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MULTIPLE INTELLIGENCES OF TYPICAL READERS AND DYSLEXIC ADOLESCENCES

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ABSTRACT: *The study of multiple abilities or intelligences could be a very promising field of research for students with learning difficulties, in order to build into alternative learning plans to enhance language acquisition and reading ability. The main purpose of the present study was to assess the relationship between dyslexia and multiple intelligences as described by Gardner (1983). A total of 117 secondary school students (39 dylexic and 78 typical readers) examined using the Multiple Intelligences Test. Results showed that dyslexic students displayed a preference for spatial intelligence and had less linguistic abilities, compared to the typical readers. Moreover, scores on the spatial intelligence scale were positively related to the likelihood of being member of the dyslexic group while, scores on the linguistic intelligence were negatively associated to this likelihood. The paper discusses these results in the light of recent research on abilities and disabilities associated with dyslexia, as well as in terms of their application to classroom learning for students with dyslexia.*

KEYWORDS: dyslexic adolescents, typical readers, multiple intelligences

INTRODUCTION

Traditionally, special educators have believed that the learning achievement of students with disabilities can be improved if more appropriate and effective learning and teaching strategies are implemented. Individuals learn in different ways and demonstrate certain strengths. If their learning strengths and preferences can be more fully developed, the learning gap will be closed.

Based on Gardner's multiple intelligence theories (Gardner, 1983; 1999; 2006), Rose and Meyer (2002) argue that students have various multifaceted learning abilities and potentials and that if they have deficits in a specific area(s), they will be compensated for by the strength in others. In the first edition of his multiple intelligence theory, using seven intelligences, Gardner (1983) argued that every individual has different strengths and weaknesses in his/her intelligence although the potential of the intelligence is unchanged. The seven intelligences and their locations in the brain are as follows: (a) linguistic intelligence, which can be found in Broca's area and both hemispheres; (b) logical-mathematical intelligence which can be found in the left hemispheres; (c) musical intelligence, which is mostly developed in the right hemisphere; (d) spatial intelligence in the posterior regions of the right cerebral cortex; (e) bodily kinesthetic intelligence, located in the cerebellum and concerns the thalamus, main ganglions and others parts of the brain; (f) interpersonal and (g) intrapersonal, which are both served largely by the frontal lobes. In his newest edition of the multiple intelligences theory, Gardner (2006) acknowledges the possibility of adding new intelligences to the list. He has worked on naturalistic, spiritual and existential intelligences to be included in his list of multiple intelligences. However, the potential additional human capabilities, perceptions and attunements involved in these intelligences, are highly subjective and complex, and arguably contain many overlapping aspects (Searson & Dunn, 2006).

On the other hand, the seven intelligences are measurable and we can evidence or illustrate them. Moreover, it is well documented that that they have particularly strong ramifications in the classroom (Al-Salameh, 2012). McMahon (2004) states that if we can identify children's strengths among these intelligences, educators can accommodate different children more successfully according to their orientation to learning. As an antidote to the narrow definition of intelligence as reflected in standardize test results, Gardner's theories have been embraced and transformed into curricular interpretations across many countries (Ellison, 2001). Multiple intelligences and the way of learning and thinking contribute to the educational process in an integral way with teaching methodology (Al Ghraibeh, 2012). Many teachers instinctively respond to the notion that students learn and excel in a variety of ways, and believe that a classroom that offers an array of learning opportunities increases the likelihood of success for more students (Kornhaber, 2004). Hanson (2004) states that the goals of Gardner's theory and education is to encourage the development of well-rounded individuals. Multiple intelligence theory implies a student's learning gap may be closed by employing learning strategies that resonate with the student's strengths.

Kornhaber (2004) conducted a study that documented four reasons multiple intelligence has been positive in the educational arena. These fours reasons are as follows: a) improvements in standardized test scores, b) improvements in student's behaviour, c) increase parent participation, and d) improvements for students with learning disabilities (example improved learning, improved motivation, effort or social adjustment). Kornhaber (2004) commented that the improvements were associated with multiple intelligences due to the fact that children have different modalities and different ways to express themselves. Hanson (2004) connects increased performance when learning is taught through multiple intelligence as acceptance of one's culture in which many different kinds of learners were valued. He also stated that if students are engaged academically and socially, then it makes sense that fewer students will get into trouble behaviorally. Multiple intelligence may be associated with benefits for students with learning disabilities because the theory supports the idea that these students had strengths and not only weaknesses (Kornhaber, 2004). Acknowledging these strengths seemed to offer academic as well as emotional benefits. Nolen (2003) also remarked that students with learning differences "feel good about being able to choose and play on strengths, while they're also working on weaknesses in other areas so that they can be come more effective" (p. 116).

Regarding dyslexic students, it has been supported that they often show enhanced facility at visual and/or spatial tasks (LaFrance, 1997). Investigations into the possibility that individuals with dyslexia are superior in visual-spatial abilities has, however, yielded conflicting findings, depending on the tasks or measures used to assess these abilities. Students with reading disorders have been found to have visual-spatial abilities that are superior (Attree, Turner & Cowell, 2009; Von Karoli, 2001; Von Karoli, Winner, Gray, Sherman, 2003), inferior (Morris et al., 1998; Rourke, 1985), and comparable (Koenig, Kosslyn & Wolff, 1991; Winner et al., 2001) to controls. In all these studies no link between dyslexia and multiple intelligence was examined, although there is some evidence that dyslexic students usually favour visuospatial and kinaesthetic learning styles (Exeley, 2003; Lisley, 2007). Research also indicates that the regions of the brain associated with visuospatial abilities are larger in individuals with dyslexia (Galaburda, Sherman, Rosen, Aboitiz & Geschwind, 1985).

Moreover, studies of talented individuals with dyslexia suggest that dyslexia may be positively associated with visuospatial abilities, artistic talents, or creativity (Sherman, 2002; Chakravarty, 2009; Wolf & Lundberg, 2002). Explanations for such talents among people with dyslexia have been proposed using a compensatory argument. These distributions of talents may represent compensation contributing to the evolutionary resistance of dyslexic genes (Wolf, & Lundberg, 2002). An alternative explanation is the default and channeling hypothesis (Winner, et al, 2001), which suggests that individuals with dyslexia who have enhanced spatial talents are more likely to choose spatial as opposed to verbal occupations because the choice of the latter avenue may not be open to them. This does not necessarily suggest any difference in spatial abilities between those with or without dyslexia.

As a whole, visuospatial ability has been given only token attention as an important dimension of cognitive functioning and often has been ignored by the psychological and educational community (Attree et al., 2009). The paucity of research in this area may be due, in part, to a widely agreed definition of "visuospatial abilities". Indeed, they are within a somewhat complex cognitive domain generally related to the broader field of "intelligence". For example, Carroll's (1993) description of intelligence and associated cognitive skills derive from a multifactorial theory of intelligence, close to Gardner's model of multiple intelligences. He proposed multiple dimensions of human abilities, which are related in complex ways to learning, achievement, and problem-solving. Therefore, the study of these multiple abilities or intelligences would be a very promising field of research for students with learning difficulties, in order to build into alternative learning plans to enhance language acquisition and reading ability.

The main purpose of the present study was to assess the relationship between dyslexia and multiple intelligences as described by Gardner (1983). Given that neurofunctional studies suggest that the processing patterns of dyslexic people in the left and right hemispheres show differences compared with non-dyslexics (Grigorenko, 2001; Hoeft et al., 2006; Papanicolaou et al., 2003) our hypothesis was that differences would be revealed between the dyslexic group and their peers in preferred ways to learn. With regard to the researchers' knowledge, there are no studies that deal with difference between dyslexics and non-dyslexics in learning preferences and its relation with the multiple intelligences. Specifically, using a Multiple Intelligences Test (MIT) to assess the seven multiple intelligences proposed by Gardner (1983), the aims of the study were to examine whether: a) the two groups of adolescents (dyslexics and non-dyslexics) differed in terms of their performance on each of the MIT subscales, and b) group membership could be accurately predicted from scores in the MIT subscales. Findings from this study would be helpful for educators and other workers in the educational field to boost academic and vocational guidance, in order to spare dyslexic students' academic failure. In addition, they would enrich the knowledge of previous studies in this field.

METHOD

Participants

A total of 117 secondary school students (93 boys and 24 girls) participated in this study. The dyslexic students (8 girls and 31 boys), (N = 39; age range 13–18 years, M = 15.13 years, SD = 1.56 years) had a statement of dyslexia after assessment at the Centre of Diagnosis, Assessment and Support of Magnesia, Greece. This centre belongs to the Ministry of Education and is listed amongst the formal assessment centres for specific learning difficulties. The assessment was carried out by a psychologist and a special educator and the criteria used included: (a) assessment of intelligence using the standardized Greek version of Wechsler Intelligence Scale for Children – Revised (WISCIII-R; 3rd Edition), and (b) assessment of oral reading accuracy, reading rate, reading comprehension, listening comprehension, dictation and free writing using informal reading inventories. Students with dyslexia had a consistent history of persistent specific literacy difficulties, with reading levels at least 18 months behind chronological age, but with a performance Intelligent Quotient above 80 on the standardized Greek version of WISCIII-R. None of the dyslexic participants had comorbid disorders.

A comparison group of 16 girls and 62 boys (N = 78; age range 13–18 years, M = 14.58 years, SD = 1.23 years) was formed of pupils who attended the same classes with dyslexics. They had not been matched for IQ with students with dyslexia; instead they presented typical academic performance according to their teachers' ratings. Additionally, they did not have a history of major medical illness, psychiatric illness, developmental disorder, or significant visual or auditory impairments according to the medical reports of their schools. The participants of the control group were matched for age (U = 1200.50, p = .055) and gender with dyslexics (1 dyslexic : 2 control). All children participated in the study were native speakers attending mainstream public schools, while immigrant pupils were not included in the sample.

Materials and Procedure

For the purposes of this study, the simple Multiple Intelligences Test (MIT, young people version; Chislett & Chapman, 2005) was used. The MIT consists of 35 items (seven components with 5 items each), which assess the seven multiple intelligences proposed by Gardner (1983).

Items of linguistic type indicated high ability in words and language, written and spoken (retention, interpretation and explanation of ideas and information via language, understanding of the relationship between communication and meaning, etc.). Logical-mathematical intelligence consisted of items that measured both persons' perceptions on their mathematical ability and on logical thinking skills (e.g. ability to detect patterns, analyze problems, perform mathematical calculations, reason deductively, etc.). Musical intelligence items referred to musical ability,

awareness, appreciation and use of sound; recognition of tonal and rhythmic patterns, etc. Spatial intelligence measured persons' views on his/her abilities to visualize and work with multidimensional objects (e.g., interpretation and creation of visual images; pictorial imagination and expression; relationships between images and meanings, and between space and effect, etc.). Bodily-kinesthetic intelligence was operationalized to include items measuring persons' views on their abilities related to working with hands and coordinating their bodies (e.g., body movement control, manual dexterity, physical agility and balance; eye and body coordination, etc.). Interpersonal intelligence items measured persons' perceptions of his/her abilities to social relations (e.g. perception of other people's feelings, ability to relate to others, interpretation of behaviour and communications, etc.). Intrapersonal intelligence consisted of items that measured self-awareness, personal cognisance, personal objectivity, the capability to understand oneself, etc.
Each respondent was personally invited to complete a paper and pencil version of the questionnaire. Participants were asked to use the Likert-scale from 1 (*totally disagree*) to 4 (*totally agree*) to evaluate their attitude towards the statements measuring multiple intelligences. The highest number of scores in each section was recorded and this used in each category to identify and classify the students into their respective intelligence types. The study's repeatability was assessed through the *Test-Retest* technique, which involved 30 resubmissions (25% of the total sample) and subsequent comparison of the results of the administrations. The remarkably high coefficient of stability ($r = 0.95$) confirmed the study's reliability.

Statistical analysis
All data screening, processing and analysis procedures were performed using SPSS 19. Mann-Whitney test was used to compare the MIT scores between groups. Binary logistic regression was carried out to investigate if group membership could be accurately predicted from scores in the MIT subscales

RESULTS

Group differences
Table 1 presents the means and standard deviations for all seven intelligences, on both typical readers and dyslexic adolescents. In order to examine whether the two groups differed in terms of their performance on each of the MIT subscales, a Mann-Whitney test was conducted. It should be mentioned that within the typical development group, scores on five of the seven subscales of the MIT were not normally distributed, while within the dyslexic group one variable was not normally distributed, according to the Shapiro-Wilk test ($p < .05$). According to the results of the Mann-Whitney test (Table 1), there was a significant difference between the two groups with regard to the participants' performance on two of the seven subscales. Specifically, the median performance on spatial intelligence subscale ($U = 997.50$, $Z = -3.05$, $p < .01$), as well as on the linguistic subscale ($U = 1063.50$, $Z = -2.66$, $p < .01$), differed between dyslexic and typical readers. Considering the mean ranking values, the dyslexic group had higher scores (more high scores, mean rank 72.42) in the spatial intelligence subscale and lower scores (more low scores, mean rank 47.27) in the linguistic intelligence subscale than the comparison group (mean rank 52.29 and 64.87 respectively).

Table 1. Differences between dyslexic and typical development groups.

MIT subscales	Dyslexic *M (SD)*	Typical Development *M (SD)*	*U*	*p*
Linguistic	12.62 (2.50)	13.94 (2.65)	1063.50	.008*
Logical-mathematical	13.36 (2.68)	14.01 (3.04)	1315.00	.231
Musical	14.36 (3.30)	14.18 (2.82)	1495.00	.880
Bodily-kinesthetic	16.03 (2.79)	16.22 (2.52)	1465.50	.747
Visuo-spatial	11.79 (2.69)	10.15 (2.34)	997.50	.002*
Interpersonal	16.00 (2.74)	15.59 (2.25)	1377.00	.399
Intrapersonal	12.67 (1.87)	12.83 (2.51)	1516.50	.979

* $p < .01$

Group membership – Logistic regression analysis

The second research question was whether group membership (dyslexic - nondyslexic/typical development group) could be accurately predicted from scores in the MIT subscales or not. Thus, binary logistic regression was conducted to examine group membership (1=dyslexic group, 0=nondyslexic/typical development/control group) by employing the enter method (IBM SPSS Statistics 19). The regression model included the seven subscales of the MIT as predictor variables.

The significance level for the model chi square (omnibus χ^2) was low (χ^2 = 23.352, *df* = 7, *p* = .001). Thus, the null hypothesis was rejected and the variables included in the model did predict, taken together, group membership. The value of the Nagelkerke R^2 (.251) showed that the model had a rather moderate contribution in predicting group membership (25%). Consequently, the predictor variables could explain approximately 25% of the variance of being a member of the one or the other group. The result of the Hosmer and Lemeshow test revealed that the model fit the data well (χ^2 = 5.980, *df* = 8, *p* = .649)

Considering the rate of correct classification (Table 2), the results indicated that only 46.2% of the participants initially assigned to the dyslexic group, and 88.5% of those who were observed in the typical development group were correctly classified. The overall classification accuracy was moderate (74.4%). The model including the seven predictor variables, compared to the model including constant-only, did improve the level of predictability, although just by 8% approximately. Moreover, it should be noted that 21 cases of the 39 which in fact were assigned to the dyslexic group get misclassified when the classification cutoff was 0.5 (false negative rate 23%).

Comparing the sensitivity (46.2%) and specificity measures (88.5%) (Table 1), it appears that the prediction for the participants who were actually assigned to the dyslexic group was less accurate than for those in the control group.

Table 2. The observed and predicted frequencies for membership in the dyslexic group (cutoff: .50).

	Predicted		
Observed	Dyslexic group	Typ. dev. group	% correct
Dyslexic group	18	21	46.2
Typ. dev. group	9	69	88.5
Overall % correct			74.4

Furthermore, the contribution of each predictor variable regarding group membership was examined. For each of the seven independent variables, the regression coefficient, Wald test, and odds ratio are presented in Table 3. Two of the seven predictor variables had significant effect, that is, spatial intelligence and linguistic intelligence. Considering the odds ratio for spatial intelligence, it is revealed that an increase in the specific subscale is associated with an increase of the odds (by a factor of 1.36) that the participant student will be a member of the dyslexic group. However, although the effect of linguistic intelligence was also significant, the odds ratio for the specific variable indicated that an increase in the participant's score is associated with a decrease of the odds (by a factor of 0.77) that he/she will be a member of the dyslexic group.

Table 3. Results of the logistic regression (enter method) predicting group membership from the seven MIT subscales.

Predictor	*B*	Wald	*p*	Odds ratio
Linguistic intelligence*	-.261	7.938	005	.770
Logical-mathematical intelligence	-.074	.769	.381	.929
Musical intelligence	.059	.546	.460	1.061
Bodily kinesthetic intelligence	-.052	.307	.580	.950
Spatial intelligence**	.307	11.205	.001	1.360
Interpersonal intelligence	.121	1.520	.218	1.128
Intrapersonal intelligence	-.013	.016	.900	.987

Note: *p<.05; **p<.01

Overall, the model that included the MIT subscales had a rather modest ability in discriminating between students with typical development and students with dyslexia. The independent variables of spatial intelligence and linguistic intelligence had a relative importance in predicting group membership. Although each variable contributed to the prediction of group membership, linguistic intelligence was negatively related to the event (membership in the dyslexic group). Nonetheless, the increased false negatives should be taken into account and further examined.

The results of the logistic regression only partially could support a hypothesis that the participants' scores on each of the MIT subscales predict membership in the dyslexic group. Specifically, it appears that a participant's scores on the vast majority (5 out of 7) of the MIT subscales is not related to the likelihood that he/she will be a member of the dyslexic group. Scores on one subscale (spatial intelligence) were positively related to the above mentioned likelihood, while scores on the subscale of linguistic intelligence were negatively related to this likelihood.

DISCUSSION

The present study examined the link between multiple intelligences and dyslexia in secondary school students. The results indicated a significant difference in two out of the seven intelligences proposed by Gardner (1983). It appears that dyslexic students displayed a preference for spatial intelligence and have less preference for linguistic abilities, compared to the typical readers.

The results of this study support the diverging abilities hypothesis (Von Karolyi, 2001), according to which, dyslexia is associated with strengths in specific processes mediated by the right hemisphere along with weaknesses in specific processes mediated by the left hemisphere. Our results seem to be in line with research findings suggesting that the deficits characterizing dyslexia may also be associated with superior visuospatial abilities (e.g., Attree et al., 2009; LaFrance, 1997; Von Karoli et al., 2003) and can be attributed to the larger regions of the brain associated with spatial abilities found in individuals with dyslexia (Galaburda et al., 1985). Further research is required to determine the sources of this difference in more detail and to explore ways to take it into account when designing instructional support programs for dyslexic students.

Spatial intelligence gives a person the ability to manipulate and create mental images in order to solve problems. Children with spatial intelligence are best taught using pictures or photographs (Nolen, 2003) and it seems that non-linear, pictorial, more graphical, organizational techniques may be more suitable for people with dyslexia (Dror, Makany & Kemp, 2011). In a very recent study Konstantinidou & Euripidou (2012) showed that pictorial presentation of information in school-age children with reading disabilities results in superior learning, recall, and recognition performance. Therefore, incorporating visual aids in the form of pictures, diagrams, concept maps, and sketches (consisting of simple, clear, and salient information) could potentially enhance classroom learning for students with dyslexia. For children with learning difficulties visual aids in the form of simple pictures along with systematic cognitive strategies and direct instruction as suggested by previous literature could maximize improvement (Swanson & Hoskyn, 1998).

Moreover, the results of the logistic regression analysis showed that scores on the spatial intelligence subscale of the MIT were positively related to the likelihood of being member of the dyslexic group while scores on the linguistic intelligence were negatively associated to this likelihood. These findings are consistent with research evidence showing that the main impaired mechanisms involved in reading disabilities is linguistic in nature (e.g., Ramus, 2003; Shaywitz & Shaywitz, 2005) and recent findings concerning dyslexics' superiority in representing and conceptualizing information in a visual, rather than a verbal, way (Attree et al., 2009; Bacon, Handley, & McDonald, 2007).

Neurophysiological evidence is consistent with the possibility that the dyslexic brain may process visuospatial material in an atypical way (e.g. Riccio & Hynd, 1996). During reading tasks, brain activation in normal participants is observed in the primary visual cortex and then in the left temporal lobe. Participants with dyslexia, on the other hand, present a similar temporal course of activation, but in the right hemisphere (e.g., Grigorenko, 2001), areas typically associated with spatial, rather than language, processing (Al Ghraibeh, 2012). It has been proposed that this is the reason that individuals with dyslexia often possess visuospatial talents which may compensate for their difficulties with language (Galaburda, 1993).

However, our results only partially support the hypotheses that there would be a differentiation between dyslexics and typical readers in terms of their performance on each of the MIT subscales, and their group membership in the MIT. The fact that we could not discriminate subtypes of dyslexia in our study (official Centres that carry through the diagnosis of dyslexia in Greece do not discriminate dyslexics in various subtypes) may account for the limited support of our hypotheses. As indicated by recent functional magnetic resonance imaging research distinct brain regions show reduced activation in diverse patterns of dyslexia (for a review see Paré-Blagoev, 2007). More specifically, dyslexic children with phonological problems showed reduction is in left temporo-parietal regions, which are involved in speech, dyslexics with visual problems showed reduction is in the magnocellular system, which is involved in vision and in dyslexics with temporal processing problems, reduction seems to include the frontal and left temporal areas.

Moreover, the over presentation of boys in our research may have affected results concerning differences in linguistic and spatial intelligence. Recent evidence suggests that superior visuospatial ability is more apparent in dyslexic male students (Brunswick, Martin & Marzano, 2010). It is also possible that spatial superiority in our dyslexic sample may reflect males' preferential use of non-verbal processing strategies to avoid problems inherent in verbal processing.

Additionally, it should be noted that the study was exploratory in nature, and results must be considered with caution. A more robust theoretical framework and a larger sample representative of the dyslexic population are needed to come to any significant conclusion regarding whether there might be a subgroup of individuals with dyslexia with spatial or other talents.

IMPLICATIONS TO RESEARCH AND PRACTICE

From an applied perspective, the findings provide some insight into how educators might tailor assessment and educational intervention programs to suit the particular needs of the dyslexic learner. Future research needs to substantiate these findings. Examining the long-term effects of educational approaches with individuals with dyslexia that utilize visuospatial modes of thought could prove an interesting area for future research. Gardner's theory of multiple intelligences has met with a strongly positive response from many educators. It has been embraced by a range of educational theorists and, significantly, applied by teachers to the problems of schooling. It has helped a significant number of educators to question their work and encouraged them to look beyond the narrow confines of the dominant discourses of skilling, curriculum, and testing and assessment. As there are only a few studies on the application of multiple intelligence theory, there is a need to conduct more studies on this issue. This present study may give insights for teachers and educators about integrating multiple intelligences into their practice.

CONCLUSION

Multiple intelligence theory implies a student's learning gap may be closed by employing learning strategies that resonate with the student's strengths. Linking dyslexia to talent casts this condition in far more optimistic light than linking it to a deficit only. The discovery of talent associated with dyslexia may eventually lead to more effective educational strategies and help guide individuals with dyslexia to professions in which they can excel.

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