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Low Auditory-Verbal Cognitive Profile: A "Risk Factor" for Specific Learning Difficulties in Preschool Children in Greece

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Abstract

Preschool-age children with a low auditory-verbal cognitive profile may be predisposed to develop subsequent learning difficulties. This study, through the use of early diagnostic procedures and a special intervention program, attempts to "balance" these discrepancies. More specifically, aim of the present study is to implement an intervention programme in children being "at risk" for learning difficulties. For the purpose of the present study, the DTLA-2 test was used to assess 420 preschool children aged between 6.0 and 6.4 years. During pretesting, the 420 children were divided into 4 groups according to their cognitive profiles based on the DTLA-2 test assessment. Of the total sample, 40 children according to their low performances in all cognitive verbal and non-verbal sub-tests of DTLA-2 were selected for the final construction of the experimental group (11 boys and 9 girls) and its control group (10 boys and 10 girls). The intervention procedure lasted 3 months and the children attended approximately 20 sessions (20 - 25 minutes each), either individually or in a small group of two or three children. In the three-month follow-up (post-test), a better balance in their cognitive profile was achieved compared to the control group. In a one year follow-up, similar results were detected.

More specifically, the differences between the verbal and non-verbal scales of the DTLA-2 test remained significant in the control group, whereas, in the experimental group, no significant differences were detected between the two scales, thus revealing the positive results of intervention, as regards preschool children's "at risk" specific cognitive profile. These results underline the importance of early diagnosis and appropriate intervention in children with specific cognitive profiles, who are "at risk" for developing subsequent learning difficulties.

Keywords

Preschool Children, Verbal Cognitive Profile, Cognitive Development, Language, Communication, Specific Learning Difficulties

1. Introduction

Children with obvious developmental delays or disorders are usually identified at an early stage and thus, are provided with some kind of special education. On the other hand, especially during the preschool age, it is highly unlikely to easily detect those children who, despite their normal intelligence, appear with important differentiations in their performance among different areas of learning. In several cases, those differentiations are so significant, that they might develop to become "specific types of learning difficulties". In this vein the main difficulty in identifying these children at an early age is that, even during the normal process of development, different cognitive abilities tend to develop at a different pace and time. More specifically, during the preschool years, it is often the case, that a great number of children show a rapid development in one or more cognitive areas, whereas, development in other areas of learning seem to proceed at a slower manner. This phenomenon does not necessarily happen due to a learning difficulty (Al-Yagon, 2003; Zucker, Cabell, Justice, Pentimonti, & Kaderavek, 2013).

Given this situation, the task of trying to identify children being "at risk" for developing learning difficulties, from the preschool age, becomes even trickier. On the other hand, a great number of studies have shown that children, adolescents or even adults with learning difficulties, who still struggle to cope with specific learning tasks, had shown many indications of their learning difficulty, from their preschool age and that, if those indications had been detected at an early stage, school failure and, in the most cases, psychological, social and behavioral problems following learning difficulties, could have been prevented and avoided, at least, to a satisfactory level (Coleman & Dover, 1993; Flynn & Rahbar, 1998; Huffman & Speer, 2000; Yip, 2018; Zenner, Herrnleben-Kurz, & Walach, 2014).

In addition, educational programs and every-day school schedules during the preschool years, are, by nature, more flexible and can be more easily modified to meet children's special needs, as opposed to the strictly task-oriented programs

of elementary and secondary curriculums (Bonti, 2013; Lum, Conti-Ramsden, Morgan, & Ullman, 2013).

Since 1980 a lot of studies have shown interest in the primary "signs" or indications of learning difficulties from the early years (McDonald, 2018). More specifically, it has become generally accepted, through the years, that two are the main areas of early development in which signs of subsequent learning difficulties can be detected. The first area concerns difficulties in language development and auditory-verbal disabilities which might lead to later problems with organizing, interpreting and producing both oral and written language and the second concerns visual-perceptual difficulties which have been strongly related to "dyslexic type" difficulties, i.e. problems with learning to read, write, being aware of the spelling rules and patterns of written language, as well as dealing with number (Al-Yagon, 2003; Krishnan, Watkins, & Bishop, 2016; Gredler, 2000). Therefore, it became obvious that there was a need for constructing tools, methods and educational programs for the early detection and intervention concerning the signs of learning difficulties from the preschool-age, in order to prevent and avoid school failure (Bonti, 2013; Lum, Ullman, & Conti-Ramsden, 2015).

Researchers share a common belief that if a dysfunction occurs in one or more of the cognitive functional systems during the early developmental period, it leads to subsequent difficulties in several areas of learning and concerns about 10% - 15% of preschool-age children. These include language, reading and writing, as well as behavioral or emotional difficulties (Graziano et al., 2015; Ergul, 2012; Lerner, 1993; Dockrell & McShane, 1992).

Specific developmental disorders are usually classified based on the particular perceptual areas in which the disorders are presented (McArthur & Bishop, 2001; Santiago & Matos, 1994). The main processes that seem to interfere with the different types of learning difficulties include either language development or visual-perceptive or auditory-perceptive skills. For example, specific reading difficulties (dyslexic type) have often been related to low performance on the "practical" scale of WISC-III, as well as with the "automatization" level and the visual-perceptive channel of communication as described in the Illinois Test of Psycholinguistic Abilities (I.T.P.A., Kavale & Forness, 1985). Accordingly, developmental language disorders have been related to low levels of performance on the "language" or the "acoustic-phonetic" scales of the same diagnostic tools.

Auditory-perception disorders usually indicate that problems exist in the interpretation of hearing-language information. The most common auditory-perception difficulties have been described within the relevant literature as the difficulty in the ability to determine the source of an auditory stimulus, in the ability to differentiate between sounds (Abrahamson, Enticott, & Tonge, 2010) and in discriminating the whole from its parts, i.e. being able to recognize and discriminate a specific sound heard simultaneously with other sounds (Grievink, Peters, van Bon, & Schilder, 1993; Pajak, Creel, & Levy, 2016).

They also tent to show low auditory memory ability (Archibald & Gathercole, 2006; Sharma, Purdy, & Kelly, 2009), low ability of relating auditory or visual stimuli (Brumback, Harper, & Weinberg, 1996), low ability of analyzing and composing of phonemes into syllables or single phonemes to words and low ability phoneme auditory recognition (Vandewalle, Boets, Boons, Ghesquie're, & Zink, 2012a), while having difficulties in auditory concentration span in general, as regards to auditory-verbal information (McArthur & Bishop, 2001; Vandewalle et al., 2012a).

As Taylor, Anselmo, Foreman, Schatschneider, & Angelopoulos (2000) point out, the main characteristic of preschool "at risk" for learning difficulties children's cognitive profiles, is the significant discrepancies found among different developmental levels of cognitive abilities. Other researchers have claimed that, as regards to reading ability during school-age, primary abilities play an important role, such as rapid naming of objects, letter identification and phonological awareness (Scanlon & Vellutino, 1996).

Concerning the use of standardized tests for early detection of preschool-age children being "at risk" for learning difficulties, the most common criticisms mention the lack of a theoretical base for choosing them, their inadequate inner coherence and their doubtful validity and reliability as regards their predictive value, as well as their great financial cost, related to the results they actually offer. According to Teisl, Mazzocco, & Myers (2001), researchers need to select and isolate the most appropriate sub-tests of the several most known diagnostic criteria, especially those with the most predictive value for subsequent learning difficulties and modify them in such a way so that they could be inserted in everyday school assessment-screening procedures and assist with the structuring of intervention programs.

A number of researchers argue that more dynamic-oriented assessment procedures should be used parallel to standardized tests, especially for the early detection of learning difficulties during preschool age (Brown, Campione, & Murphy, 1997; Buscemi, Bennett, Thomas, & Deluca, 1996).

It is an axiom to consider that language function is a sensitive indicator of neuromotor impairment, hearing loss, general learning disabilities and specific language and communication difficulties. As a result, failure to follow typical trajectories in language and communication is both a risk factor for later language difficulties and an indicator of potential difficulties with literacy (Gray, Plante, Vance, & Henrichson, 1999), numeracy (Abrahamson et al., 2010) and socio-behavioural aspects of development (Lindsay & Dockrell, 2000; Lum et al., 2015). Research community underlie the fact that children with speech and language difficulties have indicated that there are high rates of continued communication difficulties in this population (Vandewalle et al., 2012b). Children with a specific language problem appear to have a more favourable prognosis than those with language impairments secondary to sensory, structural, neurological or cognitive problems (Abrahamson et al., 2010). Under the aegis of the accurate identification

the assessment of language problems is of vital importance for the appropriate management of interventions, planning educational placements and to support children and their families, as well.

In the sphere of accurate identification it is essential to mention that identifying the existence of a problem is the first step in the language assessment process. The second step is to characterize the nature and extent of the child's difficulties in terms of differing language skills. A broad range of information gathering activities are available to meet this goal. The assessment process itself will be guided by the initial evaluation of the child, the theoretical orientation held by the assessor and practical constraints related to time and resources. Three broad approaches to the assessment of language problems can be identified—standardised tests, analysis of language samples, and parental or teacher questionnaires. These approaches are not mutually exclusive.

Concluding, it must be stressed that almost every study concerning early detection of learning difficulties during preschool-age, agree that almost 1/3 of preschool children can be considered as being "at risk" of developing some kind of learning difficulty during their school years. Therefore, since it is impossible to evaluate all preschool-age children for primary risk cognitive factors, it seems that the best way for dealing with this issue is to offer teachers and educators knowledge concerning the importance of specific abilities that seem to comprise the prerequisites for the several learning processes responsible for the appearance of the most known types of learning difficulty. The main idea is that preschool children "at risk" for learning difficulties can be recognized and should be helped at an early stage, so as to avoid school failure and the psychological and behavioral problems that usually accompany them (Bonti, 2013).

1.1. Research Questions

Based on the above theoretical views concerning the early detection of the primary routes responsible for learning difficulties and given the fact that there is great disagreement among scientists as regards the actual mechanisms and abilities considered as being responsible for school failure and finally, since there seems to be a need for assessment and intervention programs for dealing with the risky cognitive factors of children's early years, the present study attempts to answer the following research questions:

- Which are the characteristics of preschool age children that can be considered as "risk factors" for possible subsequent learning-language difficulties during school-age?
- What are the learning-cognitive profiles of preschool age children that are "at risk" for developing specific learning/language difficulties?
- Is it possible, having detected those profiles from an early age, to develop better assessment and intervention programs in order to prevent and reduce specific learning-language difficulties during school age for "at risk" children?

1.2. Research Hypothesis

The research hypothesis of the present study is the following: If the characteristics that appear in the most common types of cognitive profiles of preschool age children at risk for subsequent learning-language difficulties are detected at an early stage and an intervention program is addressed to them, aiming at the reduction of the discrepancies among their cognitive ability profiles, then they should be able to begin typical school education having much less possibilities to develop specific learning difficulties (Hypothesis 1).

In addition, independently of whether the particular abilities on which children show a lower level of performance, are directly related to one or more types of learning-language difficulties, it is believed that if children develop those abilities, considered as being dominant and are the basic components of different cognitive tasks at the same time, then, through the process of generalization and transfer, it is believed that these children should no more be considered as being "at risk" for learning difficulties (Hypothesis 2).

1.3. Goals of the Present Study

Finally, the present study aims, through the close examination of the different perceptual, language and other cognitive abilities with regards to school success, as well as through the examination of those abilities' interrelations, to offer helpful information regarding assessment and intervention approaches. A final aim is that those approaches should be able to influence the educational procedures used in everyday school practice so as to offer a better educational basis and thus, to a great extent, prevent and avoid the risk cognitive factors that eventually lead to several types of learning and language-related difficulties.

2. Method

2.1. Stage A: Initial Evaluation (Pre-Test)

For the purpose of the present study initially there was a small-scale pilot survey of a small number of 15 kindergarten children from different regions of Thessaloniki, privileged (eastern areas) or not (western areas), conducted for investigational purposes, both for the appropriateness of benchmarking (DTLA-2) and the appropriateness of the samples homogeneity (this distinction was based largely on parental education and living conditions rather than economic factors).

An important element that emerged from the pilot study was that children who were evaluated, had to come from similar socio-cultural environments, and already from this small sample was evident that there were significant differences in performance between children of different areas, pointing out that is not possible to have a meaningful comparison between them. Furthermore, it became clear that this distinction would be important to exclude external (family-environmental) factors that could affect the performance of children who would not be feasible to control satisfactorily within the framework of this re-

search. Therefore, the pilot study showed that the survey sample should be exclusively from nurseries from either the western or the eastern regions of Thessaloniki, which was confirmed through the process of evaluation.

This study initially involved 420 preschool children, (infants who had completed the sixth year of age, from 6.0 to 6.4 years) who were enrolled in kindergartens both in the western and the eastern areas of Thessaloniki, came from different socio-cultural backgrounds. All the children were evaluated based on the endpoint of learning capacity of the DTLA-2.

2.1.1. Observations of Kindergarten Teachers

Based on a number of studies which have shown that teachers' views about their students have a significant predictive value in relation to their abilities among different developmental areas (Gresham, MacMillan, & Bocian, 1997; Flynn & Rahbar, 1998), for the first screening of the sample, teachers were asked to point out the students that they believed, were not able to profit from the everyday school educational program, especially as regards language-related tasks. More specifically, they were asked to choose the children who seemed to have difficulties, especially with language (perceptive and/or expressive) tasks. Finally, children already having a formal diagnosis of other S.E.N. conditions, (such as visual, motor or hearing impairment, mental or psychological problems, autistic characteristics, etc.) were excluded from the sample.

Assessment Instruments

DTLA-2 (*Detroit Test of Learning Aptitude*-2) *assessment criterion*

The DTLA-2 assessment criterion (Detroit Test of Learning Aptitude, Hammil, 1985) was selected as the basic assessment instrument mainly because it is not an information-processing test, but it assesses the procedural level of learning aptitude and allows the examination of several sub-variables of learning, such as memory, language expression and perception, etc. As opposed to other instruments used for assessing children's cognitive abilities (for example, Spearman, 1904; Binet-Simon, 1905; Stanford-Binet, 1973; Weschler, 1967, 1981 in: D'Angiulli & Siegel, 2003), which are based on the spherical theory of intelligence and their results are described in relation to a general score. Thus, the significance and the interrelation among different abilities is not examined at all. On the contrary, DTLA-2 assesses primitive, not taught abilities that have not been developed via typical instruction.

Several comparative studies using different criteria (WISC, DTLA-2, ITPA), have shown that DTLA-2 has a significant predictive value as regards the early detection of learning difficulties, both through its results of separate sub-tests as well as the overall scores (Stocker & Parker, 2002; Cohen, Hall, & Riccio, 1997; Huges & McIntosh, 2002). DTLA-2 consists of 11 sub-tests. For the purpose of the present study the sub-tests were divided into the following two groups: **Language—Verbal Ability Sub-tests:** Word Opposites (WO), Sentence Imitation (SI), Word Sequences (WS), Oral Directions (OD), Story Construction (SC), Conceptual Matching (CM). **Non-Verbal—(practical) Ability Sub-tests:**

Design Reproduction (DR), Symbolic Relations (SR), Object Sequences (OS), Word Fragments (WF), Letter Sequences (LS).

2.1.2. Sample Grouping

During pretesting, the 420 children were divided into 4 groups according to their cognitive profiles based in the assessment:

1) Children with low performance on the tasks related to language as opposed to high performance on the non-verbal tasks (at least 10 - 15 points difference between the two levels).

2) Children with low performance on the non-verbal tasks as opposed to high performance on the verbal tasks (at least 10 - 15 points difference between the two levels).

3) Children with overall low performance throughout the test, without a significant discrepancy between the two cognitive levels.

4) Children with average or above average performance throughout the test, without a significant discrepancy between the two cognitive levels.

Children with normal or high performance (group d) occurred in both western and eastern areas of Thessaloniki and were excluded, (5%, 21 children in the total sample). Of the remaining 399 children, 320 (80% of the total sample) who experienced problems of type a, b and c, belonged to the western regions, while the remaining 79 children (20% of the total sample) were in the east of Thessaloniki. Of the total 399 children, 76 (19%) belonged to groups A and B (signs of learning difficulties of one or the other), of which, 56 were children in western districts, while only 12 children belonged to the eastern. The remaining 320 children (approximately 81% of the total sample) had difficulties of the c type, and so completely excluded from the sample. The very high percentage (80%) children with difficulties and three types (a, b and c), confirms once again the credibility of the judgment of kindergarten teachers, at least for the initial detection of the population of preschool children who are at risk for subsequent occurrence of learning difficulties (Teisl et al., 2001).

As it appeared that the majority of children with difficulties in a or b type concentrated in the western areas, it was decided to carry out the intervention in those children. Furthermore, the fact that the research was conducted in one area of Thessaloniki, helped to eliminate where possible, the external socio-cultural factor. Furthermore, children in the western areas, mostly came from low socio-economic strata and hence their performance was not affected nor strengthened by family or social externalities. To confirm this hypothesis, information was gathered from the kindergarten teachers, which were interviewed for the professional and socio-economic situation of families of children in the sample. From the outset children who were not native Greek speakers were excluded, as well as children who had some obvious genetic, neurological, sensory, mental or physical developmental disorders and children who have family or emotional strain-emotional history.

Moreover, both in screening tests and evaluations to identify children at risk

for occurrence of learning disabilities, children which scored low should be excluded because of the limited opportunities they had to learn or because of low socio-cultural environment of or troubled family members. To assess the skills of these children, as also stated by Mantzicopoulos (1999), different types of diagnostic methods should apply. Finally, none of the children surveyed had received any specific intervention (speech therapy, special educational or other).

Out of the 76 children presenting either type a or type b difficulties, 40 children were selected for the final construction of the experimental group and its control group. These children were selected based on a more detailed analysis of their cognitive profiles:

- They all presented a significant discrepancy between verbal and non-verbal levels of the test (10 points and above).
- There was a similar performance among several sub-tasks (i.e. low performance in common tasks and similar scoring between them).
- Their overall (general) mean scores were similar with the other children of the same group and were at a normal level of general score.

Finally, the children were randomly grouped by 20 in either the experimental or the control groups. The only restriction was to keep an equal number of boys and girls within the groups A & A1 (A experimental group: 11 boys-9 girls and A1 control group: 10 boys-10 girls).

2.1.3. Additional Testing

During the second phase of pretests, all groups were given additional tasks lasting 15 - 20 minutes for each child. This complementary testing for groups A and A1 comprised from construction of narrative stories either through the use of pictures or objects (ex. toy animals) and Oral completion of a story (give the ending). Those tasks further assessed children's cognitive abilities, which were qualitatively assessed through the use of a list of the skills considered as being fundamental for language development and narration, as described within the theoretical framework (Van Kraayenoord & Paris, 1996; Vion & Colas, 1999).

In a similar manner, as described above, children's performance on those tasks was assessed through a qualitative manner, based on a checklist designed on the basis of the relevant theoretical framework. All tasks were designed for the first time for the purposes of the present study, so as to reassure that none of the children had met any of the tasks, a fact that would have affected the validity of the results.

2.2. Stage B: Intervention

The detailed analysis of the results from the DTLA-2 and the additional tasks lead to the construction of an educational intervention program for the experimental group. The program was designed to develop the abilities that were considered as placing the 20 children "at risk" for subsequent learning—language difficulties. The intervention procedure lasted 3 months attended approximately 20 sessions (20 - 25 minutes each), either individually or in a small group of two

or three children. On the 20 children of the control groups no special intervention was addressed.

2.2.1. Intervention Tasks for Target Group A

Since, as it was explained earlier, narration involves almost all of the basic structural aspects of language organization, it was the main task in which target group A was exercised. The actual activities were designed based on the components of "story grammar". Twenty different stories (3 to 8 pictures each) were used through a number of narration activities.

Emphasis was given in several aspects of story grammar, shown to be important for the best possible language development through narrative activities (Van Kraayenoord & Paris, 1996; Vion & Colas, 1999; DeMarie & Ferron, 2003; Lange & Pierce, 1992). These were the use of rich pictorial material, providing emphasis on constructing mental pictures, the use of humor or exaggeration in order to promote visualization and maintenance of information in memory and exercises in conscious memory strategies. Extra activities for the reinforcement of language abilities included the description of pictures using words related to space and time, understanding of sequence in everyday situations, sentence construction, word puzzles, picture sorting, following oral directions with the use of a puppet and other auditory memory activities including oral information.

The tasks were constructed in such a way, so as to prepare the children for 'formal' learning, since, as Lerner (1993) points out, by overcoming difficulties in single tasks, the child, builds learning abilities. Moreover, in all tasks, teaching emphasized the use of cognitive and metacognitive strategies. All tasks were carefully designed so as to avoid any resemblance with the tasks of the DTLA-2 and were sex-free.

The success, though, of such an intervention program is shown if "transfer" from one learning situation to another is achieved and this should be revealed through the examination of the experimental group's performance during re-testing with the DTLA-2.

2.2.2. Post-Test

Approximately three months after the intervention was completed, post-testing took place. The experimental and the control groups were assessed through the use of DTLA-2, as well as with additional tasks, similar to those of the pretest phase.

2.2.3. Assessing Treatment Integrity

There are several recommendations in the literature concerning how to achieve treatment integrity (Gresham, Gansle, & Noell, 1993; Perepletchikova, Hilt, & Chereji, 2009; Perepletchikova & Kazdin, 2005). To ensure the integrity of the intervention process, a treatment integrity methodology was implemented based on recommendations from the literature (Vollmer, Sloman, & Peter-Pipkin, 2008).

The methodology that was created utilised two researchers, who were present

in all the intervention sessions. In order to ensure both, adherence and competence to the intervention protocol a checklist was created and used by the observer to record the adherence and competence of the other researcher following the intervention protocol for the whole session. For continuity and to ensure validity the two researchers never switched roles. At the end of each session the researcher following the intervention protocol self-assessed herself using the same check list, and then both lists were compared following the exact agreement method recommended by Vollmer et al. (2008). There was a complete agreement (100%) in 18/20 sessions and an 80% agreement in the other two sessions. Interestingly these two sessions were the 1st and 2nd sessions of the intervention.

2.2.4. Follow-Up Assessment during the 1st Grade of Primary School

In order to reveal whether or not the children from the experimental and the control groups, actually developed learning difficulties or not, during school-age and in order to find out significant differences between the children that had been addressed the intervention program and their controls with a similar "at risk" cognitive profile, it was our intention to carry out a follow-up assessment in the whole sample of the study. Unfortunately, due to several external factors, only 27 of the 40 children were located during this phase, which prohibited a complete and systematic re-assessment of the whole sample's school performance in specific learning areas. Nevertheless, once again the teachers were asked to describe their students' abilities in the basic learning areas and to point out the children that seemed to be experiencing difficulties in one or more learning areas.

2.2.5. Statistical Analysis

Initially, for each of the two groups the Mean, the Minimum, the Maximum score and the Standard Deviation of scores for each variable were calculated and the method of "Normal distribution fitting" for each variable was followed to ensure that parametric statistical methods could be used.

Therefore, the quantitative data of the study were analyzed (within and between groups), through the use of the following three statistical methods:

1) t-tests for Paired-Samples in order to compare the children's performances in each variable (sub-test, group of sub-tests or ability) before and after intervention.

2) t-tests for Independent Samples of Group was carried out to compare the mean scores of each variable for the experimental group and its control group, both during pretest and post-test, as well as in order to compare the differences in scores pro and after intervention for each variable between the experimental group and its control group (A-A1).

3) Correlation Coefficients were also used within each group, both during pretest and posttest, so as to detect any possible influences between the variables.

3. Results

The results of all three statistical methods carried out for the analysis of the quantitative data of the study, through the formal assessment with DTLA-2 of the four groups before and after intervention showed that there was a significant relation between the type of intervention addressed to the experimental group and their overall cognitive performance during post-testing, in comparison with the control group. More specifically, the differences between the verbal and non-verbal scales of the test remained significant in the control group, whereas, in the experimental group, no significant differences were detected between the two scales, thus revealing the positive results of intervention, as regards pre-school children's "at risk" specific cognitive profile.

3.1. Experimental Group A

The experimental group A increased the average overall performance from 89 points during the pre-test to 96 points during the post-test, i.e. by 6.5 degrees according to the grading scale of the DTLA-2 criterion used ($p < 0.01$). In the first evaluation, group A had presented an average performance in the tests of 81.4 points, while in the post-test a mean of 93.2 points was achieved, an increase of the average performance in the tests after the intervention by 11.8 points, a very significant increase in both evaluation criteria of the test itself, but also in terms of statistical significance ($p < 0.001$). Such an increase made it viable to exclude them from the "at risk for subsequent learning-language difficulties" population of preschool children.

Pre - Post Performance of the A Group

More specifically, the tests in which the experimental group showed the most improvement in performance after the intervention was mainly, Story Construction (SC), Sentence Imitation (SI), and Word Sequence (WS) which evaluates the immediate memory recall, all three at a high level of statistical significance ($p < 0.001$), (See **Figures 1(a)-(c)**) followed by Oral Directions (OD) with $p < 0.01$, which is a complex test and requires a combination of skills and strategies to solve projects included. The test of Word Opposites (WO), also saw a significant improvement in the level of statistical significance $p < 0.01$. In contrast, no improvement was observed on average in Conceptual Matching (CM).

3.2. Control Group A1

The overall, average performance of the corresponding control group showed a relatively uniform improvement with an increase of 2.8 points, which corresponds to a significance level of $p < 0.001$.

3.2.1. Pre - Post Performance of the A1 Group

Specifically, half the group (10/20 children) showed some improvement in Word Opposites (WO), with a significance of $p < 0.05$. At the same level of statistical significance ($p < 0.05$), ranged and improved tests of Word Sequence (WS), the

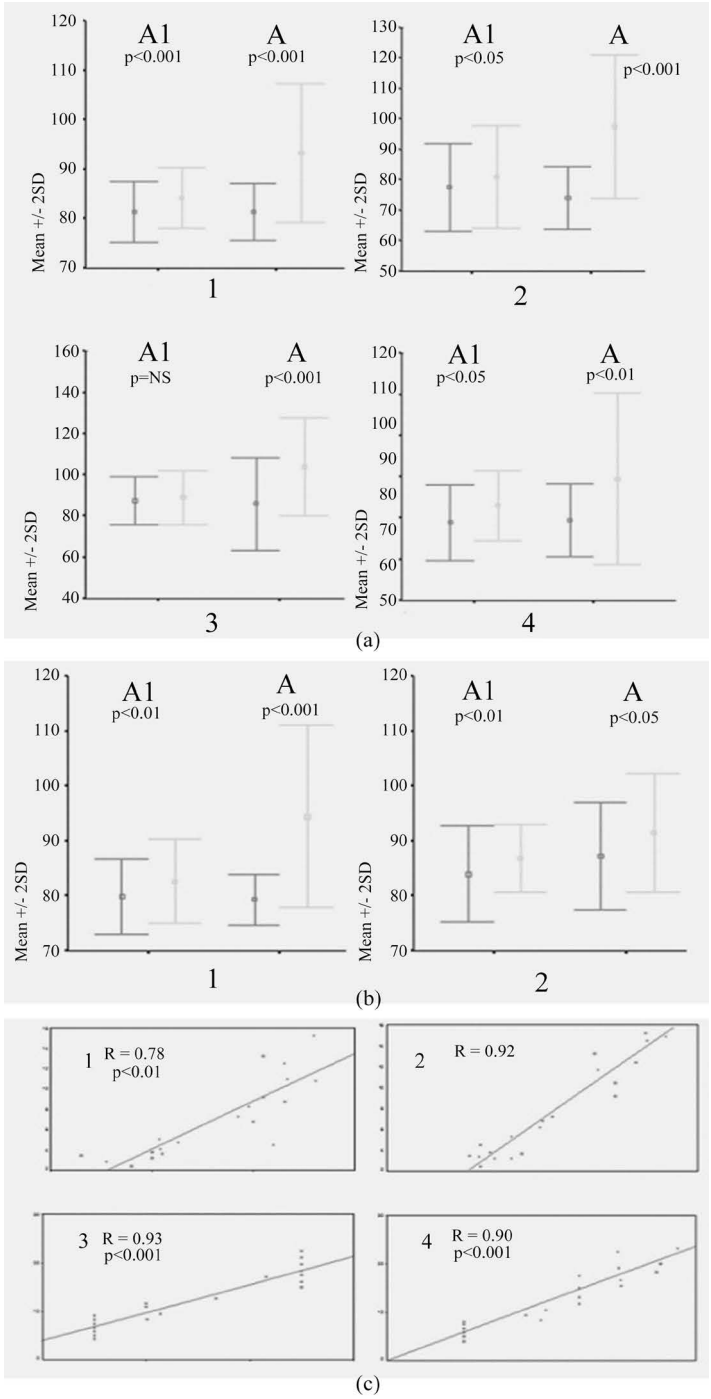

Figure 1. (a) Pre versus Post-test score differences for both control (A1) and experimental (A) groups with the respective p values from the t-test in the most influenced categories. Y axis shows the score value and the mean score ± 2SDs is plotted. 1 = the overall mean score, 2 = SC, 3 = SI, 4 = WO. (b) Pre versus Post-test score differences for acoustic-phonetic processing ability at the skill level (APPA) and at a strategic level (STR), for both control (A1) and experimental (A) groups with the respective p values from the t-test in the most influenced categories. Y axis shows the score value and the mean score ± 2SDs is plotted. 1 = APPA, 2 = STR. (c) Application of correlation coefficients, based on pre-post-test comparison of increased performance per group, under the criterion DTLA-2. 1 = Mean vs APPA, 2 = Mean vs STR, 3 = Mea vs SC, 4 = Mean vs WO.

oral tests (OD) and Story Construction (SP). Almost no improvement was observed in the average performance of the group in tests of Sentence Imitation (SI) and Conceptual Matching CM).

3.2.2. Pre-Post Performance in Terms of Skills and Strategies

According to the scores from the pre-test and post-test performance on the various tests, the performance of each group in the acoustic-phonetic skill level and at an acoustic-voice strategic level were measured and statistically tested for significance.

3.2.3. Experimental Group A

According to the classification made on verbal tests to those that assess the acoustic-phonetic processing ability at the skill level (APPA) and those who assess it at a strategic level (STR), the experimental group (A) showed the greatest improvement in skill level ($p < 0.001$), since on average went up from 78.8 to 94 points (15.2 points difference), while lower but still significant was the improvement in the strategic level ($p < 0.05$), which increased by 4.3 points from 87.2, on average, rose to 91.5 points (**Figure 1(b)**).

3.2.4. Control Group A1

In the control group, the post-test performance was highest in all of those tests considered to evaluate acoustic-phonetic ability (APPA) (from 79.9 to 82.6) and the acoustic-phonetic strategy (STR) (from 84 to 86.8 on average) level of statistical significance $p < 0.01$. As shown in **Figure 1(b)**), the performance of this group on average, although improved, remained quite low comparison to the experimental group.

3.2.5. Correlation Coefficients

The application of this statistical method was intended to identify possible correlations (positive affinity) between individual variables in order to identify whether and how much statistical significance, the increase in one variable is likely to contribute to the increase of one or more other variables. Findings from the application of correlation coefficients identified important links between the individual variables, based on pre-post-test comparison of increased performance per group, under the criterion DTLA-2, and are shown below.

3.2.6. Correlation Coefficients—Experimental Group A

The improvement of the overall group average seems to correlate with improvements in both acoustic-phonetic capacity (APPA) and the acoustic-phonetic strategy (STR), a statistical significance of $p < 0.01$ and $p < 0.001$, respectively (**Figure 1(c)**). More specifically, individual tests positively correlated with the increase in overall average performance of the group were as follows: SC ($p < 0.01$), WO ($p < 0.05$) and WS ($p < 0.05$).

The improvement in the overall average performance was found to correlate with the improvement of the following tests: SC ($p < 0.001$), WO ($p < 0.001$),

LPDD ($p < 0.001$) and WS ($p < 0.01$), (**Figure 1(c)**) graphs 3, 4, 5 & 6), as well as with the increase of APPA ($p < 0.001$) and STR ($p < 0.01$). Regarding the correlations in between individual tests, a positive link was found between the following tests: SC-OD (r = 0.84, $p < 0.01$), SC-WO (r = 0.85, $p < 0.01$), SC-WS (r = 0.79, $p < 0.01$), OD-WO (r = 0.92, $p < 0.001$), OD-WS (r = 0.89, $p < 0.001$), WO-WS (r = 0.88, $p < 0.01$).

The individual tests that helped in increasing APPA, were: SC ($p < 0.001$), WO ($p < 0.001$) and WS ($p < 0.01$), while no statistical significance was found at the contribution of the test SI to improve acoustic-phonetic capacity. In contrast, there was a positive correlation between APPA-OD, ($p < 0.01$). Improving STR seems to occur only when OD improves ($p < 0.01$) and not CM as well. Whereas the improvement of STR was linked to some of the tests that are typically considered to evaluate the acoustic-phonetic ability as a skill rather than as a strategy, these were: WO ($p < 0.01$) and WS ($p < 0.01$).

4. Discussion

Based on these results, it can be argued that exercising in narration, influenced the development of other cognitive abilities, through the activation of several brain functions such as short-term memory, coding, vocabulary, analogical thinking, grammatical and syntactical concepts, etc. Information—processing theories and correlation models of learning strongly suggest the inter-relation and duplex influence between the different brain functions (Nithart et al., 2009). Moreover, as Hamilton (1987) and other researchers suggest, meaning making exercises, narration activities and story-construction are the base for the overall language development of preschool children (Peskin & Astington, 2004).

The finding that children of group A, who were exercised in the several types of narrative language scored significantly high on the short-term memory subtest (Word Sequences), can be interpreted based on Roney's (1989) view, who claims that the complexity within the several cognitive types of narrative language sets enormous prerequisites upon short-term memory. Development of short-term memory in group A might also have occurred due to the fact that this group was taught to make a systematic use of mnemonic strategies during the narration activities, such as, repetition, grouping, and organization of information. All these mnemonic strategies have been closely related to the development of verbal short-term memory (Jarrold & Hall, 2013; Klecan-Aker, 1993).

In addition, all the above activities, have obviously contributed to children's development of grammatical and syntactical aspects of language, as shown through the increase of their scores on the "Sentence Reproduction" sub-test.

Since all the above language abilities are closely related to several types of language impairment, it can be argued that the "risk" factor related to the lack of those abilities, detected during pretesting in those children, has been reduced to a satisfactory level, so as to prevent the development of specific language difficulties, at least during the first school years.

Another interesting finding, even though it seems that researchers do not share the same views about this issue, is that, none of the children from group A (located during the 1st grade), was characterized by his/her teacher as facing any kind of difficulty in reading ability or in mathematical reasoning. This finding could not be measured through a statistical analysis, therefore, it could be argued that the development of language and verbal short-term memory abilities of these children might have contributed to their normal reading and mathematical reasoning performance (Morris, Stuebing, Fletcher, Shaywitz, Lyon et al., 1998).

Several researchers claim that there is a strong relationship between these abilities, whereas, others argue that language development factors cannot be clearly related to reading development, on the first grades of school, since decoding skills seem to be more important during this age (Watson et al., 2003; Montgomery, 1995). Of course, the long-term benefits of the intervention cannot be claimed, since it is broadly known that most children with learning difficulties have significant problems with transfer and generalization of knowledge and strategies from one learning task or situation to another (Rickard, 2004).

Moreover, the fact that the children from A1 control group did not show significantly better post-test performance in all three sub-tests (WS, SC and SR) can be explained through the fact that those children were not systematically trained, neither on narration and story grammar nor in mnemonic strategy use. Probably the methods children are being taught narration skills within the nursery school program is not adequate enough to promote language cognitive skills, especially for children that face difficulties in those areas (Vandewalle et al., 2012a). This finding comes to an agreement with several researchers, who have argued that children's preschool language school experiences should include very well-structured narration activities and oral dialogues combined with rich pictorial materials, since those tasks are considered as being necessary prerequisites for the development of reading, writing, reading comprehension and metacognitive skills (Van Kraayenoord & Paris, 1996; Vitiello, Greenfield, Munis, & George, 2011). Group's A post-test development in performance in the Oral Directions (OD) sub-test, as opposed to their controls, who did not show significantly higher performance in the same task, a task that requires multiple strategies and a combination of abilities, could also be related to the intervention program, since it included exercise in auditory concentration and memory, strategically organization of information based on their chronological order, as well as visualization of information through the use of pictured stories, abilities and strategies definitely required for a successful performance in the particular sub-test.

Exercise in narration tasks of group A probably contributed somehow in the development of the children's overall vocabulary, as shown in their increased post-test score in the Word Opposites (WO) sub-test, whilst the control group did not seem to improve in the same sub-test. This is not an unusual finding, since during intervention, group A children were asked to use a well-developed vocabulary in order to construct their stories, which included comparison concepts, adverbs, conjunctions, synonyms and opposites. At this point it should be

pointed out that all of the children comprising the sample of the present study came from similar socio-cultural backgrounds, thus considered as having similar family and school environment language experiences. Therefore, group's A improvement in vocabulary is mainly related to the intervention program they received.

Of interest is the finding that none of the two groups showed significant improvement on their post-test performance in the Conceptual Relations (CR) subtest, whilst all of the children had performed at a high level both during pretesting and post-testing. According to the DTLA-2 manual, the actual sub-test does not assess a single ability, but requires the combination of a series of cognitive abilities, such as the conceptual interpretation of pictorial stimuli, conceptual comprehension and their conceptual relation. Thus, it is the only sub-test which solely assesses children's mental-cognitive ability, without requiring specific visual-perceptual or auditory-verbal abilities. This finding agrees with the nature of specific learning difficulties, as described within their commonly accepted definition, according to which, children with several types of specific learning difficulties, possess a normal or above average overall mental-cognitive potential combined with "unexplained" low performance in specific learning abilities or cognitive areas (McClelland et al., 2014). The fact that the whole sample performed well in this task (CR), both before and after intervention, as opposed to the significant differentiation in performance detected between the cognitive sub-areas, justifies the initial hypothesis that those children, were "at risk" for developing specific learning difficulties. Moreover, it seems logical that intervention did not seem to influence none of the groups' post-test performance in the particular sub-test, since none of the intervention tasks aimed at improving children's overall mental-cognitive level.

In addition, group A also showed a better overall post-test performance in the Object Sequences (OS) sub-test, than their controls (who also performed well), probably having used a number of taught mnemonic strategies, through transfer and generalization, since the tasks on which they were instructed on those strategies were of totally different nature (narration tasks).

Once again, the above findings, concerning preschool-age children's conscious use of cognitive, mnemonic and metacognitive strategies when faced with several cognitive tasks, are challenging for those researchers who claim that preschool-age children do not possess the cognitive, developmental prerequisites for being taught such strategies (Williford, Vick, Whittaker, Vitiello, & Downer, 2013).

Of great importance is also the fact that the pre and post-test performance of the experimental group, following intervention, was reduced at a level, thus placing the children of this group at the non-risk population. If the same improvement was detected homogeneously on both sides of the test, then the difference indicating the risk cognitive factor, would have remained at the same level and therefore, the overall improvement would have not been related to the intervention. The control group retained their differences, thus, still considered as being at risk for subsequent learning difficulties.

As opposed to other studies using the discrepancies or the index dispersion among different scales of standardized criteria of cognitive testing (ex. WISC-III) as an indicator for risk cognitive-learning factors during preschool-age (Verhagen & Leseman, 2016; Watkins & Worrell, 2000), who have claimed that their results did not offer adequate diagnostic knowledge neither predictive value.

The criterion used in the present study (DTLA-2) showed high levels of diagnostic-predictive value, at least as regards the early detection of preschool-age children at risk for learning difficulties its predictive value has been proved from other studies as well (Stocker & Parker, 2002; Huges & McIntosh, 2002).

To conclude, the large differences found through the detailed analysis of the qualitative data regarding the performances of the experimental group as opposed to its control group, proved that intervention lead to the development of the particular learning-cognitive abilities, in which children, initially, faced difficulties. Although the sample during post-test at the 1st grade was incomplete, nevertheless, the teachers of the children that have attended the experimental group did not mention significant difficulties in the basic learning areas, as opposed to the control group's children of the 1st grade (Pajak et al., 2016). Last but not least, the study revealed that difficulties in particular cognitive abilities, if detected at an early stage, can be dealt with to a great extent and in a relatively short period of time, with the appropriate educational intervention program.

5. Implications of the Study

Many children with language difficulties may not be identified until school age. In specific, in a population-based study of children tested in kindergarten, Tomblin et al. (1997) reported that among those determined to have a speech and language disorder, 29% had been previously identified, whereas 71% had not been identified. The severity of impairment was similar for children identified before school entry or during kindergarten. As a result, it is of vital importance to underlie the fact that the early identification of language difficulties provides essential evidence that there can be valuable in enriching young children's literacy opportunities. Furthermore, the implementation of intervention programmes in preschool children with learning difficulties can enhance the development of the particular learning-cognitive abilities, in which children, initially, faced difficulties. Furthermore, our study emphasizes the fact that researchers must screen young children for language delays because these children are at risk not only for language difficulties but may also be at a disadvantage in the development of preliteracy skills. Additionally, in relation to clinical practice, our results add to a growing body of evidence that language intervention in the early school years can produce substantial and lasting improvements in children's language skills. A significant aim for future studies should be to conduct longer term follow-up assessments of such effects and, ideally, to conduct studies in which language interventions are delivered over longer periods of time. Current evidence suggests that such interventions could have considerable educational benefits and be highly cost

effective. Additiionaly, this is likely to be further aggravated by the fact that our society is rapidly moving from a work force that depends on physical labor to one that relies on cognitive and communication skills. Given this trend, these children with learning difficulties who in the past could employ their nonverbal capabilities to their benefit, will now face fewer such opportunities and even greater future risk for social and economic penalties.

6. Limitations

Even though, according to the overall findings of the study, it seems that intervention reduced the post-test differences between the verbal and non-verbal abilities of the experimental group' s children, as opposed to their controls, it cannot be guaranteed that those children will never again face difficulties on the cognitive areas on which their problems were initially identified nor it can be argued that the initial cognitive discrepancies between their verbal and non-verbal abilities were balanced at a level that can assure that they will not produce learning difficulties in the future. The long-term profits of this intervention would have involved a longitudinal close examination of the children's overall school performance, for at least four or more years. This could not happen within the framework of the present study.

Although statistical analysis was not carried out regarding possible differences between the two sexes, since the sample was too small, nevertheless, from the overall statistical analysis of the results, both pre and post intervention, no differentiations between the two sexes were detected. This finding comes to an agreement with other studies that have compared preschool children's performances, as regards to their sex, and have not found significant differences (Watson et al., 2003). It is possible that the "3:1" analogy, often mentioned between boys and girls, respectively, cannot be obvious in samples that are examined for their cognitive performance before and after having received special intervention, after they have been already detected as being "at risk" for learning difficulties.

In order to avoid external factors, all the children of the study's sample were chosen to fit a similar socio-cultural background. Therefore, the possible family and socio-cultural environment influences, as regards children's cognitive performance, could not be examined in the present study. It would be interesting though, in a future similar study, to choose children from different socio-cultural environments and compare their performances in a number of levels, both pre and post intervention. As Huffman & Speer (2000) argue, apart from the intervention programs that might be addressed to a child in order to enhance his learning and cognitive development, a family-social environment characterized by "social ordinarity", would nourish the active and dynamic interaction between child and adults taking into account the child's individual, emotional, personality and cognitive characteristics and significantly contribute to the development of higher level use of cognitive and metacognitive strategies.

It might be the case, that in the present study, given that the samples were

from different socio-cultural environments, the results might differ in many levels, such as the post-test performances of the control groups in certain tasks or in the use or not of strategies and metacognitive ability, independently of the similar school experiences (Mazzocco, Devlin, & McKenney, 2008).

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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