Abstract

The goal of the current study is to examine the contribution of verbal and non-verbal abilities to the mathematical achievements of kindergarten children. Particularly, this study compares kindergarten children at risk of a language-based specific learning disorder and kindergarten children with typical development. First, the relation between verbal ability and early mathematical ability was examined among the two groups separately. Then, we compared the verbal ability, non-verbal ability, and early mathematical ability of the children in the two groups.

To achieve research objectives, 3 questions were examined: (a) To what extent do the early mathematical ability of kindergarten children at risk of a language-based specific learning disorder and children with typical development differ? (b) To what extent are the mathematical difficulties of kindergarten children at risk of a language-based specific learning disorder related to their verbal ability? (c) To what extent are the mathematical difficulties of kindergarten children at risk of a language-based specific learning disorder related to their non-verbal ability?

Research hypotheses were: (a) the achievements of children with typical development will be higher than the achievement of children at risk of a language-based specific learning disorder in all tasks examining early mathematical ability: building mathematical series, building and coping shapes, counting, perceiving quantity, adding and subtracting and number knowledge; (b) There is a positive relation between verbal ability (vocabulary) and achievements in all tasks examining early mathematical ability; (c) There is a positive relation between non-verbal ability and achievements in all tasks examining early mathematical ability. That is, the higher the scores on the Kaufman triangular test, the higher their scores on the early mathematical ability tasks.

The present study included 65 kindergarten children of middle socioeconomic status from 3 kindergartens of regular education, from the same area of supervision, of whom 29 were boys (44.6%) and 36 girls (55.4%). The participants are children aged 4.5-6 years (*M*= 4.99, *SD*= 0.43), who were divided into 2 groups. Thirty children at risk of a language-based specific learning disorder (15 boys and 15 girls; *M*= 4.94, *SD*= 0.39), without sensory, physical or cognitive impairments, with a verbal ability below the norm (according to PPVT4 and Kaufman tests: verbal ability *M*= 22.4, *SD*= 8.3; non-verbal ability *M*= 2.23, *SD*= 2.31), and 35 children with typical development (14 boys and 21 girls; *M*= 5.03, *SD*= 0.47) (verbal ability: *M*= 30.17, *SD*= 6.04; non-verbal ability: *M*= 5.8, *SD*= 1.73).

Two individual meetings were held with each child. These meetings took place in the mornings, in a quiet room in the kindergarten, to maintain children's concentration. In the first session, the children's verbal and non-verbal abilities were tested, using two tests. A PPVT4 (Peabody Picture Vocabulary Test) Test assessed children's verbal ability. A triangular test from the Kaufman Assessment Battery for Children (K-ABC) assessed children's non-verbal ability. For children at risk of a language-based specific learning disorder, only those whose ability was verbally lower than normal were sampled. In the second session, children's early mathematical ability was assessed, using an e-ZaBE test. Each session lasted approximately 20 minutes.

The findings of the current study indicate that the achievements of kindergarten children with typical development were higher than the achievements of kindergarten children at risk of a language-based specific learning disorder in all measures of early mathematical ability, except counting. Children's verbal ability significantly contributed to explaining the variance of quantity perception ability, beyond the child's non-verbal ability. Namely, the higher the child's verbal ability, the better their ability to perceive quantity.

Also, the findings of the regression analysis showed that children's non-verbal ability significantly contributed to explaining both the variance of early mathematical ability (general index) explaining six of the seven measures of early mathematical ability. Specifically, children's non-verbal ability contributes to explaining the variance of early mathematical ability, as well as to explaining child's ability to build mathematical series, build and copy shapes, count, perceive quantity, add and subtract, and to children's knowledge of numbers.

The uniqueness of the present study has to do with the population it focuses on, young children at risk of a language-based specific learning disorder. Many studies have examined specific learning disorders in children and adolescents, yet only few studies have focused on the early mathematical ability of kindergarten children (4.5-6 years) with learning disorders in general and kindergarten children at risk of a language-based specific learning disorder in particular.