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Metacognition, Metacognitive Judgments and Executive Functions (associated with memory): A Comparison between High Function ASD and Typical Developing Children

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Abstract

The aim of the research was to examine the Metacognitive ability, the Metacognitive Judgment ability, Executive Functions and the functioning of memorization of children ages 8-12 with HFASD, in comparison to children with typical development (TD). In addition, the interconnection between the metacognitive ability and executive function was examined as well as the actual memory recollection of the test subjects.

Social and communication functioning is the focus of most studies which examine children with autism spectrum disorder (ASD), while the emphasis in the current study is on their cognitive skills. Memorization, which relate to the background variables of the subjects, is most significant to cognition and learning. However, among children with ASD emerges vague picture on that ability. Aside from memorization ability, studies which examined metacognition (Thinking about thinking) assessed children with typical development, while the knowledge on metacognition ability of children with untypical development, and particularly with ASD, is poor. Metacognitive ability and metamemory (the knowledge and awareness of one's own memory, including the contents and processes of one's memory) of children with high functioning autism spectrum disorder (HFASD) was examined only in few studies. Those studies showed inconsistent results (Farrant, Blades & Boucher, 1998; Farrant, Blades & Boucher, 1999; Wojcik, Allen, Brown & Souchay, 2011). Individuals with autism are usually divided into two groups, those with ASD accompanied by mental disability as opposed to individuals with average or above intelligence - high function ASD (HFASD) (Corbett, Constantine, Hendren, Rocke & Ozonoff, 2009). This current research focused on children with HFASD. Moreover, this research is unique because it observes judgment of learning in children with HFASD; ability that until now, to the best of the writer's knowledge, was not scientifically examined in any research among this population, all this in comparison to typical development.

JOLs are used in order to determine how long and how much effort is required to process a task or the correctness of the result. Judgment of learning ability was tested twice: immediately after watching a movie and another time half an hour after watching it. The reason for these separate tests was due to the fact that children at the age of six are capable of recalling their recollections more accurately after a certain break, than immediately following the learning phase (Schneider et al., 2000).

The sample of the research included 48 boys, which were in 3rd to 6th grades in Israeli elementary schools all around the country. Twenty five were boys with typical development, and 23 boys with high functioning autism.

The hypothesis of the research was: there will be differences in the executive functions between children with HFASD and children with typical development. Children with HFASD will show lower abilities of mental flexibility and planning, in comparison to children with typical development. The questions of the research were: 1. will there be differences found between children with HFASD and children with TD in their metacognitive abilities? 2. will there be differences found between children with HFASD and children with TD in their ability of judgment of learning? 3. will there be differences found between children with HFASD and children with TD in the functioning of recollection. 4. is there a connection between the metacognitive ability and the metacognitive judgment, and actual recollection in the general population of the research and in each of the groups individually? 5. will a connection be found between metacognition to executive functions, and executive functions to the memory recollection in the general population of the research and in each of the groups individually?

The tools used in this research were:

1. The Peabody Test (PPVT-III) for assessing cognitive level (Dunn & Dunn, 1997).

2. The Social Communication Questionnaire (SCQ) for screening Autism Spectrum Disorders (Rutter, Bailey & Lord, 2003).
3. Metacognitive Judgment questioner for assessing the judgment of learning ability following a video clip.
4. Metamemory questioner to examine declarative knowledge.
5. Strategic questioner designed to assess different types of strategies (to remember the movie) and in general.
6. Memory questioner designed to assess recollection ability.
7. The D-KEFS Sorting Test from the Delis-Kaplan Executive Function System, designed to assess mental flexibility (Kaplan & Kramer, 2001).
8. The "Tower of Hanoi" test to examine the planning ability (Borys, Spitz & Dorans, 1982).

The hypothesis of the research regarding executive functions (mental flexibility and planning ability) was confirmed. It was found that children with HFASD expressed significantly lower abilities of mental flexibility in all three measurements, in comparison to children with typical development. Controlling the verbal ability retained the differences only in one measurement (conceptualization) suggesting it exists beyond verbal ability. In examining the planning ability, it was found that children with HFASD showed significantly lower planning ability in comparison to children with typical development. Controlling the verbal ability retained the difference in the planning ability, thus the differences between the groups extend beyond verbal ability.

Analyzing the metacognition results yielded several findings: First, it was found that there is a significant difference between subjects with TD in comparison to subjects with HFASD in the declarative knowledge. Therefore, it seems as if children with HFASD have difficulty in understanding the factors that influence our memory and in knowledge about

strategies. Controlling the verbal ability retained the difference in the declarative knowledge, thus the differences between the groups extend beyond verbal ability.

Second, it was found that there is no significant difference between the strategic ability of children with HFASD in comparison to children with typical development. In other words, both groups used memory strategies in order to remember a movie shown to them. Finally, there was found a significant difference between the younger group of children (8-10) in comparison to the older group (11-12) in the "Memorization" strategy, so that the second used the strategy more broadly then the younger group.

Analyzing the metacognitive judgment results (which were passed twice – immediately after watching the movie and again 30 minutes later) brought upon several findings: It was found that there is no significant difference between children with TD and children with HFASD in the judgment of learning (how much are the subjects confident that they can answer the questions related to the movie in the correct way). However, it was found that there is a significant difference between the groups in age and there was a significant interaction. Based on the results, children with HFASD from the younger age group (8-10) were more certain that they knew the answers, in comparison to the children with TD of the same age group. On the other hand, in the older age group (11-12), children with TD were more certain that they had the right answers in comparison to children with HFASD.

When examining actual memory ability, it was found that children with HFASD recalled significantly fewer details related to the movie, half an hour after watching it, compared to children with typical development.

When examining the connections in judgment of learning to actual recollection among each of the research population groups separately, there was found a connection between them, but not significant, as a result of the low number of subjects.

When examining the connections between each of the executive abilities to the metacognition among each of the research population groups separately, there was found a connection between the metamemory and mental flexibility in conceptualization as well as in each ability by itself – Mental ability and planning ability to actual recollection.

The findings of this research reinforce the importance of the metacognition and the abilities of the executive functions among children with HFASD in the educational field, and can explain some of the learning difficulties of that population in elementary school. In order to enhance achievements among children with HFASD learning should involve cognitive and metacognitive processes. It appears that there is a need for a suitable educational program for children with HFASD, which is aimed at developing the declarative knowledge. Further, it is suggested that an intervening program for children with HFASD should include the study and practice of the executive functions of mental flexibility and planning, that projects on metacognition, and in addition should focus on metacognitive judgment in order to improve recollection and learning abilities.