in reading in the elementary grades is best predicted by measures of phonological awareness and phonological processing skills in kindergarten, difficulties with decoding and word identification should be addressed as early as possible in a child's school experience (Wagner *et al.*, 1994). However, research also suggests that phoneme awareness deficits are characterized in dyslexic students at all ages (Bruck, 1992).

The development of reading fluency has been linked to successful reading since the research on the psychology of reading (Chard *et al.*, 2002). Reading fluency is developed through repetition, like playing tennis which is perfected through repetition (Chard *et al.*, 2002). In 1974, Laberge and Samuels discussed how reading involves automatically processing letters into words and words into meaningful texts (Chard *et al.*, 2002). In spite of research stating the necessity of reading fluency, it is still an element that is often overlooked in the development of reading programmes (Chard *et al.*, 2002). After the primary grades, students are expected to read independently to learn contents for pleasure, and if they are unable to process the assigned material, they may develop

negative attitudes towards reading and fall behind in content acquisition (Worthy & Prater, 2002). Thus, being a fluent reader makes the workload in the upper elementary and secondary grades manageable. Fluency is rarely taught after the primary grades, although fluency instruction has been found to be appropriate for all ages and a crucial component of completion and enjoyment in reading (Cunningham, 2001).

Many dyslexic students depend on semantic-contextual cues and pictures to figure out word meaning because they do not know how to decode words (Kim & Goetz, 1994) and are unable to focus on meaning (Williams, 1991). When a great deal of capacity is required for decoding, comprehension suffers (Laberge & Samuels, 1974). Given the increasing difficulty of words found in content textbooks, dyslexic students need to learn strategies to re-decode words accurately and automatically. Dyslexic students know alarmingly few words (Beck & McKeown, 1991). Typically, these students do not read books, and thus, lack exposure to words (Carlise, 1993). In addition, many dyslexic students do not read fluently because of continued difficulties with phonology, language structure and decoding (Samuels, 1979). They have difficulties with basic word recognition (Beck & McKeown, 1991), and thus, they read word by word at a slow rate (Henk *et al.*, 1986). This reflects a lack of sensitivity to grammatical boundaries and makes it difficult for them to read fluently and comprehend the text. Given the strong relation between fluency and comprehension

(e.g., Anderson *et al.*, 1991), strengthening students' fluency may further boost their comprehension (Fuchs *et al.*, 1999).

Dyslexic students do not brainstorm and activate prior knowledge before reading or making connections to old and new information (Campbel *et al.*, 1998). Torgesen (1982) found that students with reading disabilities were inactive readers and were lacking in comprehension strategies that would assist them in understanding the meaning of text. These students have difficulty summarizing and comprehending text because they tend to reflect on information that is not central and tend to omit pertinent pieces of information (Winograd, 1984). In particular, one of the largest problems for dyslexic students is differentiating peripheral details from main ideas in the text (Wong, 1991). As noted by Daneman (1991), vocabulary is partially an outcome of comprehension skills, and likewise, reading comprehension is partially an outcome of vocabulary. Dyslexic students need specific strategy training in monitoring comprehension and specific strategy instruction in previewing and activating prior knowledge (Langer, 1984), predicting (Readence *et al.*, 1998), clarifying and summarizing to facilitate content text understanding (Torgesen, 1982).

Reading comprehension is an active process that requires an intentional and thoughtful interaction between the reader and the text. As reader tries to comprehend the material he/she reads, he/she must bridge the gap between the information presented in the written text and the knowledge he/

she possesses. Reading comprehension thus involves thinking. The reader's background knowledge, interest and the reading situation affect comprehension of the material. Each person's integration of the new information in the text with what is already known will yield unique information (National Reading Panel, 2000). All reading instructions should provide for the development of reading comprehension. For dyslexic students, reading comprehension is a major problem. Comprehension skills do not automatically evolve after word-recognition skills have been learned. Although most dyslexic students eventually learn the basics of word-recognition skills, many continue to have great difficulty with tasks that require comprehension of complex passages. These students need to learn strategies that will help them become active readers who understand the text (Lerner, 2006).

Reading comprehension is the reader's ability to understand what is read; ultimately to be able to restate it in his or her own words (Harris & Hodges, 1981). Thus, the reader must be able to decode words on the printed page, recognize important elements of the text, manipulate the ideas presented and reorganize them so they are recalled readily when needed. There is inter-relatedness between fluent reading and comprehension (Cheek & Cheek, 1986). Comprehension, like reading, is divided into a hierarchy, the scope of which includes literal, interpretive and critical skills. Literal comprehension is the process of getting verbatim details from the text, and is thought of as the basic skill. Proficiency must

be developed with literal comprehension before higher level skills can be acquired, making literal comprehension an integral part of the total reading process. Interpretive skills involve drawing conclusions, making generalizations, predicting outcomes and synthesizing ideas. Drawing inferences and interpreting the language of the author are important in comprehending the inner meaning of the material read (Cheek & Cheek, 1986). Lastly, critical comprehension skills require that evaluative judgments and reasoning be put to use by the reader. Burns and Roe (Burns & Roe, 1980) stated that critical reading is the evaluation of writing, which includes skills such as the ability to differentiate between fact and opinion, or between fantasy and reality (Rubin, 1991).

Comprehension has been studied repeatedly in the literature (e.g., Kamps *et al.*, 1994; Layton & Koenig, 1998). There are a variety of methods regarding measurements of comprehension and retention. Researchers have investigated the area of reading comprehension using retelling assessments. For example, Askew (1985) explored the effects of a measurement task and retelling on sixth-grade students' comprehension of expository text. In another investigation, Morrow (1985) examined the effects of preschool children's comprehension and sense of story structure using retelling as the dependent measure. Additionally, retelling is also used to evaluate the effects of study skills instruction as related to comprehension of expository tests (Adams *et al.*, 1982; McCormick & Cooper, 1991). Likewise, a number of techniques for aiding

students in understanding text have been evaluated empirically in the literature. For example, previewing text has been found to have a positive effect on comprehension. Dowhowe (1987) found that a group of students instructed with guided oral reading showed significant gain in comprehension in comparison to the unassisted group who read alone.

The aim of this study was to compare between the experimental group and the control group of dyslexic students after the treatment of Barton programme. The research hypotheses were as follows:

- There is a statistically significant difference in the reading skills between the control group and the experimental group of the dyslexic students after the Barton treatment programme.
  - There is a statistically significant difference in the reading phonic between the control group and the experimental group of the dyslexic students after the Barton treatment programme.
  - There is a statistically significant difference in the reading fluency between the control group and the experimental group of the dyslexic students after the Barton treatment programme.
  - There is a statistically significant difference in the reading comprehension between the control group and the experimental group of the dyslexic students after the Barton treatment programme.

## METHODOLOGY

### *Design*

Based on literature review, the experimental design was employed for the current research. This design controls the threats to internal validity. Explanations of how this design controls these threats are as follows: (1) History: This was controlled in that the common history events, which might have contributed to the pre-test and post-test in the experimental group effects, would also produce the pre-test and post-test in the control group effects, while a solution to history in this research is the randomization of experimental occasions, i.e. balanced in terms of the experimenter, time of day, week and so forth; (2) Maturation, testing and mortality are controlled in which they are manifested equally in both the treatment and control groups.

### *Procedure*

In this study, the students of the fourth and fifth grades with dyslexia were first identified by using a questionnaire called "Dyslexia Screening Instrument". Two 100-word passages from their book, with 10 comprehension questions, were selected and assigned to the students to read. Their marks were scrutinized in the first semester and found to be lower than their counterparts. In order to examine their IQ, Raven's Test was performed to differentiate dyslexic students from the other groups with learning problem like slow learners, and the students with the average IQ higher than 90 made up the population of this

research. Finally, the population consisted of 138 dyslexic students in the fourth and fifth grades in Ilam, Iran. The population included 40 male students of the fifth grade, 37 male students of the fourth grade, whereas 38 female students of the fifth grade and 22 female students of the fourth grade. Their age ranged from 10 to 12 years. The researcher used the random number tables to select 64 dyslexic students and to categorize them into two groups, namely; the control group and the experimental group, with 32 students in each group. The tests for the reading scales ("Letter-Word Identification", "Reading Comprehension" and "Reading Fluency") were conducted on both groups. The children were given verbal instructions on how to complete the "Letter-Word Identification", "Reading Fluency" and "Reading Comprehension" (Woodcock *et al.*, 2004). The measures were used one by one in the classroom by the researcher who read the items aloud and circulated in the classroom, while observing the students' understanding of the instrument and providing assistance whenever necessary. In addition, demographic variables, such as age and IQ, were obtained as well. When the students had completed the measures (approximately 40 minutes later), they returned to their classroom.

### *Treatment*

The Barton (2000) Intervention Programme was used in this study. The Barton Reading and Spelling System has 10 levels which are broken into lessons, and each lesson, in turn, is further broken into procedures. In



this study, only level one and level two were taught with some adjustments. In advance, level one and level two were adjusted to fit this study. Considering the fact that there are 26 consonants (6 vowels, a digraph and a few exceptions) in Persian, 6 lessons were specified for level two. Like the Barton (2000) Intervention Programme, the teaching procedures in the adjustment programme started with the easy level and gradually became complicated. Since instruction tools were not available in Persian, the researcher provided the necessary tools based on the Barton programme. The instruction tools included: (1) colour-coded tiles of letters, (2) word lists, (3) cards, on which words are written in blue for the consonants and red for the vowels, (4) a whiteboard, (5) blue and red markers, and (6) a notebook for dictation, along with red and blue pencils, an eraser and a sharpener. According to Barton (2000), level one is taught first, followed by the teaching of 6 consonants and one vowel in each session of level two. Sometimes, due to the difficulty of some consonants or vowels, some lessons were repeated for 2 to 4 sessions. Therefore, the instruction was done one by one for 36 sessions in 12 weeks. Each week, three sessions were conducted, whereby each session lasted for 45 minutes. It seems necessary to note that the students received the treatment in their school one by one, which was arranged by the principal. Meanwhile, the instruction time was set by the tutors. If the students could not learn a lesson properly, the lesson would be repeated till they learned it.

### *Pilot Study*

The purpose of carrying out the pilot study was to evaluate the suitability and appropriateness of the use of the instruments. For the pilot study, 30 dyslexic students with similar characteristics to that of the participants in this study were randomly selected in Ilam. These consisted of 19 male and 11 female students. This study was carried out from 1<sup>st</sup> to 10<sup>th</sup> March, 2010. The data were entered using the SPSS Version 17 Windows XP software to determine reliability of the scales. The reliability test was applied by calculating the Cronbach's alpha on most variables to measure the inter-item reliability. It appeared that there was consistency in the following variables: Letter-Word Identification, Reading Fluency and Reading Comprehension. Internal consistency is usually measured by using Cronbach's alpha, a statistic that is calculated from the pair-wise correlation between items. Meanwhile, internal consistency ranges between zero and one. Cronbach's alpha coefficient of reliability, an alpha of .70, is normally considered to indicate a reliable set of items (De vau, 2002). The reliability coefficient for each instrument used in this pilot study was also obtained. Cronbach's (1951) alpha reliabilities of the Letter-Word Identification, Reading Fluency and Reading Comprehension were found to be .84, .85 and .83, respectively. The results of the reliability coefficient showed a high reliability for all the three instruments, suggesting that these instruments were considered as appropriate to be employed further in this study.

### Validity

In order to achieve the validity of Letter-Word Identification, Reading Fluency and Passage Comprehension Scales, 10 psychology experts first graded the scales from 1 to 5. The acceptable degree figures are shown in Table 1. Although there was no statistic for content validity, a statistical figure and mean were introduced (*see* Table 1). It is important to note that what have been presented in Table 1 are the acceptability degree criteria among the judges.

TABLE 1  
Juror rank given by experts (Gregory, 2004)

| Juror | Mean Fluency | Mean Comprehension | Mean Letter |
|-------|--------------|--------------------|-------------|
| 1     | 4.61         | 4.85               | 4.59        |
| 2     | 4.3          | 4.7                | 4.9         |
| 3     | 4.65         | 4.75               | 4.82        |
| 4     | 4.45         | 4.92               | 4.9         |
| 5     | 4.66         | 4.78               | 4.85        |
| 6     | 4.7          | 4.9                | 4.94        |
| 7     | 4.45         | 4.7                | 4.6         |
| 8     | 4.75         | 4.8                | 4.9         |
| 9     | 4.75         | 4.8                | 4.75        |
| 10    | 4.75         | 4.87               | 4.94        |

### Measures

**Diagnostic Reading Battery:** The Diagnostic Reading Battery (WJ III DRB) by Woodcock, Mather and Schrank (2004) was developed for reading skills. WJ III DRB can be used to determine and describe the status of a student's ability and achievement in five areas, such as phonemic awareness, reading fluency and reading comprehension. WJ III DRB is also useful in the diagnosis

or the identification of specific weaknesses that may be interfering with school learning. The wide age range and breadth of coverage are important advantages of WJ III DRB for research at all age levels, i.e. from early childhood through mature adulthood. In this study, reading skills refer to phonemics, reading fluency and reading comprehension. In order to assess these three sub-variables, the researcher used three WJ III DRB sub-scales, namely, phonemic awareness, reading fluency and reading comprehension.

#### Letter-Word Identification Test:

Letter-Word Identification measures the subject's word identification skills. The initial items require the student to identify letters that appear in large type on the subject's side of the Test Book, and the remaining items require the person to pronounce words correctly. The student is not required to know the meaning of any word. The items become increasingly difficult as the selected words appear less and less frequently in written English. Letter-Word Identification has a median reliability of .91 in the age range between 5 to 19 years, and .94 in the adult age range (Woodcock *et al.*, 2004). In this research, the Cronbach's alpha reliability for the scale was .87, while the test-retest reliability was .86.

**Passage Comprehension:** The initial Passage Comprehension items involved symbolic learning, or the ability to match a rebus (pictographic representation of a word), with an actual picture of the object. The next items were presented in a multiple-choice format and required the students to



point to the picture which was represented by a phrase. The remaining items require the student to read a short passage and identify a missing key word that makes sense in the context of that passage. The items become increasingly difficult by removing pictorial stimuli and by increasing passage length, and the level of vocabulary and complexity of syntactic and semantic cues. In this modified cloze procedure, the subject must exercise a variety of comprehension and vocabulary skills. Performance on this reading task can be compared directly with the performance in one of the counterpart Oral Comprehension tasks. The Passage Comprehension has a median reliability of .83 in the age range between 5 to 9 years, and .88 in the adult age range (Woodcock *et al.*, 2004). In this study, the Cronbach's alpha reliability for the scale was .85, while the test-retest reliability was .87.

**Reading Fluency:** Reading Fluency measures the student's ability to read simple sentences quickly in the Subject Response Booklet, decide whether the statement is true, and then circle on the Yes or No answers. The difficulty of the sentences gradually increases to a moderate level. The students attempted to complete as many items as possible within the time limit of 3 minutes. Reading fluency has a median reliability of .90 in the age range between 6 to 19 years and .90 in the adult age range (Woodcock, *et al.*, 2004). In this study, the Cronbach's alpha reliability for the scale was .85, whereas the test-retest reliability was .88.

### **Dyslexia Screening Instrument**

**(DSI):** The Dyslexia Screening Instrument (DSI) consists of checklists of basic neuropsychological skills that were designed by Coon, Waguespack and Polk in 1994. This instrument is a rating scale that was specifically designed to describe the cluster characteristics associated with dyslexia and to discriminate between the students who display the cluster characteristics and those who do not. It was designed to measure the "entire population of students or the students who exhibit reading, spelling, writing or language-processing difficulties" (Coon, Waguespack, & Polk, 1994). Besides, DSI was also designed to be used with students in Grade 1 to Grade 12, i.e. aged 6 to 21. The internal consistency reliability coefficient is .99 for elementary students, which is determined using Cronbach's coefficient alpha, while the inter-rater reliability for elementary students is .86 of the DSI that is assessed by determining the homogeneity of the statements and the consistency of ratings across examiners. Coon *et al.* (1994) stated that the "content is based on an extensive review of relevant literature and on experts in the field of dyslexia" (p.20). On the other hand, construct validity is supported by the discriminate analysis classifications, which place elementary and secondary students accurately (98.2% and 98.6%, respectively).

A classroom teacher who has worked directly with the students for at least four months should complete the DSI Scale. This caused a rating that would bring more accurate results because the teacher

had observed the students over a lengthy period of time and could compare their performance to that of the classmates. As for elementary students, the preferred rater is the teacher who instructs the student in a variety of subjects. The teacher should complete the DSI form (based on the questionnaire answers, as follows: Never exhibit, Seldom exhibit, Sometime exhibit, Often exhibit and Always exhibit). In this study, the Cronbach's alpha reliability for the scale was .89.

**Raven's Progressive Matrices Test:** Raven's Standard Progressive Matrices (SPM) Test was constructed to measure the educative component of "g" (general IQ), as defined in Spearman's theory of cognitive ability (Raven, Raven, & Court, 1998). Kaplan and Saccuzzo (1997) stated that "research supports the RPM as a measure of general intelligence. The advanced form of the matrices contains 48 items, presented as one set of 12 (Set I) and another of 36 (Set II). Items are again presented in black ink on a white background and become increasingly difficult as progress is made through each set. These items are appropriate for age 5 to 65. Lynn and Vanhanen (2002) summarized a large number of studies based on normative data for the test, which have been collected in 61 countries. The internal consistency reliability estimate for the Raven Progressive Matrices total raw score is .85 in the standardization sample of 929 students. This reliability estimate for the revised SPM indicates that the total raw score on the SPM possesses "good" internal consistency reliability, as provided

in the guidelines of the US Department of Education (1999) for interpreting a reliability coefficient. SPM has been widely used for decades as a measure of educative ability or "the ability to evolve high level constructs which makes it easier to think about complex situations and events" (Raven *et al.*, 1998). In an extensive analysis of the cognitive processes that distinguished between higher scoring and lower scoring, examinees on the Standard Progressive Matrices and Advanced Progressive Matrices, Carpenter, Just and Shell (1990) described the Raven's test as "a classic test of analytic intelligence". In this research, the Cronbach's alpha reliability for the scale was .83.

#### *Reading Text*

The Reading Text was developed based on the text contents of the fourth and fifth grades. During the administration of the research, 80 percent of the text-book had been taught, and thus, the developed tests were based on 80 percent of the Persian text-books. The tests were evaluated by the fourth and fifth grade teachers. After 3 times revisiting, they evaluated the tests as conveniently. The tests included a story of one-hundred related words understandable to each education level and followed by 10 questions which indicated the students' level of understanding. The students were required to read the tests out aloud and answer the questions. If any student could read the text correctly in less than 90 percent of the text and perform less than 50 percent on the reading comprehension, he/she

commits more than 10 errors and answers less than 5 comprehension questions, that particular student is identified as dyslexic. To determine reliability, the Cronbach's coefficient was employed. The reliability coefficients for the fourth and fifth grades' reading tests were 0.87 and 0.90, respectively.

**RESULTS**

In this study, data analysis was carried out using SPSS Version 17.0. The results of the pre- and post-test for the Reading Skills Tests (Letter-Word Identification, Passage Comprehension and Reading Fluency) used in this study are presented in Table 2.

Table 2 reveals the means and standard deviation for the Letter, Fluency and Comprehension Scales of the pre-intervention programme and post-intervention programme. The table also

shows that there is a significant difference in the post-test means of Letter-Word Identification, Fluency and Comprehension for the experimental and control groups of the selected dyslexic students.

Table 3 displays the multi-variate analysis of variance, before and after the treatment of Barton intervention programme. From the table, it was revealed that there was no statistically significant difference before the intervention programme; however, the results showed a statistically significant difference after the intervention programme. Similarly, the fact that Roy's and Hotelling's statistics are equal tells us that this particular effect is probably due to just one of the dependent variables is rather highly correlated. This can easily be checked by using the Analysis of Variance.

The results in Table 4 showed the sum of squares between the groups and within

TABLE 2  
A comparison of the pre-test and post-test of reading skills

| Test          | Experimental group |      |          |      | Control group |      |          |      |
|---------------|--------------------|------|----------|------|---------------|------|----------|------|
|               | Pretest            |      | Posttest |      | Pretest       |      | Posttest |      |
|               | M                  | SD   | M        | SD   | M             | SD   | M        | SD   |
| Letter        | 42.25              | 9.92 | 53.61    | 9.38 | 42.46         | 10.9 | 42.76    | 11   |
| Fluency       | 52.58              | 9.82 | 59.67    | 8.81 | 52.03         | 11.6 | 53.33    | 12.7 |
| Comprehension | 27.22              | 9.57 | 34.67    | 7.26 | 27.06         | 8.7  | 27.66    | 9.12 |

TABLE 3  
Multi-variate Analysis of Variance for reading skills

| Test        | Value | Pre-test |      | Post-test |       |     |
|-------------|-------|----------|------|-----------|-------|-----|
|             |       | F        | Sig  | Value     | F     | p   |
| Pillai's    | .001  | .019     | .996 | .971      | 6.311 | .00 |
| Wilks'      | .998  | .019     | .996 | .029      | 6.311 | .00 |
| Hotelling's | .001  | .019     | .996 | 33.215    | 6.311 | .00 |
| Roy's       | .001  | .019     | .996 | 33.215    | 6.311 | .00 |

TABLE 4  
Analysis of variance for reading skills

| Test                         | Pretest  |    |        |      |          | Posttest |    |        |       |          |
|------------------------------|----------|----|--------|------|----------|----------|----|--------|-------|----------|
|                              | SS       | df | MS     | F    | <i>p</i> | SS       | df | MS     | F     | <i>p</i> |
| Fluency between groups       | 4.56     | 1  | 4.56   | .04  | .84      | 613.608  | 1  | 613.61 | 5.146 | .027     |
| Fluency within Groups        | 6770.515 | 59 | 114.75 |      |          | 7035.441 | 59 | 119.25 |       |          |
| Letter between Groups        | .663     | 1  | .663   | .006 | .938     | 1793.541 | 1  | 1793.5 | 17.26 | .000     |
| Letter within Groups         | 6387.402 | 59 | 108.26 |      |          | 6130.722 | 59 | 103.91 |       |          |
| Comprehension between Groups | .386     | 1  | .386   | .005 | .946     | 749.346  | 1  | 749.35 | 11.05 | .002     |
| Comprehension within Groups  | 4947.287 | 59 | 83.852 |      |          | 4001.441 | 59 | 67.82  |       |          |

the groups, *df*, the mean square between the groups and within the groups, *F*, and the statistically significant difference before and after the treatment of Barton intervention programme. This table also confirms the statistically significant difference after the treatment of Barton intervention programme ( $f= 5.146, 17.26, 11.05, p<0.027, 0.000, 0.002$ ).

## DISCUSSION

In this study, the following hypothesis was investigated: There is statistically a significant difference in the reading skills between the control group and the experimental group of the dyslexic students after the treatment of Barton intervention programme. Additionally, both groups were compared with each other with regard to reading phonics, reading comprehension and reading fluency variables. In this study, it was hypothesized that the experimental

intervention affected the reading phonics, reading comprehension and reading fluency. It appeared that the data analysis supported the hypothesis. Similarly, the results also showed that there was a significant difference in the reading skills of the experimental group (who received the treatment) and the control group. Apparently, the results are in line with several studies done in this area (e.g., Barton, 2000; Carnine *et al.*, 1990; DeFord, 1991; Rivers & Lombardino, 1998; Snow *et al.*, 1998). Likewise, these studies also revealed that the intervention programme caused reading comprehension to improve. Notably, dyslexic students need direct instructions of alphabet since teaching alphabet directly makes teaching of primary reading easier. Besides, the studies also showed that if multi-sensory methods were used in teaching the dyslexic students, their level of learning would increase (Barton, 2000; Orton, 1976). Most

dyslexic students have a lot of problems with phonetic skills and they cannot learn these skills as easy as other normal students. Multi-sensory methods, such as the Barton intervention programme, can improve the dyslexic children's reading skills. Using the Barton intervention programme, reading and spelling are taught at the same time. In addition, in this programme, the whole word was not used at the beginning of the course. Instead, the lesson began with the teaching of sounds, and this was followed by some parts of the words. The results of the recent studies on the importance of reading skills specify that intervention programmes are specifically significant in teaching dyslexic students to acquire reading skills. Thus, teachers can use such interventions to improve dyslexic students' reading skills. Intervention programmes are important since they provide the teachers the chance to exercise new methods. Therefore, it is emphasized in the intervention programmes that teachers should actively participate the activities concerning solving the children's problems in reading.

The results of this study revealed that there was a statistically significant difference in words recognized between the experimental group and the control group. Reading skills require the ability to recognize words. Thus, when readers develop facility in word recognition, they can focus on the meaning of the text. Without strengthening the primary levels of reading, the higher cognitive skills cannot function (Williams, 1998). If a reader exerts much of his/her effort in recognizing words,

less processing capacity will remain for his/her comprehension. Early recognition skills are of paramount importance since they can accurately predict later skills in reading comprehension. Students, who get off to a slow start, rarely become strong readers (National Reading Panel, 2000). Hence, early learning of word recognition leads to stronger reading abilities in school and out of school. Besides, reading a wide variety of materials provides readers the opportunities to increase their vocabulary, develop an interest in books and foster general reading growth (Lyon, 2003).

The results of this study also indicated that there was a significant difference in the reading fluency between the experimental group and the control group, after the treatment of Barton intervention programme. Fluency has been identified as a necessary link between word analysis and comprehension of a text. In addition, it is considered a basic tool in learning reading skills (Chall, 1983). Moreover, reading fluency is the ability to read connected texts rapidly, effortlessly and automatically (Hook & Jones, 2004). The importance of fluency and its essential role in building overall reading ability have only been highlighted recently (National Reading Panel, 2000). Readers must develop their reading fluency in order to build a bridge from word recognition to reading comprehension (Jenkins *et al.*, 2003).

Furthermore, the results revealed that there was a significant difference in reading comprehension between the experimental group and the control group,

after the treatment of Barton intervention programme. Reading comprehension is an active process which requires an intentional and thoughtful interaction between the reader and the text. As the reader tries to comprehend the material he/she reads, he/she must fill the gap between the presented information in the written text and the knowledge he/she possesses. Thus, reading comprehension skills involve thinking. The reader's background knowledge, interest and the reading situation affect the comprehension of the material. A reader integrates the new information in the text to what he/she already knows (National Reading Panel, 2000).

In the past decades, attempts had been made to improve dyslexia. In doing so, different theories have been posed in this regard. The fundamental basis of these methods is the multi-sensory method, which is applied to the teaching of reading skills. This method is called VAKT (i.e. visual, auditory, kinetics, tactile) that includes the proposed approaches of three founders of reading intervention, namely, Orton (1976), Fernald (1988) and Kirk (1976). The Barton method is based on Orton's theory. According to the results of this study, if this method was applied to the dyslexic students, whereby the majority of them could gain the necessary abilities to read. The findings indicated that Barton intervention programme was successful and caused the students in the experimental group to improve their reading skills. In a nutshell, it can be concluded that the

Barton intervention programme is a suitable programme for teaching dyslexic students the skills of reading.

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