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The Association between Memory Processing Systems and Reading and Writing Abilities in Second-Grade Students with and without a risk Learning Disabilities

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Abstract

Introduction: It is assumed that short-term auditory verbal memory (STM), working memory (WM), declarative - verbal learning rate, and retention of verbal information, as well as procedural learning, underlie literacy achievements. Several studies show differences between children with and without learning disability (LD) in some of these domains. It should be noted that we were not able to find studies testing the retention of verbal information and the procedural learning in LD versus typical learners (TL). Moreover, the relationship between these variables to reading and writing was not examined among children with LD.

The purpose of the study: In the current study, we attempted to examine the association between the auditory declarative verbal memory components and procedural learning to the reading and writing abilities in second graders with and without a risk for LD. Because differences between children with LD and their peers in literacy abilities are multifaceted, it was assumed that in spite of the association between memory skills and literacy achievements, these factors will not fully explain group differences in literacy achievements. Furthermore, Children at risk for LD may present different associations between literacy achievements and memory functions than their typically developing peers.

Participants: A sample of 63 second-graders: 30 students at risk for LD and 33 TL, matched for age, gender, and non-verbal IQ, took part in the study. All students are of a low- to middle-income socio-economic status. In the current study, students at risk LD were the students who have impaired reading or writing accuracy as measured by the "Maakav" test - a kit for early detection of reading and writing difficulties in elementary school children.

Method: the independent variables were STM, WM, rate of learning and retention of verbal information, as well as measures of speed and accuracy from the procedural learning assessment task. The *STM* and *WM* were assessed by "The number recall test" from WISC R-95. The *Rate of learning* and *Retention of information* were assessed using the Rey-AVLT test. The *Procedural learning* was measured using the ILT (the invented letter task) 24 hours and 2-weeks post-training performance. In addition, the *socio economic status* was evaluated using a SES (socio economic status) questionnaire and the *non-verbal IQ* was assessed using the Raven test. The dependent variables in study were the Meytzav-like test (the Meytzav is a nationally standardized test in literacy) and its sub-tests: dictation accuracy, reading and writing accuracy, reading comprehension, written expression and linguistic knowledge.

Results: Comparisons test of independent variables revealed difference only one measure of PM difference (ILT- Speed after two weeks) between groups.

The first research hypotheses was that group differences in reading and writing ability will remain beyond the differences in WM, verbal STM, PM, verbal learning rate, and retention of verbal information. This hypothesis was fully supported. Although WM and PM contributed to the variance, they did not fully explain differences in performance between children at risk for LD and TL, on the Meytzav measures that showed group differences.

The second research hypotheses was that different factors would explain the achievements in reading and writing in students at risk for LD and in TL. The results indicates that somewhat different factors explain the literacy achievements in students at risk for LD and in TL. While in the TL group, long-term accuracy and speed measures of PM, declarative learning rate, and STM were strong predictors of reading

and writing achievements, in children at risk LD the predictors of literacy scores were WM, and accuracy measure of PM.

Discussion: The finding of the current study indicate that the children at risk LD and TL tested here, rely partially on different mechanisms and partially on similar mechanisms while solving the Meytzav test. In both groups, long-term PM measures were strong predictors of reading and writing achievements. However, among children at risk for LD, the data indicate that these measures were less consistent as predictors, and that the WM was a predictor of literacy scores.

According to the clear association that was found in the literature between WM and general intelligence, it is possible that children at risk for LD relied somewhat on their general intelligence abilities to solve the Meytzav test, while TL children use acquired declarative knowledge and procedural skills. It is possible that the difference between the groups does not stem from cognitive difference, but from the practice of reading and writing skills in the TL group and not in the at-risk for LD group. The at-risk for LD group uses general memory and general intelligence to solve the Meytzav test, rather than relying on specific long-term memory skills that can be used for solving the literacy assignment in the Meytzav test.